Annual Report
2024-2025

Bangladesh Sugarcrop Research Institute

Annual Report
2024-2025

Bangladesh Sugarcrop Research Institute
Ishwardi, Pabna, Bangladesh

Annual Report 2024-2025

Bangladesh Sugarcrop Research Institute

Compilation and Editing : Dr. Md. Ataur Rahman

Published by : Bangladesh Sugarcrop Research Institute

Ornamented by : A Z M Rajiul Ansary

Cover Design : Quazi Srasthatya Prottasha

Publication No.: 310
January, 2026

Bangladesh Sugarcrop Research Institute
Ishwardi, Pabna

CONTENTS

বিএসআরআই বোর্ড

১।	মহাপরিচালক	চেয়ারম্যান (পদাধিকার বলে)
২।	অর্থ বিভাগ কর্তৃক মনোনীত উহার অন্যূন উপসচিব পদমর্যাদার একজন কর্মচারী;	সদস্য
৩।	কৃষি মন্ত্রণালয় কর্তৃক মনোনীত উহার অন্যূন উপসচিব পদমর্যাদার একজন কর্মচারী;	সদস্য
৪।	শিল্প মন্ত্রণালয় কর্তৃক মনোনীত উহার অন্যূন উপসচিব পদমর্যাদার একজন কর্মচারী;	সদস্য
৫।	কাউন্সিল কর্তৃক মনোনীত উহার অন্যূন পরিচালক পদমর্যাদার একজন কর্মচারী;	সদস্য
৬।	কৃষি মন্ত্রণালয় কর্তৃক মনোনীত কৃষি সম্প্রসারণ অধিদপ্তরের অন্যূন পরিচালক পদমর্যাদার একজন কর্মচারী;	সদস্য
৭।	শিল্প মন্ত্রণালয় কর্তৃক মনোনীত বাংলাদেশ চিনি ও খাদ্য শিল্প কর্পোরেশনের অন্যূন পরিচালক অথবা সমপদমর্যাদার একজন কর্মচারী;	সদস্য
৮।	বিজ্ঞান ও প্রযুক্তি মন্ত্রণালয় কর্তৃক মনোনীত বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) এর অন্যূন মুখ্য বৈজ্ঞানিক কর্মকর্তা পদমর্যাদার একজন বিজ্ঞানী;	সদস্য
৯।	ইনস্টিটিউটের পরিচালকগণ;	সদস্য (পদাধিকারবলে)
১০।	কৃষি মন্ত্রণালয় কর্তৃক মনোনীত ইনস্টিটিউটে কর্মরত ২ (দুই) জন জ্যেষ্ঠ বিজ্ঞানী;	সদস্য
১১।	কৃষি মন্ত্রণালয় কর্তৃক মনোনীত ইনস্টিটিউট বহির্ভূত একজন প্রথিতযশা বিজ্ঞানী;	সদস্য
১২।	ইনস্টিটিউট কর্তৃক মনোনীত সুগারক্রপ চাষাবাদ সংশ্লিষ্ট কার্যে নিয়োজিত একজন কৃষক ও একজন কৃষাণী;	সদস্য
১৩।	ইনস্টিটিউটের প্রশাসন বিভাগের প্রধান, যিনি উহার সদস্য-সচিবও হইবেন।	সদস্য-সচিব

BSRI BOARD

1.	Director General	Chairman (Ex-officio)
2.	An employee not below the rank of Deputy Secretary, to be nominated by the Finance Division;	Member
3.	An employee not below the rank of Deputy Secretary, to be nominated by the Ministry of Agriculture;	Member
4.	An employee not below the rank of Deputy Secretary, to be nominated by the Ministry of Industry;	Member
5.	An employee not below the rank of Director, to be nominated by the Council;	Member
6.	An employee not below the rank of Director of the Department of Agricultural Extension, to be nominated by the Ministry of Agriculture;	Member
7.	An employee not below the rank of Director of the Bangladesh Sugar and Food Industries Corporation, to be nominated by the Ministry of Industry;	Member
8.	A scientist, not below the rank of Chief Scientific Officer of Bangladesh Council for Science and Industrial Research (BCSIR), to be nominated by the Ministry of Science and Technology;	Member
9.	Directors of the Institute;	Member (Ex-officio)
10.	Two senior scientists working in the Institute, to be nominated by the Ministry of Agriculture;	Member
11.	An eminent scientist, outside of the Institute, to be nominated by the Ministry of Agriculture;	Member
12.	A male farmer and a female farmer engaged in sugarcrop cultivation related activities, to be nominated by the Institute;	Member
13.	The head of Administration Division of the Institute, who shall also be its Member-Secretary.	Member-Secretary

কার্যাবলী

১। জাতীয় এবং আন্তর্জাতিক সংস্থা ও সংগঠনসমূহের সহযোগিতায় চিনি, গুড় ও সিরাপ উৎপাদন উপযোগী শর্করা সমৃদ্ধ ফসল বা বৃক্ষের উৎপাদন বৃদ্ধি এবং উহাদের উন্নত ও উচ্চফলনশীল জাত উদ্ভাবন সংক্রান্ত বিভিন্ন বিষয়ের উপর গবেষণা কর্মসূচি গ্রহণ করা;

২। চিনি, গুড়, সিরাপ ও মধু উৎপাদনের লক্ষ্যে প্রযুক্তি ও কলাকৌশল উদ্ভাবন করা;

৩। চিনি, গুড় ও সিরাপ উৎপাদন উপযোগী শর্করা সমৃদ্ধ ফসল বা বৃক্ষের ব্যবহারের কলাকৌশল সম্পর্কে গবেষণার ব্যবস্থা করা এবং উহাদের উপজাতসমূহের উপর গবেষণা কার্যক্রম পরিচালনা করা;

৪। সুগারক্রপভিত্তিক গবেষণা, খামার স্থাপন ও ব্যবস্থাপনার উপর গবেষণা করা এবং উহাদের অর্থনৈতিক সুবিধা চিহ্নিত করা;

৫। বিভিন্ন ধরনের সুগারক্রপের জার্মপ্লাজম সংগ্রহ করিয়া জার্মপ্লাজম ব্যাংক গড়িয়া তোলা, এবং সুগারক্রপের জার্মপ্লাজম সংরক্ষণ, মূল্যায়ন ও রক্ষণাবেক্ষণ করা;

৬। সুগারক্রপ গবেষণায় জীব প্রযুক্তির প্রয়োগের মাধ্যমে রোগ ও ক্ষতিকর পোকা-মাকড় প্রতিরোধ করা, এবং খরা, লবণাক্ততা, জলাবদ্ধতা, ঠাণ্ডা ও তাপসহ বিভিন্ন প্রতিকূল পরিবেশ সহিষ্ণু সুগারক্রপের জাত ও উৎপাদন বিষয়ক প্রযুক্তি উদ্ভাবন করা;

৭। সুগারক্রপ ও আনুষঙ্গিক বিষয়ে গবেষণাগার ও লাইব্রেরি প্রতিষ্ঠা করা;

৮। ইনস্টিটিউট কর্তৃক উদ্ভাবিত সুগারক্রপের নূতন জাত ও প্রযুক্তিসমূহের প্রদর্শনীর আয়োজন করা, এবং উক্ত জাত ও প্রযুক্তিসমূহের বিষয়ে কৃষকদের প্রশিক্ষণ প্রদানের উদ্দেশ্যে এলাকা নির্ধারণ ও স্কিম গ্রহণ করা;

৯। মিষ্টি জাতীয় ফসল উৎপাদনের উন্নত প্রযুক্তির উপর সরকারি ও বেসরকারি কর্মচারী, কৃষক এবং দেশি-বিদেশি গবেষকদের প্রশিক্ষণ প্রদান করা;

MANDATES

1. To undertake research programme on various areas related to the productivity enhancement of sugar, brown sugar (gur) and syrup producing carbohydrate enriched crops or trees and to develop its improved and high yielding varieties in collaboration with national and international institutes and organizations;
2. To develop technologies and techniques in order to produce sugar, brown sugar (gur), syrup and honey;
3. To undertake research on utilization techniques of sugar, brown sugar (gur) and syrup producing carbohydrate enriched crops or trees and their by-products;
4. To conduct research on sugarcrop based farming, establishment and management of farm and find out their economic benefits;
5. To establish germplasm bank through collection of different sugarcrop germplasms and conservation, evaluation and maintenance of sugarcrop germplasms;
6. To prevent insect-pests through the application of biotechnological tools in sugarcrop research and to develop drought, salinity, water-logging, cold, heat and other stress tolerant sugarcrop varieties and production technologies;
7. To establish laboratories and libraries on sugarcrop and related matters;
8. To demonstrate new varieties and technologies developed by the Institute and select areas and undertake scheme for training farmers on those varieties and production technologies;
9. To train-up public and private employees, farmers and local and foreign researchers on advanced production technologies of sweetener crops;

১০। বিভিন্ন গবেষণা প্রতিষ্ঠান ও কেন্দ্রের বিশেষজ্ঞদের দ্বারা মিষ্টি জাতীয় ফসলের চিহ্নিত সমস্যাবলি সম্পর্কে মত বিনিময় করা, এবং মিষ্টি জাতীয় ফসলের সাম্প্রতিক উদ্ভাবনের সহিত সংশ্লিষ্ট সকলকে পরিচিত হইবার সুযোগ সৃষ্টি করিবার জন্য সেমিনার, সিম্পোজিয়াম ও ওয়ার্কশপের আয়োজন করা;

১১। জলবায়ু পরিবর্তনজনিত সৃষ্ট ঝুঁকি মোকাবিলায় সুগারক্রপ গবেষণা কার্যক্রম গ্রহণ করা;

১২। ইনস্টিটিউট কর্তৃক উদ্ভাবিত প্রযুক্তির ও উদ্ভিদ জাতের মেধাস্বত্ব নিশ্চিত করা;

১৩। সুগারক্রপের সহিত আন্তঃফসল হিসাবে উপযোগী যে কোনো ফসলের চাষাবাদ সম্পর্কিত গবেষণা কার্যক্রম পরিচালনা করা;

১৪। ইনস্টিটিউট কর্তৃক উদ্ভাবিত মিষ্টি জাতীয় ফসলের বিভিন্ন জাতের দ্রুত বিস্তারের লক্ষ্যে পর্যাপ্ত পরিমাণ ব্রিডারবীজ উৎপাদন ও সরবরাহ করা;

১৫। সুগারক্রপ বিষয়ে স্নাতকোত্তর, পিএইচ.ডি. এবং পোস্ট পিএইচ.ডি. পর্যায়ে গবেষণার সুযোগ সুবিধা সৃষ্টি করা;

১৬। সুগারক্রপের উন্নয়নের ক্ষেত্রে গবেষণায় নিয়োজিত যে কোনো ব্যক্তি বা সংস্থাকে সহযোগিতা করা;

১৭। সুগারক্রপ গবেষণা ও শিক্ষা সম্প্রসারণে তথ্য ও যোগাযোগ প্রযুক্তির প্রয়োগ করা;

১৮। সুগারক্রপ গবেষণা সংক্রান্ত মনোগ্রাফ, বুলেটিন ও শস্য পঞ্জিকাসহ ইনস্টিটিউটের গবেষণালব্ধ ফলাফল ও সুপারিশের ভিত্তিতে সাময়িকী, প্রতিবেদন ও সংশ্লিষ্ট অন্যান্য তথ্য প্রকাশ করা;

১৯। মিষ্টি জাতীয় ফসলের নীতি নির্ধারণে সরকারকে সাহায্য করা, এবং মিষ্টি জাতীয় ফসল সম্পর্কিত যে কোনো বিষয়ে সরকার, স্থানীয় কর্তৃপক্ষ ও অন্যান্য প্রতিষ্ঠানকে পরামর্শ প্রদান করা;

২০। সরকার কর্তৃক, সময়ে সময়ে, প্রদত্ত নির্দেশনা অনুযায়ী উহার উপর অর্পিত অন্যান্য দায়িত্ব পালন করা; এবং

২১। এই আইনের উদ্দেশ্য পূরণকল্পে, প্রয়োজনীয় অন্য যে কোনো কার্য সম্পাদন করা।

10. To exchange view on problems of sweetener crops identified by different experts of various research institutes and centers, and to arrange seminar, symposium and workshops to create opportunity for relevant persons to be familiar with the recent inventions related to sweetener crops;

11. To undertake research on sugarcrop in addressing risk caused by climate change;

12. To ensure the Intellectual Property Rights (IPR) of the technologies and plant varieties developed by the institute;

13. To conduct research on the production technology of any crop suitable to be used as intercrop with sugarcrop;

14. To produce and supply sufficient amount of breeder seeds for rapid dissemination of different sugarcrop varieties invented by the institute;

15. To create opportunities and facilities for Post-Graduate, Ph.D. and Post-Doc. research on sugarcrop;

16. To assist any person or organization engaged in research on the field of sugarcrop development;

17. To apply Information and Communication Technology (ICT) on research and extension education of sugarcrop;

18. To publish periodicals, reports and other related information based on the findings and recommendations of the institute, including sugarcrop research monograph, bulletin and crop calendar;

19. To assist the Government on sweetener crops policy formulation and to advise the Government, local authority or any institution regarding any matter related to sweetener crops;

20. To perform such other functions as may be assigned to it, from time to time, according to the directions given by the Government: and

21. For carrying out the purpose of this Act, to perform such other functions as may be required.

FOREWORD

It is with great pleasure and pride that I present the Annual Report of the Bangladesh Sugarcrop Research Institute (BSRI), which documents the research activities conducted during the 2023–2024 cropping season by various research divisions, Regional Sugarcane Research Stations (RSRS), and Sub-Stations. Alongside the presentation of research findings, this report also includes information on other institutional activities. The content has been compiled and presented in a language that is accessible and easily understood, even by general readers.

This report is a regular publication of the institute, serving as a formal record of our activities during the specified period. The preliminary research findings featured herein are expected to support sugarcane scientists, researchers, extension personnel, and farmers in formulating advanced research programs and accelerating the adoption of sugarcane technologies in the field.

To date, the institute has released forty-eight (48) sugarcane varieties. In addition to variety development, BSRI has made significant progress in areas such as granular jaggery (gur) production, intercropping systems, pest and disease management, fertilizer application, and biotechnological research. Many of these innovations have been evaluated, refined, and recommended by our respective research disciplines. The dissemination of these technologies is being carried out through training programs, field demonstrations, and the distribution of printed materials such as leaflets and booklets.

I firmly believe that the adoption of BSRI-developed varieties and improved production technologies by farmers will contribute to increased yields of sugarcane and associated crops, ultimately aiding in the achievement of self-sufficiency in sugar and jaggery (gur) production in Bangladesh.

Finally, I extend my sincere appreciation to all scientists, officers, and staff whose dedication and hard work made this publication possible. I also offer special thanks to our funding agency, the Ministry of Agriculture (MoA), and all stakeholders for their continued support. My gratitude also goes to those involved in the compilation and editing of this report.

January, 2026

Dr. Kabir Uddin Ahmed
Director General

BREEDING DIVISION

RESEARCH HIGHLIGHTS

- A total of 1,165 germplasm accessions have been planted in the germplasm bank. In addition, 11 new germplasm accessions were collected, and 295 accessions have been characterized to date.
- Crossing activities were conducted from 14th November to 15th December 2024, resulting in 871 crosses, including 497 Marcotte crosses, 335 field crosses, 26 selfings, and 13 poly crosses.
- Based on germination tests, fuzzes were sown in the second week of July 2024. 93,240 seedlings were pricked and potted in the nursery, and 85,353 seedlings were transplanted to the field, of which 83,412 seedlings survived.
- From the true seed-derived seedling population, 1,841 genotypes were selected for evaluation in the 1m × 4m first-line trial, based on traits such as germination, stalk number, height, girth, erectness, and resistance to pests and diseases.
- In the 1m × 4m test stage, 168 promising clones were selected from 1,142 evaluated clones.
- In the 4m × 4m second-line trial, 297 clones were tested (including check variety BSRI Akh 46), and 38 superior clones were selected for advancement to the Preliminary Yield Trial (PYT).
- Out of 44 clones in the Preliminary Yield Trial (PYT), 24 were selected for further evaluation in the Advanced Yield Trial (AYT). From the overall performance, I 69-21 (105.95 t/ha), I 108-21 (101.59 t/ha), appeared as promising clones.
- In AYT, out of 16 clones, twelve were selected. Considering the cane yield the clone I 05-20 (102.17 t/ha) produced about 11% higher cane yield than the check variety BSRI Akh 46 (92.30 t/ha) and clones I 118-20 (101.08 t/ha) were also found as promising.
- Nine sugarcane clones with the check BSRI Akh 46 were evaluated in ZYT I stage. Among them I 190-19 produced the highest yield (108.41 t/ha), followed by I 70-19 (101.72 t/ha), both outperforming the check BSRI Akh 46 (94.87 t/ha).
- Six clones were tested against check BSRI Akh 46 at ZYT II stage. The clones I 75-18 (104.30 t/ha) and I 141-18 (106.71 t/ha) produced significantly higher cane yields compared with the check variety BSRI Akh 46.
- Out of five clones at ZYT III stage, the Clone I 94-16 produced the highest cane yield (100.74 t/ha) followed by I 49-17 (98.3 t/ha), both outperforming the check variety BSRI Akh 45.
- In case of the Zonal Yield Trial (ZYT)-I, Ratoon clone I 68-17 produced higher cane yield. Zonal Yield Trial (ZYT) II, Ratoon I 94-16 produced higher cane Yield.
- Under photoperiodic treatment, out of 20 germplasms 15 were found to emerge flower.
- 84 gm fuzz of 5 clones (S-23-06, S-23-14, S-23-07, S-23-02, S-23-04) were irradiated for varietal development.
- Pollen from eight sugarcane clones/ varieties and one wild was stored at -20°C, enabling successful hybridization, producing 178 grams of fuzz and 980 seedlings transplanted to the field.
- The breeder seed program at BSRI, Ishwardi, produced 227.83 tons of seeds from 78 varieties/clones, with 65.40 tons distributed to sugar mills and research divisions.

- The five *Stevia rebaudiana* genotypes showed significant morphological diversity in growth, flowering, and leaf traits, highlighting their breeding potential.
- Artificial pollination with Barhe pollen improved native date palm fruit quality, and F_1 seeds were collected for evaluation.
- In 2022, 85 of 120 planted F_1 hybrids survived at BSRI, some showing improved traits like sucker production.
- Six date palm genotypes (local and Arabic) were characterized, revealing significant differences in morphological, flower, fruit, and seed traits.

HYBRIDIZATIONFOR HIGH SUGAR, HIGHYIELDING, SHORT DURATION AND SELF DETRASH VARIETIES OF SUGARCANE

CROSS CAMPAIGN

Crossing activities were started from 14th November and continued to 15th December 2024. During this period 871 crosses were made, of them, 832 biparental crosses (497 marcotte and 335 field crosses (BSRI-243, Bandarban-92), and 26 genotypes were selfed and 13 were poly crossed. During the season 57 male and 145 female parents were included in the crossing programme. Finally, 15172 gms of fuzz were harvested and stored in deep-freeze. The summary is given in table 1.

Table 1. Summary of the 2023-2024 cross campaign

Type of crosses	No. of crosses	No. of arrows		Fuzz obtained (gms)
	Made	Pollinated	Harvested	
A. Biparental crosses				
a) Marcotte	497	1641	1612	10626
b) Field Cross	BSRI-243 Bandarban-92	BSRI-395 Bandarban-184	BSRI-345 Bandarban-156	BSRI-1888 Bandarban-1657
C. Selfing	26	84	68	809
D. Poly cross	13	37	31	192
Total:	871	2337	2212	15172

SEEDLING GROWING

Based on the germination test, fuzzes from the crosses were sown in the seedling growing tray in the second week of July 2024. Then 93,240 seedlings were pricked and potted in the seedling nursery bed. Finally,85,353 seedlings were transplanted in the field, of which 83,412 survived.

SELECTION FROM SEEDLINGS OF TRUE SEED

Among 85,353 seedlings, 1841 genotypes were selected for first line trial, 1m x 4m test stage. The selection was done considering selection criteria viz. germination, stalk number per clump, height, girth, cane color, erectness, bud type, absence of pith-pipe, growth cracks, leaf character, and natural incidence of diseases and insect pests etc.

CLONAL SELECTION FROM 1m x 4m TEST STAGE

Each plot consist of 4m long single row with 1m distance from one another. Considering stalk number, height, girth, erectness, field brix, absence of pith-pipe, growth cracks and natural incidence of diseases and insect pests, out of 1,142 clones in 1m x 4m test stage, 168 selected.

CLONAL SELECTION FROM 4m x 4m TEST STAGE

It was a non-replicated trial consisting of 297 clones along with BSRI Akh 46 as a check variety. The trial was conducted at BSRI with

4m x 4m plot size. Based on selection criteria, out of 297 clones, 43 were selected for further evaluation in the Preliminary Yield Trial.

EVALUATIONS OF SUGARCANE CLONES TO DEVELOP SITE-SPECIFIC GUR VARIETY

The trial was conducted with one promising gur genotype, Modhumala, along with the variety BSRI Akh 41 as a check. The experiment was laid out in a randomized complete block (RCB) design with three replications across three locations. Based on the selection criteria, Modhumala produced a higher cane yield (169.80 t/ha) compared to the check variety BSRI Akh 41 (157.05 t/ha) and also recorded higher tiller (153.08 thousand/ha) and millable cane count (103.57 thousand/ha). Modhumala was highly preferred by local people for gur production.

Table 2. Performance of gur genotypes at different locations (BSRI, Chapai Nawabgonj, Barishal) 2023-2024

Variety/Clone	Tiller count/ha ($x10^3$ ha^{-1})	Millable Count ($x10^3$ ha^{-1})	Yield data (tha^{-1})	Gur Recovery
Modhumala	153.08 a	103.57 a	169.80 a	12.50%
BSRI Akh 41	149.23 a	95.38 ab	157.05 b	12.00%
CV (%)	4.58	12.00	5.91	

EVALUATION OF SUGARCANE CLONES TO DEVELOP SITE-SPECIFIC CHEWING VARIETY

The trial was conducted with one promising chewable cane genotype, Black Ruby, along with the variety BSRI Akh 42 as a check. The experiment was laid out in a randomized complete block (RCB) design with three replications across six locations: Jashore, Chapai Nawabganj, Kurigram, Gazipur, Comilla and Bandarban. The check variety BSRI Akh 42 was included due to its good chewing quality, high cane yield, and wide adoption in farmers' fields. Results showed that, on average, Black Ruby produced about 7% higher chewable cane count (78.76 thousand/ha) and 12% higher cane yield (171.79) compared to the check variety BSRI Akh 42, indicating its superior performance across diverse environments.

Table 3. Performance of Black Ruby against the check BSRI Akh 42 at different locations of Jashore, Chapai Nawabgonj, Kurigram Gazipur, Comilla and Bandarban in Zonal Yield Trial (ZYT I, II and III)

Variety/ Clone	Jashore		Chapai Nawabgonj		Kurigram		Gazipur		Comilla		Bandarban		Mean	
	NCC (000/ha)	TCH	NCC (000/ha)	TCH	NCC (000/ha)	TCH	NCC (000/ha)	TCH	NCC (000/ha)	TCH	NCC (000/ha)	TCH	NCC (000/ha)	TCH
Black Ruby	82.15	172.79	87.97	188.36	78.56	165.81	76.09	150.75	73.13	146.25	74.67	178.85	78.76	171.58a
BSRI Akh 42	77.36	161.31	76.44	170.14	67.71	145.08	68.79	138.0	81.25	138.13	72.10	165.91	73.94	152.98b
CV (%)													7.35%	8.10%

Table 4. Quality and chemical composition of cane juice of Black Ruby and the check BSRI Akh 42

Variety/Clone	Brix (%)	Purity (%)	Fibre (%)	Pol (%) of cane
Black Ruby	16.4	82.90	11.88	10.64
BSRI Akh 42	16.0	81.49	12.54	10.13

The analysis was done in September-December, 2024. The chemical analysis shows that the clone Black Ruby is comparable in most parameters with the check BSRI Akh 42. The clone Black Ruby is early maturing variety, in the month of September-October the clone showed it's maturity.

DEVELOPMENT OF SALT-TOLERANT VARIETIES OF SUGARCANE

From 17 crosses 549 gms of fuzz were harvested and stored in deep freeze. In 1m x 4m stage among 26 clones 9 were selected. From 4m x 4m stage nine clones, one clone was selected.

DEVELOPMENT OF DROUGHT TOLERANT VARIETIES OF SUGARCANE

From 28 crosses 965 gms of fuzz were harvested and stored in deep freeze. In 1m x 4m stage among 113 clones 9 were selected. From 4m x 4m stage out of twelve clones, two clones were selected.

GENETIC ENHANCEMENT OF SUGARCANE (*SACCHARUM* SP. HYBRIDS) FOR RESISTANCE TO RED ROT DISEASE

Fourteen crosses were made using the wild (*Spontaneum* sp.) as pistil parent and *S. officinarum* as pollen parent. From these crosses 42 grams of fuzz were collected and 293 F_1 progeny were developed and planted in for further evaluation to use in backcrosses.

PRESERVATION OF SUGARCANE POLLEN AND EVALUATION OF POLLEN VIABILITY FOR CROSS SYNCHRONIZATION

Pollen from eight sugarcane (*S. officinarum*) clones/varieties and one wild (*Saccharum spontaneum*) were collected and stored in Petri dishes under refrigerated conditions. Periodic viability tests were conducted, and pollen preserved at -20°C maintained its viability throughout the year.

Fig. Preserved Pollen viability% over time

This preserved pollen was used in hybridization, resulting in the completion of seven cross setting. A total of 178 grams of fuzz was produced, and 109 seedlings were obtained from one gram test sowing. In total, 980 seedlings were produced and transplanted in the field (Table 5).

Table 5. Cross-Setting with preserved pollen

Sl. No.	Cross Name	Parentage		Fuzz Produced	No. of Seedling (1gm)
		Female	Male (Preserved Pollen)		
1	SP-23-1(M-23-408)	I 295-08	I 101-66	37gm	27
2	SP-23-2 (M-23-440)	I 26-02	I 101-66	16gm	20
3	SP-23-3(M-23-445)	I 316-08	*S. spontaneum*	8gm	35
4	SP-23-4(M-23-453)	I 108-01	I 433-99	31gm	15
5	SP-23-5(M-23-481)	I 275-13	I 129-13	27gm	0
6	SP-23-6(M-23-482)	I 142-11	I 72-00	48gm	7
7	SP-23-7(M-23-483)	I 197-93	I 433-99	11gm	5
		Total Fuzz Produced		178gm	109

COLLECTION, CHARACTERIZATION, AND CONSERVATION OF INDIGENOUS AND EXOTIC GERMPLASM OF SUGARCANE

The BSRI germplasm bank currently maintains a total of 1,165 germplasm, including 1,112 *Saccharum officinarum* (622 institute bred, 175 local, 298 foreign, and somatic variant 17) and 53 wild species (*Saccharum spontaneum* - 16, *Erianthus arundinaceus* - 20, and *Erianthus rockii* 17). Among these, 366 germplasm are flowering, including wild species. This year, During 2023–24, eleven new germplasm were incorporated into the collection. The breeding nursery holds 318 entries, comprising 227 institute-bred, 12 local, 62 foreign, and 17 somaclonal variants, all maintained using conventional planting methods.

Up to the reporting period, a total of 295 germplasms have been characterized, including 24 germplasms that were characterized during the 2023–24 season.

VARIETAL IMPROVEMENT OF SUGARCANE THROUGH INDUCED MUTATION

A total of 84 grams of fuzz from five selfed crosses (S-23-06, S-23-14, S-23-07, S-23-02, and S-23-04) were subjected to gamma irradiation at three dosage levels: 8.77 Gy, 13.15 Gy, and 17.54 Gy (1 Roentgen=.00877 Gy). From the irradiated fuzz, a total of 1,327 seedlings were successfully produced as part of the varietal development programme.

PHOTOPERIODIC REGULATION OF FLOWERING IN SUGARCANE

A total of 54 germplasms from both early and late flowering groups were treated. Among them, 15 germplasms successfully produced flowers. Using these flowering germplasms, a total of 20 crosses were made. As a result, 278 grams of fuzz were harvested.

EVALUATION OF PROMISING CLONES UNDER DIFFERENT YIELD TRIALS AT DIFFERENT AGRO-CLIMATIC CONDITIONS

CLONAL SELECTION FROM PRELIMINARY YIELD TRIAL (PYT)

The experiment was conducted in a Randomized Complete Block Design (RCBD) with three replications, using a plot size of 4m × 4m at BSRI, Ishwardi, and RSRS, Thakurgaon. Out of 44 clones, several showed promising performance and were evaluated based on germination, tiller count, millable cane, and cane yield. Among them, I 69-21 (105.95 t/ha), I 108-21 (101.59 t/ha), I 88-21 (102.14 t/ha), and I 25-21 (100.36 t/ha) produced the highest cane

yield, all surpassing the check variety BSRI Akh 46 (93.27 t/ha). These clones demonstrated superior yield potential and could be considered for further evaluation under advanced yield trials (AYT). The clones I 57-21 (13.54%) had the highest Pol% followed by I 167-21 (13.04%). The clones I 16-21, I 33-21, I 38-21, I 56-21, I 88-21, I 100-21, I 142-21, I 153-21, I 164-21, and I 167-21 exhibited moderate resistance (MR) to red rot disease. The clone I 108-21 was found to be highly susceptible (HS). Clones I 14-21, I 28-21, I 59-21, and I 112-21 exhibited resistance (R) to the red rot disease.

Table 6. Performance of selected clones under Preliminary Yield Trial (PYT), 2023-2024 pooled over two locations

Variety/Clone	Germination %	Tiller count/ha ($x10^3$ ha^{-1})	Millable Count ($x10^3$ ha^{-1})	Yield data (tha^{-1})	Sugar content %	Red Rot Reaction
I 14-21	31.358 gh	103.07 k-n	82.1 6h-j	77.16 ij	12.38	R
I 16-21	36.57 d-g	105.2 k-n	83.91 g-j	78.08 ij	11.15	MR
I 25-21	32.595 gh	141.71 a	112.33 a	100.36 bc	9.98	MS
I 28-21	33.915 gh	102.42 l-n	81.41 h-j	76.22 j	12.40	R
I 33-21	33.942 gh	107.11 j-m	84.18 g-j	79.09 h-j	11.36	MR
I 38-21	35.422 e-h	107.72 j-m	84.75 g-j	75.87 j	11.25	MR
I 56-21	40.959 c-f	125.24 b-f	99.61 b-e	91.31 de	14.29	MR
I 57-21	30.478 gh	109.59 i-l	86.6 g-i	81.86 g-i	13.54	S
I 59-21	33.957 gh	119.74 e-i	95.98 d-f	92.9 de	12.50	R
I 65-21	36.469 d-g	111.22 h-l	89.1 f-h	88.15 ef	11.35	MS
I 69-21	36.233 e-g	133.6 a-c	105.31 a-c	105.95 a	13.15	MS
I 88-21	43.793 bc	129.38 b-e	102.87 b-d	102.14 ab	12.55	MR
I 100-21	33.936 gh	125.89b-f	99.16 b-e	96.68 cd	11.80	MR
I 108-21	43.188 b-d	130.59 b-d	104.21 a-d	101.59 a-c	11.59	HS
I 112-21	29.268 h	96.1 n	76.69 j	75.68 j	11.66	R
I 114-21	30.13 gh	123.62 c-g	97.2 c-f	79.24 h-j	11.22	S
I 137-21	55.17 a	120.92 d-h	95.53 d-f	84.62 fg	10.40	MS
I 138-21	49.497 ab	109.09 j-l	86.54 g-i	78.12 ij	10.76	S
I 142-21	29.992 gh	98.6 mn	78.23 ij	77.74 ij	12.20	MR
I 146-21	34.345 f-h	113.35 g-k	88.65 f-h	78.74 ij	12.03	MS
I 153-21	32.474 gh	105.08 k-n	84.22 g-j	77.3 ij	0.00	MR
I 164-21	41.968 c-e	135.5 ab	107.05 ab	93.29 de	11.54	MR
I 167-21	29.293 h	116.1 f-j	91.03 e-g	84.26 f-h	13.04	MR
BSRI Akh 46	35.326 e-h	106.89 j-m	83.52 g-j	93.27 de	11.73	MS
CV%	16.54	7.82	8.38	5.46		

CLONAL SELECTION FROM ADVANCED YIELD TRIAL (AYT)

Out of 16 clones, 12 were selected and planted at ZYT-I. The clone I 05-20 (102.17 t/ha) produced about 11% higher cane yield than the check variety BSRI Akh 46 (92.30 t/ha). Besides, clones I 118-20 (101.08 t/ha), I 31-20 (97.67 t/ha), I 23-20 (96.33 t/ha), and I 39-20 (94.42 t/ha) also produced higher cane yield compared to the check. These high-yielding clones are promising and may be considered for further evaluation under advanced trials. Among the clones, the

highest sucrose content was observed in I 103-20 (12.36%) followed by I39-20 (12.35%), than the check variety (11.73%). The clones I 31-20, I 93-20, and I 118-20 exhibited moderate resistance (MR) to red rot disease, while the rest were susceptible (S) or highly susceptible (HS). Clones I 98-20, I 131-20, and I 93-20 were resistant to smut disease, whereas I 137-20 showed moderate susceptibility (MS) and the check variety showed susceptibility (S) to smut.

Table 7. Performance of clones under the Advanced Yield Trial, 2023-2024

Variety/ Clone	Germination%	Tiller count ($x10^3$ ha^{-1})	Millable Count ($x10^3$ ha^{-1})	Yield data (tha^{-1})	Sugar content %	Red Rot Reaction	Smut Reaction
I 05-20	56.29 c	112.07 d-f	86.81 ef	102.17 a	11.50	R	-
I 08-20	71.592 a	108.51 ef	86.18 ef	88.75 d-f	11.55	S	R
I 23-20	32.098 g-i	122.78 bc	97.14 a-c	96.33 a-c	11.60	S	R
I 27-20	30.05 hi	111.88 d-f	88.3 d-f	83.42 f-h	11.00	S	R
I 31-20	63.933 b	129.29 ab	101.8 ab	97.67 a-c	10.62	MR	MS
I 39-20	29.347 i	124.83 bc	99.07 a-c	94.42 b-d	12.35	MS	R
I 93-20	36.2 f-h	97.01 g	78.44 g	73.67 i	11.28	MR	R
I 98-20	37.153 fg	107.41 f	84.91 ef	77.73 hi	10.50	R	R
I 100-20	42.23 ef	105.19 fg	83.53 fg	79.53 g-i	11.28	MS	R
I 103-20	37.338 fg	108.22 ef	83.87 e-g	77.5 hi	12.36	S	R
I 118-20	53.883 c	134.96 a	102.75 a	101.08 ab	6.39	MR	R
I 122-20	36.977 fg	117.45 cd	94.34 cd	85.32 e-g	6.09	HS	R
I 131-20	35.705 f-i	123.78 bc	96.19 bc	91.58 c-e	11.57	R	R
I 137-20	46.698 de	116.85 c-e	89.95 de	84.75 fg	11.82	S	MS
I 138-20	32.818 g-i	108.38 ef	85.47 ef	82.17 f-h	10.62	S	
BSRI Akh 46	50.103 cd	112.14 d-f	88.65 d-f	92.3 cd	11.00	MS	S
CV%	13.47	6.6	5.97	6.63			

CLONAL SELECTION FROM ZONAL YIELD TRIAL (ZYT-I)

Eight sugarcane clones and the check BSRI Akh 46 were evaluated in ZYT I stage. Among them I 190-19 produced the highest yield (108.41 t/ha), followed by I 70-19 (101.72 t/ha), both outperforming the check BSRI Akh 46 (94.87 t/ha). Among the clones, the highest sucrose content was observed in I 71-19 (12.57%) followed by I 70-19 (12.50 %) All clones showed better sugar content than the check. I 190-19 and I 185-19 showed moderate resistance to red rot, while others were moderately susceptible; I 71-19 and I 92-19 were susceptible. In case of smut except I 138-19 other clones showed resistant reaction. The clone I 190-19 stood out for yield and disease resistance.

Table 8. Performance of clones under ZYT-I, 2023-2024 pooled over four locations

Variety/Clone	Millable Count ($x10^3$ ha^{-1})	Yield data (tha^{-1})	Sugar content %	Red Rot Reaction	Smut Reaction
I 70-19	106.02 a	101.72 b	12.50	MS	R
I 71-19	87.63 de	84.91 e	12.57	S	R
I 92-19	86.39 e	81.14 e	10.37	S	R
I 138-19	99.86 b	94.68 cd	11.09	MS	MS
I 149-19	87.22 de	98.99 bc	10.41	MS	R
I 182-19	82.19 e	90.79 d	11.56	MS	R
I 185-19	92.81 cd	82.43 e	11.22	MR	R
I 190-19	96.48 bc	108.41 a	10.98	MR	R
BSRI Akh 46	97.95 bc	94.87 cd	11.45	MS	S
CV%	7.91	7.4			

CLONAL SELECTION FROM ZONAL YIELD TRIAL (ZYT-II)

Six clones were tested against check BSRI Akh 46 at ZYT II stage. The clones I 75-18 (104.30 t/ha) and I 141-18 (106.71 t/ha) produced significantly higher cane yields compared with the check variety BSRI Akh 46 (96.94 t/ha). Other clones such as I 71-18 (94.28 t/ha) and I 182-18 (90.55 t/ha) yielded lower than the check, while I 56-18 (91.97 t/ha) was also inferior. The clone I 71-18 had the highest sugar content (13.87%). Clone I 71-18 showed resistance to smut disease, while I 141-18 and I 182-18 were resistant to wilt disease. Clone I 182-18 showed moderate resistance to red rot and wilt. I 75-18 and I 141-18 showed moderately resistant reactions to wilt disease. Clone I 75-18 was susceptible to smut, while I 56-18 was highly susceptible. Most of the clones, including I 56-18 and I 71-18, were susceptible or moderately susceptible to red rot.

Table 9. Performance of clones under ZYT-II, 2023-2024 over five locations

Variety/Clone	Millable Count ($x10^3$ ha^{-1})	Yield data (tha^{-1})	Sugar content %	Red Rot Reaction	Wilt Reaction	Smut Reaction
I 56-18	98.16 ab	91.97 c	12.23	MS	S	HS
I 71-18	91.78 c	94.28 bc	13.87	S	MS	R
I 75-18	93.84 bc	104.3 a	12.33	S	MR	S
I 141-18	93.44 bc	106.71 a	11.67	MS	MR	R
I 182-18	95.37 bc	90.55 c	13.27	MR	MR	MS
BSRI Akh 46	100.31 a	96.94 b	12.34	MS	MR	S
CV %	7.07	5.83				

CLONAL SELECTION FROM ZONAL YIELD TRIAL (ZYT-III)

Out of five clones, the Clone I 94-16 produced the highest cane yield (100.74 t/ha) followed by I 49-17 (98.3 t/ha), both outperforming the check variety BSRI Akh 45 (93.49 t/ha). In terms of plant population, I 94-16 also recorded the highest millable cane count (98.65k/ha). The clonel 78-17 had the highest sugar content (13.21%), while other clones showed slightly lower values. Regarding disease resistance, I 94-16 showed moderate susceptibility to red rot, resistance to wilt, and to smut. Clone

I 78-17 showed resistance to wilt, while I 49-17 and I 27-16 showed smut resistance. Overall, I 94-16 demonstrated superior performance in yield, plant population, and multi-disease resistance.

Table 10. Performance of clones under ZYT-III, 2023-2024 pooled over five locations

Variety/ Clone	Millable Count ($x10^3$ ha^{-1})	Yield data (tha^{-1})	Sugar content %	Red Rot Reaction	Wilt Reaction	Smut Reaction
I 94-16	98.645 a	100.74 a	12.79	MS	R	R
I 49-17	92.465 ab	98.3 a	11.97	S	S	R
I 75-17	86.207 b	91.49 b	11.60	S	MR	MS
I 78-17	86.532 b	89.8 b	13.21	MS	R	MR
BSRI Akh 45	97.887 a	93.49 b	12.77	MR		
CV %	10.86	6.00				

Zonal Yield Trial-1, Ratoon, 2023-2024

In ZYT I ratoon trial, the highest cane yield was recorded by the clone I 75-18 (102.78 t/ha), which was higher than the check variety BSRI Akh 46 (146.74 t/ha).

Table 11. Performance of clones under ZYT-I (Ratoon), 2023-2024

Variety/Clone	Tiller count/ha ($x10^3$ ha^{-1})	Millable Count ($x10^3$ ha^{-1})	Yield data (tha^{-1})
I 56-18	124.34 e	98.77 e	94.99 b
I 71-18	145.52 bc	115.32 bc	92.68 b
I 75-18	131.88 de	103.46 de	102.78 a
I 124-18	130.98 de	103.55 de	93.36 bc
I 141-18	135.81 d	105.8 de	98.41 a
I 182-18	136.66 cd	108.59 cd	98.11 b
I 198-18	156.12 a	124.26 a	98.11 c
BSRI Akh 46	146.74 ab	116.46 b	93.7 b
CV %	5.8	5.79	5.11

Zonal Yield Trial- II Ratoon, 2023- 2024

In this experiment, the Clone I 49-17 recorded the highest cane yield (95.16 t/ha) and outperformed the check variety BSRI Akh 45 (89.90 t/ha). It also had the highest tiller (152.48k/ha) and millable cane count (118.88k/ha). The Clone I 78-17 also slightly exceeded the check in yield, while I 75-17 was lower. Overall, I 49-17 showed the best performance in yield and plant population traits.

Table 12. Performance of clones under ZYT-II (Ratoon), 2023-2024

Variety/Clone	Tiller count/ha ($x10^3$ ha^{-1})	Millable Count ($x10^3$ ha^{-1})	Yield data (tha^{-1})
I 49-17	152.48 a	118.88 a	95.16 a
I 68-17	133.75 b	106.15 b	83.57 b
I 75-17	123.4 c	98.2 c	81.38 c
I 78-17	120. 3 c	95.58 c	91.48 b
BSRI Akh 45	146.48 a	117.19 a	89.9 b
CV %	5.31	5.38	4.75

BREEDER SEED MULTIPLICATION OF PROMISING CLONES/VARIETIES OF SUGARCANE

In total 227.83 ton seeds were produced from 78 varieties/genotypes (35 variety, 33 clones, other 10), of which 65.40 ton were distributed to different sugar mills as nucleus seed and different research divisions for experiments.

MORPHOLOGICAL CHARACTERIZATION OF STEVIA GERMPLASM

The five Stevia genotypes exhibited clear variation in both growth and leaf morphological traits (Table 13, Table 14). BSRI Stevia 1 has the highest plant height (59.4 cm) with early flowering and a short juvenile period (58 days), while Stevia 5 was the shortest (41.2 cm), non-flowering, and had the longest juvenile phase (114 days). Leaf texture was mostly pubescent except in Stevia 4 (glabrous). Plant type varied from loose (BSRI Stevia 1, Stevia 3) to compact (Stevia 2, Stevia 4, Stevia 5).

Leaf shape was predominantly lanceolate, except Stevia 2 (elliptic-lanceolate) and Stevia 4 (ovate). All genotypes had acute tips, attenuate bases, and reticulate venation. Leaf margins were mostly serrate, with Stevia 3 having entire and Stevia 5 serrulate margins. These differences indicate considerable morphological diversity that can be utilized in breeding programs.

Table 13. Growth and flowering characteristics of five *Stevia rebaudiana* genotypes

Genotype	Plant type	Plant height (cm)	Flowering behavior	Juvenile period (days)
BSRI Stevia 1	Loose	59.4	Early Flowering	58
Stevia 2	Compact	52.2	Early Flowering	75
Stevia 3	Loose	51.6	Early Flowering	54
Stevia 4	Compact	53.0	Late flowering	100
Stevia 5	Compact	41.2	Non-flowering	114

Table 14. Leaf morphological characteristics of five *Stevia rebaudiana* genotypes

Genotype	Leaf texture	Leaf shape	Tip	Base	Venation	Margin
BSRI Stevia 1	Pubescent	Lanceolate	Acute	Attenuate	Reticulate	Serrate
Stevia 2	Pubescent	Elliptic-lanceolate	Acute	Attenuate	Reticulate	Serrate
Stevia 3	Pubescent	Lanceolate	Acute	Attenuate	Reticulate	Entire
Stevia 4	Glabrous	Ovate	Acute	Attenuate	Reticulate	Serrate
Stevia 5	Pubescent	Lanceolate	Acute	Attenuate	Reticulate	Serrulate

IMPROVEMENT OF LOCAL DATE PALM USING ARTIFICIAL POLLINATION AND MOLECULAR BREEDING

Five native date palm plants (P_1, P_2, P_3, P_4 and P_5) were selected from BSRI native date palm garden as female parent. Among the inflorescence of P_1-P_4 no. plants were pollinated with improve date (Barhe) pollen following pollen dusting technique in the month of February. The pollinated inflorescence was covered for 21 days to protect cross contamination. The plant P_5 was observed in natural pollination. Fruit settings, fruits development and ripening stage were observed time to time. In the middle of the month of June the fruits become fully ripped, then harvested and collect data and it was summarized in table 15. The table 15 revealed that after artificial pollination (plant P_1-P_4) fruit bearing capacity, fruit length, flesh (Epicarp) weight and thickness of native date fruit slightly increased than the controlled plant (P_5). F_1 progeny were developed using hybridized fruits seed and will be planted to observe further improvement.

Table 15. Fruiting performance of native date plants upon inter specific hybridization, 2023-2024

Parents (female)	No. of Inflo./plant	No. of Spikelet/ inflo.	No. of Fruits/ spikelet	Fruit length mm	Seed length mm	Flesh wt. gm	Seed wt. gm	Flesh thickness mm	Seed thickness mm	Total fruits wt. kg
P_1	4	21	6	6.07	4.47	23	17	0.43	1.41	2.01
P_2	9	41	12	5.73	4.2	21	16	0.6	1.43	16.38
P_3	6	42	5	5.84	4.14	27	16	0.4	1.42	4.16
P_4	9	31	7	3.35	2.25	26	22	0.49	1.23	9.37
P_5 (control)	8	32	7	4.24	3.15	15	9	0.27	1.26	4.92

Inflo.-Inflorescence , Flesh- Epicarp, Wt. -weight

Table 16. Field performance of hybridized date palm genotypes

Hybridized parents	No. of F_1 genotypes planted	No. of F_1 genotypes survived	No. of genotypes showed special traits	Remarks
Native DP × Barhe	63	49	6	produces sucker
Barhe × Native DP	14	6	1	produces sucker
Sukkri × Native DP	15	6	1	produces sucker
Sukkri × Barhe	17	6	-	No sucker
Barhe × Barhe	11	9	3	produces sucker

Native DP – Natve date palm

Date palm hybridization was made with female native date and improve date (Barhe and Sukkri) plant of BSRI garden as pistil parent and pollinated by collected pollen from native date and improve date Barhe in 2021-22 cropping season. Using these cross material's seeds total 120 number of F_1 date palm seedlings were developed and nursing at breeding yard in 2022. In the month of August, 2022 total 120 number of date palm hybrid genotypes were planted in BSRI farm at B-8 Block. Necessary intercultural operation like irrigation, weeding, fertilizer and insecticides were applied as and when necessary. Finally 85 hybrid genotypes are survived in the field with vigor growth, some of them showing sucker producing characters that's occurred only in improve date palm plant. The results was presented in table 16.

CHARACTERIZATION AND DOCUMENTATION OF LOCAL AND EXOTIC DATE PALM

The research was conducted at BSRI date palm garden and six genotypes were selected for characterization. Among the six genotypes, three were local (one male & two female) and three were Arabic (one male & two female). Morphological, flower, fruit, and seed data were collected properly and recorded. From the conducted research, different germplasm gave different results. In case of morphological data of local date palm-leaf length, spine rachis angle & Brix (%) were highest observed in plant No. 03 but collection of juice per plant (L) per day was highest in plant 02. On the other hand, morphological data of Arabic date palm-leaf length, spine length & spine area length were highest recorded in plant 02 (Table 17). For the flower & fruit data of local date palm, such as-fruit length, fruit weight, flesh thickness & fruit density were higher in plant 03 and flower & fruit data of the Arabic date palm such as-peduncle length, fruit weight & fruit density, were highest recorded in plant 01 (Table 18). In case of seed data of local

date palm such as- seed length, seed volume, seed weight percentage of fruit weight & seed volume percentage of fruit volume were highest recorded in plant No. 03. On the other hand, seed data of the Arabic date palm such as- seed length, seed volume & seed volume percentage of fruit volume were higher in plant 02 (Table 19). It was always observed that flowering time of all the local date palm germplasm was earlier than Arabic date palm germplasm (Table 18) and fruit size & weight of all the local date palm germplasm was smaller than Arabic date palm germplasm (Table 18). The conducted research result will be used to further target-based breeding purposes.

Table 17. Morphological Data (2023-24)

Parameter	Local date palm 01 (Male)	Local date palm 02 (Female)	Local date palm 03 (Female)	Arabic date palm 01 (Female)	Arabic date palm 02 (Female)	Arabic date palm 03 (Male)
Leaf length (cm)	420	364	451	450	495	410
Petiole length (cm)	30	24	36	50	43	25
Leaf blade length (cm)	390	340	415	400	452	385
Spine length (cm)	09	14	12	25	23	21
Spine area length (cm)	24	28	20	54	58	38
No. of spine per leaf	42	37	26	15	32	16
Spine rachis angle	70°	55°	80°	45°	50°	65°
Collection of juice per plant (L) per day	3.89	4.14	3.25	-	-	-
Brix (%)	12	13	15.5	-	-	-

Table 18. Flower and fruit data (2023-24)

Parameter	Local date palm 01 (Male)	Local date palm 02 (Female)	Local date palm 03 (Female)	Arabic date palm 01 (Female)	Arabic date palm 02 (Female)	Arabic date palm 03 (Male)
Flowering time	30 January, 2024	03 February, 2024	05 February, 2024	06 March, 2024	10 March, 2024	15 March, 2024
No. of inflorescence per plant	12	08	12	05	08	03
Spathe length (cm)	24	20	35	33	48	39
No. of fruit set/Inflorescence	Male	580	620	260	390	Male
Peduncle length (cm)		18	29	44	32	
Peduncle thickness (mm)		02	04	5.2	4.7	
Days to fruit maturity		13 June, 2024	23 June, 2024	22 July, 2024	24 July, 2024	
Days to fruit ripening		26 June, 2024	05 July, 2024	05 August, 2024	10 August, 2024	
Fruit per Inflorescence		420	450	170	215	
Fruit color at ripening stage		Redish	Yellowish	Dark yellow	Yellow	
Fruit length (cm)		2.5	2.7	3.8	3.5	
Fruit width (cm)		1.4	1.3	2.6	2.8	
Fruit weight (gm)		2.92	3.08	14.31	11.98	
Fruit volume (cm^3)		5.19	4.56	25.69	27.44	
Fruit shape		Cylindrical	Cylindrical	Obviate	Obviate	
Fruit apex		Obtuse	Obtuse	Obtuse blunt	Obtuse	
Flavour		Medium	Slightly good	Excellent	Good	
Flesh thickness (mm)		2.5	3.0	7	9	
Flesh color		Cream	Cream	Whitish	Cream	
Fruit density (w/v)		0.56	0.68	0.56	0.44	

Table 19. Seed data (2023-24)

Parameter	Local date palm 01 (Male)	Local date palm 02 (Female)	Local date palm 03 (Female)	Arabic date palm 01 (Female)	Arabic date palm 02 (Female)	Arabic date palm 03 (Male)
Seed length (cm)	Male	1.95	2.10	1.90	2.5	Male
Seed width (cm)		0.85	0.94	0.90	1.1	
Seed weight (gm)		1.60	1.75	3.50	2.40	
Seed volume (cm^3)		1.41	1.86	1.54	3.03	
Seed color		Brown	Brown	Whitish	Whitish	
Seed surface		Slightly rough	Soft	Soft	Soft	
Seed weight percentage of fruit weight		54.79	56.82	24.46	20.03	
Seed volume percentage of fruit volume		27.17	40.79	5.99	11.04	

BIOTECHNOLOGY DIVISION

RESEARCH HIGHLIGHTS

- Five mutants of Isd 37 (CC37M1, CC37M2, CC37M3, CC37M4, and CC37M5) and BSRI released 9 latest varieties (Isd 40, BSRI Akh 41, BSRI Akh 42, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, BSRI Akh 46, BSRI Akh 47, and BSRI Akh 48) were characterized by the SSR markers; mSSCIR3, mSSCIR1751, SMC851, mSSCIR74, UGSM382, and UGSM396. The results of this experiment showed that, the SSR markers were able to determine the genetic relationship within the mutants and the latest 9 varieties of Bangladesh Sugarcrop Research Institute (BSRI).
- Fifteen somaclones of BSRI bred varieties of sugarcane; Isd 16, Isd 20, Isd 34, Isd 37, and Isd 38 were evaluated under field condition at 10 months after plantation. Out of fifteen somaclones, three (TC2-10 (16), TC8-10(16), and TC10-10(16) developed from Isd 16, Three (TC1-10(20) PEG, TC16-10(20) PEG, and TC23-10(20) PEG) developed from Isd 20, two (TC12-10(34), and TC14-10(34) developed from Isd 34, two (TC1-10(37) SALT and TC3-10(37) SALT) from Isd 37 and five (TC1-10(38) SALT, TC3-10 (38) SALT, TC5-10(38) SALT, TC1-10(38) PEG, and TC3-10(38) PEG) developed from Isd 38. The highest yield were harvested from TC-8-10(16), TC23-10(20) and TC3-10(38) PEG. The highest brix was accumulated in TC10-10(16), TC16-10(20) PEG, TC14-10(34), TC3-10(37) SALT, TC1-10(38) PEG, and TC1-10(38) PEG.
- The genetic transformation of salt and drought tolerant genes in sugarcane was conducted by utilizing *Agrobacterium* strains *LBA4404 (PsCBL)*. The *PsCBL* salt resistance gene was transformed in sugarcane varieties Isd 33, Isd 39, and BSRI Akh 42. The survivability of plantlets was assessed at 25ºC at a concentration of 21.66 dS/m NaCl salt and they are currently being kept in a controlled *in vitro* condition.
- The MS media fortified with BAP (0.5 mgl^{-1}) and NAA (0.5 mgl^{-1}) showed the highest efficiency in shoot regeneration of sugar beet whereas the MS media augmented with NAA (2 mgl^{-1}) showed the better performances for root initiation. The rooted plantlets were transferred to perforated plastic trays containing soil: coco dust (1 : 1) and acclimatized to adopt at natural environmental condition.
- Sugarcane variety Isd 33 was utilized to produce high quality seeds (HQS) of sugarcane through micropropagation technique. The prepared explants were incubated on freshly prepared MS media supplemented with BAP (2 mgl^{-1}) and Kn (1 mgl^{-1}) for shoot regeneration and MS media containing NAA (5mgl^{-1}) for root initiation. The rooted plantlets were transferred to plastic trays containing soil and coco-dust (1:1) kept in hardening shade for acclimatization of micropropagated plantlets to adopt in the natural environmental condition. The acclimatized plantlets were transferred to poly bag and kept at yard for field plantation.
- Shoot tip and meristematic buds of Arabian date palm were used for plantlets production through micropropagation. The proliferated shoots were transferred and incubated on MS media supplemented with different concentrations of NAA for root initiation. The incubated shoots are being regularly sub-cultured on the same media to enhance the root initiation.
- The regenerated somaclones of three genotypes; BSRI stevia 1, Japanese, and Egyptian were planted in field condition to

evaluate the performances in respect of plant height (cm), total biomass (gm/plant), and green leaf weight (gm/plant) at different spacing. The BSRI released variety; BSRI stevia 1 showed the highest plant height (40.50cm) and the highest biomass (36 gm/plant) was produced at 50cm x 50cm spacing whereas the genotype; Japanese exhibited the highest yield (green leaf weight) from the same spacing of 50cm x 50cm.

CHARACTERIZATION AND DOCUMENTATION OF SUGARCANE USING MOLECULAR MARKERS

Five mutants of Isd 37 (CC37M1, CC37M2, CC37M3, CC37M4, and CC37M5) and BSRI released 9 latest sugarcane varieties (Isd 40, BSRI Akh 41, BSRI Akh 42, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, BSRI Akh 46, BSRI Akh 47, and BSRI Akh 48) were utilized to conduct characterization and documentation of sugarcane using molecular markers. DNA from the plant samples were extracted by the modified CTAB method without liquid nitrogen. High quality and enormous quantity of DNA was recovered from meristem cylinder. The isolated DNA was enough to conduct the Polymerase Chain Reaction (PCR) amplification and molecular marker like simple sequence repeat (SSR) studies.

The SSR markers; mSSCIR3 and mSSCIR1751 were used to investigate the genetic relationship within the 5 mutants of variety Isd 37. And the SSR markers; SMC851, mSSCIR74, UGSM382, and UGSM396 were utilized to characterize the BSRI released 9 latest varieties (Isd 40, BSRI Akh 41, BSRI Akh 42, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, BSRI Akh 46, BSRI Akh 47, and BSRI Akh 48).

The results of this experiment showed that, the SSR markers were able to determine the genetic relationship within the mutants and the latest 9 sugarcane varieties released from Bangladesh Sugarcrop Research Institute (BSRI) (Figure 01-03)

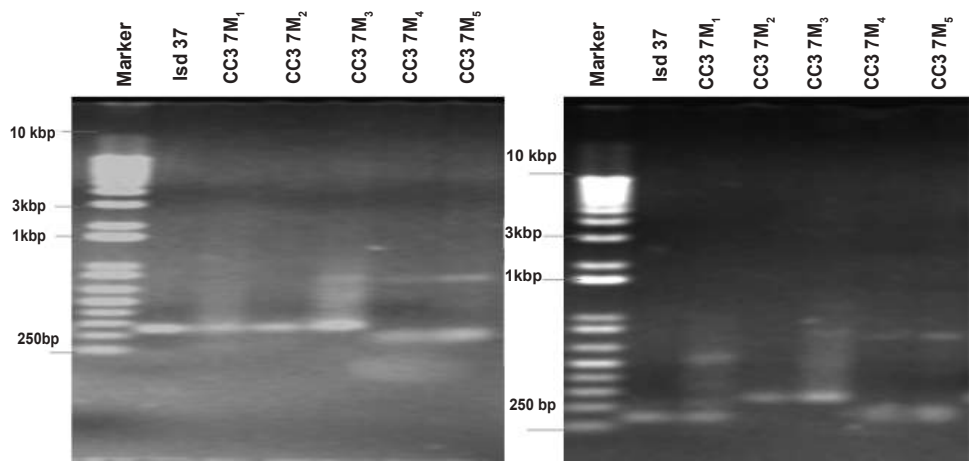


Figure 01. SSR profile of five mutants along with their parent variety based on primer pair mSSCIR3 and primer pair mSSCIR1751

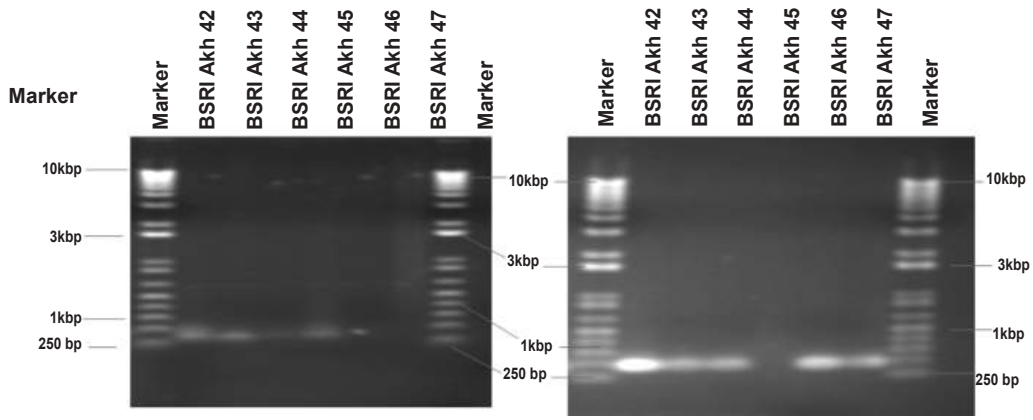


Figure 02. DNA fingerprinting of BSRI Akh 42, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, BSRI Akh 46 and BSRI Akh 47 by SMC851 and mSSCIR74

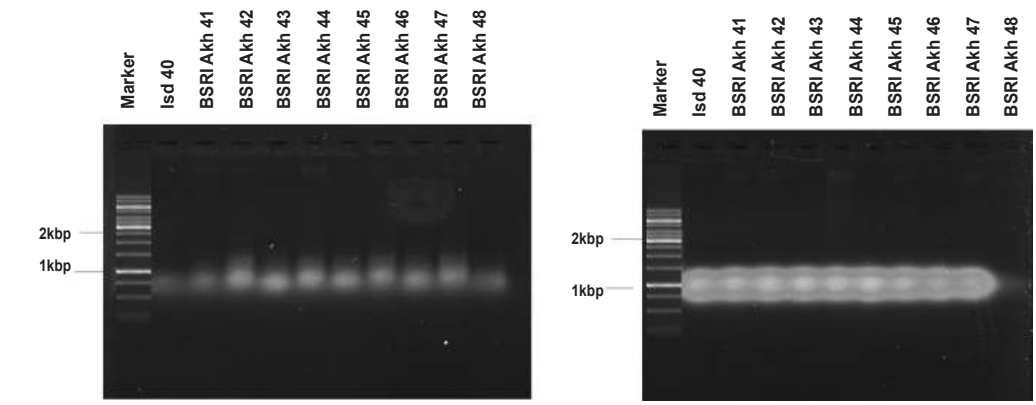


Figure 03. DNA fingerprinting of Isd 40, BSRI Akh 41, BSRI Akh 42, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, BSRI Akh 46, BSRI Akh 47 and BSRI Akh 48 by UGSM382 and UGSM396

GENETIC ENHANCEMENT OF SUGARCANE THROUGH DEVELOPMENT OF STRESS TOLERANT SOMACLONES AND THEIR FIELD EVALUATION

Fifteen somaclones of BSRI bred varieties of sugarcane; Isd 16, Isd 20, Isd 34, Isd 37, and Isd 38 were evaluated under field condition at 10 months after plantation.

Out of fifteen somaclones, three (TC2-10(16), TC8-10(16), and TC10-10(16) developed from Isd 16, Three (TC1-10(20) PEG, TC16-10(20) PEG, and TC23-10(20) PEG) developed from Isd 20, two (TC12-10(34), and TC14-10 (34) developed from Isd 34, two (TC1-10 (37) SALT, and TC3-10(37) SALT) developed from Isd 37 and five (TC1-10 (38) SALT, TC3-10 (38) SALT, TC5-10 (38) SALT, TC1-10(38) PEG and TC3-10 (38) PEG) developed from Isd 38.

The somaclone TC8-10(16) originated from Isd 16 showed the highest no. of node/cane (23.6), internode/cane (24.4), plant height (2.28m), cane middle girth (2.16cm), and yield (78.634 tha^{-1}) which were significantly different from other somaclones of Isd 16 and standard variety Isd 16. The somaclone TC10-10(16) gave the highest length (1.8m) of plant, and TC2-10(16) gave the highest no. of green leaf/cane (10.6) without any significant

differences among the somaclones of Isd 16 and the standard variety Isd 16 (Table 1).

The somaclone TC23-10(20) PEG developed from Isd 20 showed the highest plant height (2.4m) which was significantly different from other somaclone and the standard variety Isd 20. The somaclone TC23-10(20) PEG gave the highest yield (77.076 tha^{-1}) and significantly different from somaclone TC-1-10(20) PEG but not significantly different from somaclone TC16-10(20) PEG and the standard variety Isd 20 (Table 2).

The somaclone TC12-10(34) showed the highest frequency in producing plant height (2.08m) and length of leaf (1.84m) without any significant differences among them. The standard variety Isd 34 gave the highest node/cane (22.6), internode/cane (21.8) without any significant differences among the somaclones, but gave the highest cane middle girth (2.2cm.), no. of green leaf/cane (10.2) and yield (92.924 tha^{-1}) with significant differences among the somaclones developed from Isd 34 (Table 3).

The somaclone TC1-10 (37 SALT) developed from Isd 37 showed the best performance in respect of node/cane (27.2), internode/cane (27.2), plant height (26.2m) and leaf length (2.8m) without any significant differences with others. The standard variety Isd 37 exihibited the highest potentiality in producing highest cane middle girth (2.2cm), no. of green leaf/cane (2.5), and yield (160 tha^{-1}) with significant differences from the developed somaclones TC1-101 (37) SALT and TC3-10 (37 SALT) (Table 4).

There were five somaclones developed from Isd 38 were evaluated the field performance and chemically analyzed at 10 months after plantation. The highest node/cane (22.6) was achieved from the somaclones TC3-10 (38) SALT and TC3-10(38) PEG without any significant differences among the somaclones and the standard variety Isd 38.

Highest plant height was harvested from the TC1-10 (38) PEG which was significantly different from the standard variety Isd 38 and the highest length of leaf was found from the somaclone TC5-10 (38) SALT having the significant differences with TC3-10 (38) SALT and TC3-10 (38) PEG. The highest cane middle girth (1.88cm) was achieved from the somaclnes TC5-10 (38) SALT and TC1-10 (38) PEG and showed the significant differences with Isd 37, TC3-10 (38) SALT and TC3-10(38) SALT somaclones. The somaclone TC1-10 (38) PEG produced the highest no. of green leaf/cane (9.8) and the somaclone TC3-10 (38) PEG showed the highest potentiality in producing yield (70.56 tha^{-1}) and significant differences found among the somaclones and standard variety Isd 38 (Table 5).

Table 1. Field performances of sugarcane somaclones of Isd 16

Variety/Somaclone	Node/ Cane	Internodes/ Cane	Plant Height (m)	Leaf Length (m)	Cane Middle Girth (cm)	No. of Green Leaf/Cane	Yield (tha^{-1})
Isd 16	16.8 b	16.6 b	1.92 b	1.58 a	1.9 ab	10.2 a	46.674 c
TC2-10(16)	17.2 b	18.2 b	2.14 ab	1.74 a	1.8 b	10.6 a	41.578 c
TC8-10(16)	23.6 a	24.4 a	2.28 a	1.72 a	2.16 a	10.0 a	78.634 a
TC10-10(16)	20.8 a	21.4 a	1.92 b	1.8 a	2.1 a	9.0 a	67.514 b
CV %	3.486	3.109	0.243	0.400	0.292	2.71	8.714

Table 2. Field performances of sugarcane somaclones of Isd 20

Variety/Somaclone	Node/ Cane	Internodes/ Cane	Plant Height (m)	Leaf Length (m)	Cane Middle Girth (cm)	No. of Green Leaf/Cane	Yield (tha^{-1})
Isd 20	21.2 ab	21.6 a	1.96 b	1.64 a	2.1 a	12.8 a	77.076 a
TC1-10(20)PEG	18.6 b	19.4 a	2.04 b	1.56 a	1.68 b	7.0 b	43.136 b
TC16-10(20)PEG	19.4 ab	19.6 a	2.08 b	1.38 a	1.86 b	6.6 b	68.096 a
TC23-10(20)PEG	22.2 a	23 a	2.4 a	1.6 a	1.82 b	7.2 b	76.046 a
CV %	3.124	3.630	0.279	0.379	0.188	1.687	10.602

Table 3. Field performances of sugarcane somaclones of Isd 34

Variety/Somaclone	Node/ Cane	Internodes/ Cane	Plant Height (m)	Leaf Length (m)	Cane Middle Girth (cm)	No. Of Green Leaf/Cane	Yield (tha^{-1})
Isd 34	22.6 a	21.8 a	1.92 a	1.62 a	2.2 a	10.2 a	92.924 a
TC12-10(34)	20.8 ab	19.8 a b	2.06 a	1.72 a	1.88 b	8.2 b	62.02 b
TC14-10(34)	18.2 b	17.2 b	2.08 a	1.84 a	1.78 b	8.0 b	55.078 c
CV %	3.435	3.373	0.200	0.248	0.162	0.564	2.222

Table 4. Field performances of sugarcane somaclones of Isd 37

Variety/Somaclone	Node/ Cane	Internodes/ Cane	Plant Height (m)	Leaf Length (m)	Cane Middle Girth (cm)	No. Of Green Leaf/Cane	Yield (tha^{-1})
Isd 37	25.6 a	25.6 a	24.6 a	2.16 a	1.6 a	2.5 a	160 a
TC1-10(37)SALT	27.2 a	27.2 a	26.2 a	2.8 a	1.5 b	2.34 b	159.5 b
TC3-10(37)SALT	24.8 a	24.8 a	23.8 a	2.32 a	1.54 b	2.34 b	134.31 c
CV %	7.838	7.838	0.955	0.340	0.133	1.081	7.531

Table 5. Field performances of sugarcane somaclones of Isd 38

Variety/Somaclone	Node/ Cane	Internodes/ Cane	Plant Height (m)	Leaf Length (m)	Cane Middle Girth (cm)	No. Of Green Leaf/Cane	Yield (tha^{-1})
Isd 38	17.8 a	16.8 a	1.9 b	1.52 abc	1.7 c	7.2 c	53.41 d
TC1-10(38)SALT	21.6 a	21.6 a	2.12 ab	1.58 ab	1.86 ab	9 ab	62.7 b
TC3-10(38)SALT	22.6 a	21.6 a	2.22 a	1.32 c	1.72 c	8.4 bc	47.04 e
TC5-10(38)SALT	22.4 a	21.4 a	2.04 ab	1.64 a	1.88 a	8.2 bc	56.84 c
TC1-10(38)PEG	21.2 a	20.2 a	2.3 a	1.48 abc	1.88 a	9.8 a	62.718 b
TC3-10(38)PEG	22.6 a	21.6 a	2.2 a	1.4 bc	1.74 bc	8.4 bc	70.56 a
CV %	5.476	5.409	0.276	0.233	0.129	1.301	0.380

All the somaclones were chemically (brix, pol, purity, and pol % cane) analyzed at 10 months after plantation as well. The somaclone TC10-10(16) developed from the variety Isd 16 showed the highest brix (19.67), pol (17.29), purity (87.82), and pol % cane (13.66) though there was no significant differences found with other developed somaclones and the standard variety Isd16 (Figure 4).

The somaclones developed from the variety Isd 20 did not show any significant frequency in brix, pol, purity and pol % cane in comparison with the standard variety Isd 20. The sugarcane bred variety Isd 20 showed the highest brix (20.03), pol (17.6), purity (87.81), and pol % cane (13.90) (Figure 5).

TC14-10(34) somaclone developed from Isd 34 showed the highest frequency in synthesizing brix (16.37), pol (13.80), purity (84.34), and pol % cane (10.90) without any significant difference with other somaclone along with the standard variety Isd 34 (Figure 6).

Two somaclones TC1-10 (37) SALT and TC3-10 (37) SALT developed from the variety Isd 37 did not show any significant frequency in brix, pol, purity, and pol % cane in comparison with the standard variety Isd 37. The somaclone TC3-10 (37) SALT showed the highest accumulated brix (17.83), pol (15.20), and pol % cane (12.01) whereas the standard variety showed the highest purity (85.75) (Figure 7).

There were five somaclones developed from BSRI bred variety Isd 38 were chemically analyzed at 10 months after plantation. The highest brix (19.96) was accumulated in somaclones TC3-10(38) SALT and TC5-10(38) SALT with the significant difference with Isd 38 and TC3-10(38) PEG but not with TC1-10(38) SALT and TC1-10(38) PEG.

From the chemical analysis, it was shown that, the highest pol (17.78) was found in somaclone TC5-10(38) SALT and showed the significant differences with Isd 38 and the other somaclone TC3-10(38) PEG but did not show any significant differences with the somaclones; TC1-10(38) SALT and TC3-10(38) SALT.

The highest purity (89.10) was found in somaclone TC5-10(38) SALT and showed the significant differences with Isd 38 and the other somaclones TC1-10(38) PEG and TC3-10(38) PEG but did not show any significant differences with the somaclones; TC1-10(38) SALT and TC3-10(38) SALT.

The highest pol % cane (14.05) was found in somaclone TC5-10(38) SALT and showed the significant differences with Isd 38 and the other somaclones TC1-10(38) PEG and TC3-10(38) PEG but did not show any significant differences with the somaclones; TC1-10(38) SALT and TC3-10(38) SALT (Figure 8).

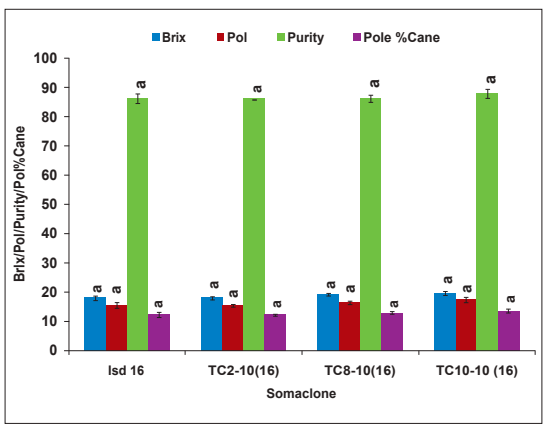


Figure 04. Chemical properties of sugarcane somaclones of Isd 16

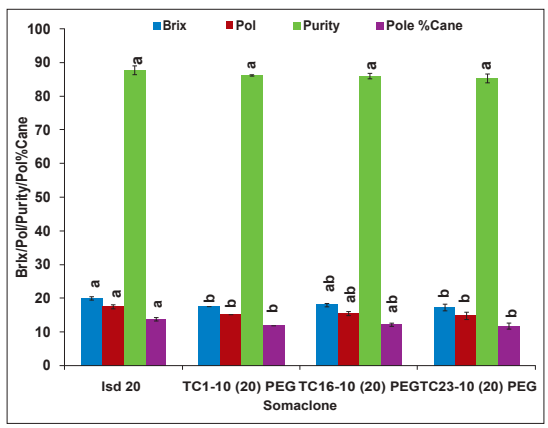


Figure 05. Chemical properties of sugarcane somaclones of Isd 20

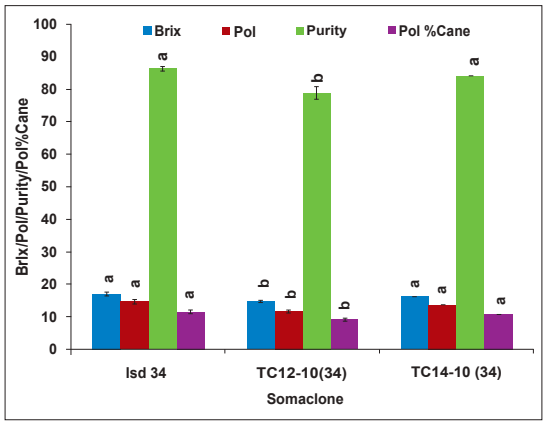


Figure 06. Chemical properties of sugarcane somaclones of lsd 34

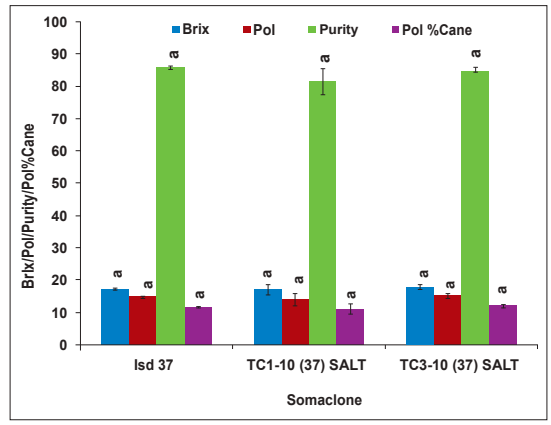


Figure 07. Chemical properties of sugarcane somaclones of lsd 37

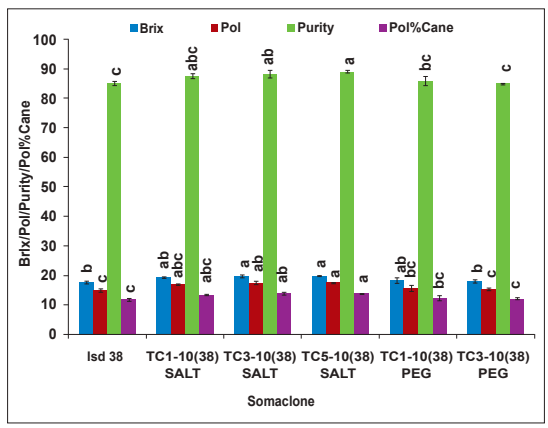


Figure 08. Chemical properties of sugarcane somaclones of lsd 38

GENETIC TRANSFORMATION OF SALT AND DROUGHT TOLERANT GENES IN SUGARCANE

The experiment entitled "genetic transformation of salt and drought tolerant genes in sugarcane" was conducted by utilizing *Agrobacterium* strains LBA4404 (PsCBL). The PsCBL salt resistance gene was transformed in sugarcane varieties lsd 33, lsd 39, and BSRI Akh 42. The survivability of plantlets was assessed at 25°C at a concentration of 21.66 dS/m NaCl salt and they are currently being kept in a controlled *in vitro* condition. After 21 days of culture initiation, transformed plantlets were died out entirely.

At 150 mM (21.66 dS/m) and 7.6% (polyethylene glycol) PEG concentration, the transformed plantlets were survived and grew rapidly. The survivability of plantlets regenerated from transformed explants at the concentrations of 150 mM (21.66 dS/m) NaCl and 7.6% of PEG indicated the success of transformation and expression of target genes (drought and salt resistance).

Transformed plantlets are being maintained by regular sub-culture at an interval of 21 days. Results indicated the possibility of the development of transgenic sugarcane against salt and drought stresses (Figure 09-14).

Figure 09. Co-cultivation of Isd 33 (Direct)

Figure 10. Co-cultivation of Isd 33 (Callus)

Figure 11. Callus of Isd 33 placed on selection media

Figure 12. Infected Callus of Isd 33

Figure 13. Shoot regenerated from infected callus of Isd 33

Figure 14. Regular separation and maintained PsCBL salt tolerant gene transformed plants of variety Isd 33.

MICROPROPAGATION FOR VEGETATIVE SEED PRODUCTION OF SUGAR BEET

The seeds of the sugar beet germplasm H10044, KWS Danicia, KWS serenade and KWS allanya were incubated on MS media to collect the explants. The leaf, leaf stalk and shoot tip were collected from the germinated seedlings on MS media and used as explants for the production of vegetative seedlings of sugar beet through micropropagation. The MS media supplemented with 2, 4-D (0.5 mgl^{-1}) and BAP (0.5 mgl^{-1}) and MS media fortified with BAP (0.5 mgl^{-1}) along with NAA (0.5 mgl^{-1}) were utilized separately. For shoot regeneration, the MS media fortified with BAP (0.5 mgl^{-1}) and NAA (0.5 mgl^{-1}) showed the highest efficiency. The regenerated shoots were incubated on MS media augmented with NAA (2 mgl^{-1}) and showed the better performances of root initiation. The rooted plantlets were washed thoroughly by running tap water to remove the media from roots. Extra cares were taken during washing to avoid the breakage of roots. The rooted plantlets were transferred to perforated plastic trays containing soil: coco dust (1 : 1). Then trays were kept under hardening shade which was made of iron stick and polythene for acclimatization. At that condition, water was sprayed regularly to maintain the humidity and temperature.

By this way, plantlets were hardened up to adopt in natural field condition. After acclimatization, plantlets were transferred to poly bag and kept for field plantation (Figure 15-17).

Figure 15. *In vitro* seed germination on MS media for explants collection

Figure 16. Callus initiation on Media

Figure 17. Shoot Developed on Media; a) H10044, b) KWS Danicia, c) KWS serenade, and d) KWS allanya

MICROPROPAGATION OF SUGARCANE VARIETIES FOR RAPID MULTIPLICATION AND HIGH QUALITY SEEDS (HQS) PRODUCTION

Sugarcane variety Isd 33 was utilized to produce high quality seeds (HQS) of sugarcane through micropropagation technique. The explants were collected from 6-8 months old field grown sugarcane. The collected explants (basal spindle leaf roll TS and basal spindle leaf segments) were prepared by performing surface sterilization and dissected into small pieces. The prepared explants were incubated on freshly prepared MS media supplemented with BAP (2 mgl^{-1}) and Kn (1 mgl^{-1}) for shoot regeneration. The regenerated shoots derived from explants, transferred on MS media containing NAA (5 mgl^{-1}) for root initiation. After root initiation, the rooted plantlets were transferred to plastic trays containing soil and coco-dust (1:1) by washing with running tap water to remove the media from the roots. The plastic trays were kept in hardening shade for acclimatization of micropropagated plantlets

to adopt in the natural environmental condition. Finally the acclimatized plantlets were transferred to poly bag having soil and cow dung (1:1) kept at yard for field plantation.

Following this procedure, around 6,000 shooted and rooted plantlets kept in test tube and around two thousand (2000) plantlets already produced from lsd 33 and kept at yard for field plantation (Figure 18-22).

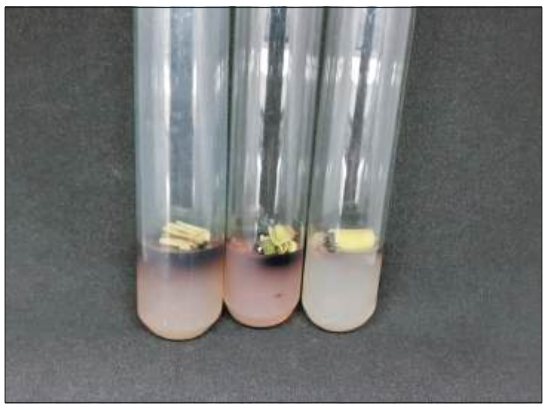


Figure 18. Explants incubation on media

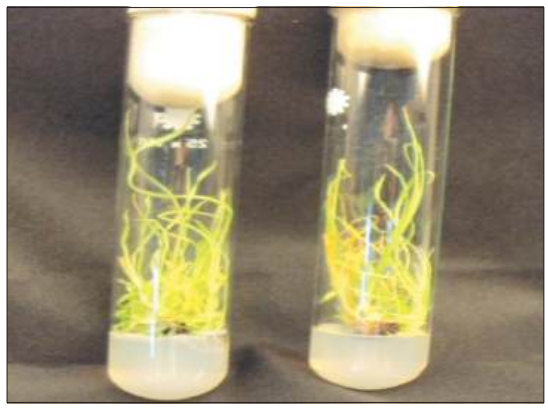


Figure 19. Shoot developed on media

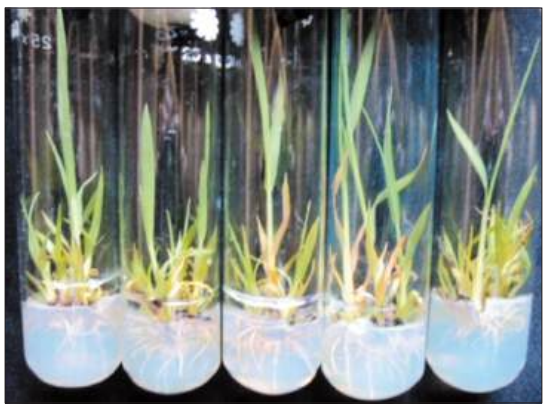


Figure 20. Root developed on media

Figure 21. Plantlets in plastic tray

Figure 22. Plantlets kept in yard for field plantation

TISSUE CULTURE FOR MULTIPLICATION OF ARABIAN DATE PALM AND PALMYRA PALM

Shoot tip and meristematic buds of Arabian date palm were used for plantlets production through micropropagation. The induced shoots developed from the incubated explants were transferred on MS media containing different concentrations of 2,4-D, citrate, NaH_2PO_4, coconut water, and activated charcoal for shoot proliferation.

The proliferated larger shoots were transferred and incubated on MS media supplemented with different concentrations of NAA for root initiation. The incubated shoots are being regularly sub-cultured on the same media to enhance the root initiation (Figure 23-24).

Figure 23. Explant incubation on media

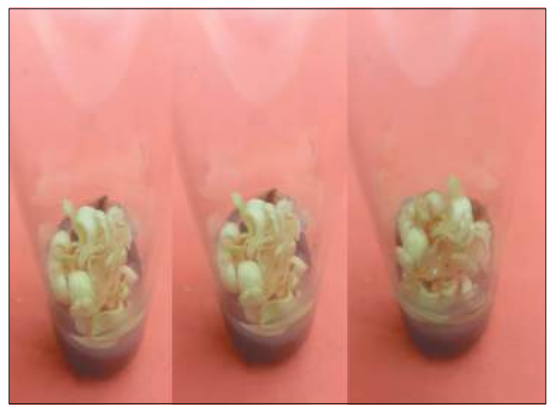


Figure 24. Shoot regenerated from media

DEVELOPMENT OF SOMACLONES OF STEVIA THROUGH TISSUE CULTURE TECHNIQUES AND SUBSEQUENT MOLECULAR DIVERSITY ANALYSIS

The somaclones were developed from three genotypes; BSRI stevia 1, Japanese, and Egyptian were produced through tissue culture technique. Leaf, internode and node of the genotypes were inoculated on MS media supplemented with different concentrations and combinations of plant growth regulators for somaclone production. The developed somaclones were planted in field to evaluate the performances in respect of plant height (cm), total biomass (gm/plant), and green leaf weight (gm/plant) at different spacing of 10cm X 10cm, 20cm x 20cm, 30cm x 30cm, 40cm x 40cm, 50cm x 50cm, and 60cm x 60cm.

The BSRI released variety, BSRI stevia 1 showed the highest performance in respect of plant height (40.50cm) compared to other genotypes; Japanese and Egyptian. The highest plant height was achieved from the spacing of 50cm x 50cm though there were no significant differences found among them. The total biomass (36 gm/plant) was produced from BSRI stevia 1 and that was highest from other genotypes; Japanese and Egyptian. The highest biomass from BSRI stevia 1 was harvested from the same spacing of 50cm x 50cm with the significant difference from other two genotypes.

The genotype; Japanese exhibited the potentiality to produce highest yield (green leaf weight) in comparison with the rest two genotypes; BSRI stevia 1, and Egyptian. The harvested yield from the Japanese stevia genotype was 4.5 gm/plant achieved from the spacing of 50cm x 50cm and which was significantly different from BSRI stevia 1 and Egyptian stevia genotype (Figure 25-27).

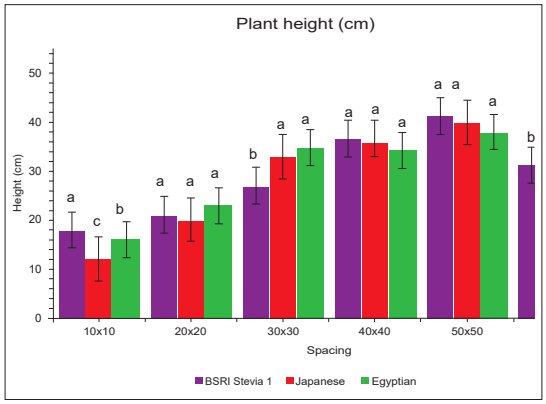


Figure 25. Effect of spacing on plant height of stevia

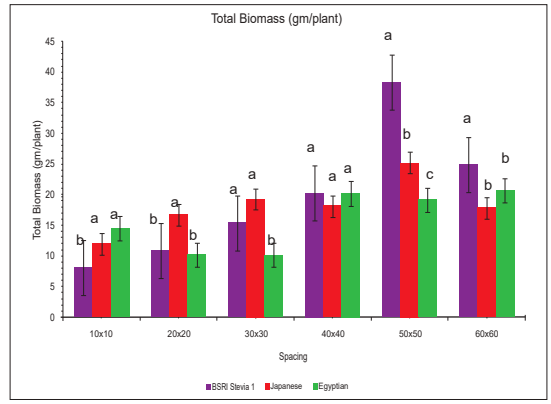


Figure 26. Effect of spacing on total biomass production in stevia

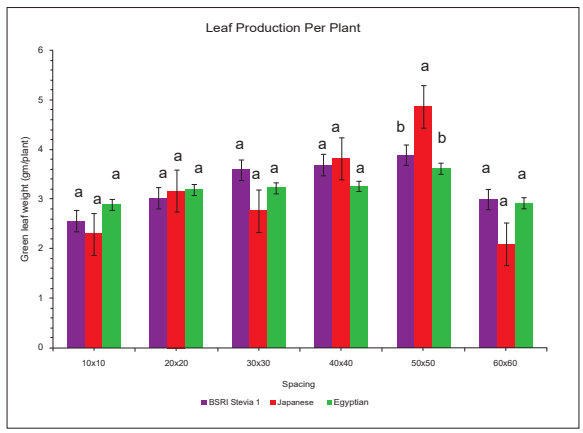


Figure 27. Effect of spacing on leaf yield of stevia

PHYSIOLOGY AND SUGAR CHEMISTRY DIVISION

RESEARCH HIGHLIGHTS

PHYSIOLOGY SECTION:

- The genotype BSRI Akh 45, I 94-16 and I 182-18 were identified as highly tolerant against drought stress condition.
- The genotype I 141-18 and BSRI Akh 46 were identified as highly tolerant against water logging stress condition.
- The genotypes BSRI Akh 45 and BSRI Akh 46 followed by I 71-18 have potentiality to grow under flood stress condition.
- The genotypes BSRI Akh 46 followed by I 94-16 under ZYT III and I 56-18 under ZYT II have potentiality to grow under salinity stress condition.
- The highest germination percent was recorded from the genotype I 78-17(85%).

SUGAR CHEMISTRY SECTION:

- BSRI Akh 45 showed early maturity, excellent recovery, stable juice quality, and balanced gur characteristics,
- The clone I 94-16 performed late maturity, high sucrose, low RS, and good storability of *gur*.
- The clone I 182-18 showed late maturity, exceptional sucrose content in *gur*, lowest RS, and low fibre.
- Clones like I 78-17 (ZYT-III) and I 75-18 (ZYT-II) also showed specific strengths, such as better colour or higher recovery.
- All the treatments showed the same result for the Brix %, RS% and pH content except T_1 (control) and was preserved for 50 days after preparation at room temperature.
- T_4 (RFD + Poultry Litter @ 5 t ha^{-1}) emerged as the best treatment for producing high-quality jaggery. T_3 (RFD + Mustard Oil Cake @ 0.5 t ha^{-1}) and T_2 (RFD + Cowdung @ 10 t ha^{-1}) also performed well, offering competitive quality traits.

PHYSIOLOGY SECTION

DROUGHT TOLERANCE IN SUGARCANE

An investigation was carried out with advanced clones during 2023-2024 cropping season at Patuadangi farm of Regional Sugarcrop Research Station (RSRS) Thakurgaon, Godagari (Rajshahi) farmer's field and BSRI (yard). The results of the investigation have been presented in Tables 1, 2 and 3. The genotypes BSRI Akh 45 and the clone I 94-16 under ZYT III and the clone I 182-18 under ZYT II performed better at RSRS (Thakurgaon) location (Table 1). In the case of Godagari (Rajshahi), the genotypes I 49-17 under ZYT III and I 182-18 followed by I 141-18 under ZYT II performed better than others (Table 2). The genotype BSRI Akh 45 gave the highest yield (87.80 tha^{-1}) followed by I 94-16 (82.08 t ha^{-1}) at RSRS (Thakurgaon) location while higher yield (96.54 t ha^{-1} and 94.90 t ha^{-1}) were obtained from the genotypes I 49-17 and I 182-18, respectively at Godagari (Rajshahi) location. The poor cane yield was recorded at Godagari (Rajshahi) location in comparison with RSRS (Thakurgaon) location possibly due to poor soil fertility level at Godagari (Rajshahi) location. Among the tested genotypes, the genotype BSRI Akh 45, I 94-16 and I 182-18 were identified as highly tolerant against drought stress condition.

Table 1. Screening sugarcane clones against drought stress (Location: Thakurgaon)

Varieties / Clones	Millable cane ($x10^3$ ha^{-1})	Yield (TCH)	Brix (%)	Grading (1-5)*
ZYT-III				
BSRI Akh 45	78.66	87.80 a	19.77	1
BSRI Akh 46	75.44	81.23 abc	19.21	1
I 49-17	76.66	65.22 c	20.88	3
I 75-17	74.44	78.55 abc	20.88	1
I 78-17	82.22	70.71 bc	20.33	2
I 94-16	76.97	82.08 ab	20.99	1
LSD (0.05)	19.48	16.17	NS	
ZYT-II				
BSRI Akh 45	78.66 a	87.80 a	19.77	1
BSRI Akh 46	75.44 a	81.23 a	19.21	1
I 141-18	52.55 c	56.62 c	18.88	3
I 182-18	60.33 bc	61.95 bc	20.66	2
I 71-18	76.00 a	65.04 bc	19.44	2
I 75-18	70.44 ab	59.45 c	20.55	3
I 56-18	70.22 ab	75.88 ab	20.55	1
LSD (0.05)	12.60	13.96	NS	

* Tolerance rating scale (1-5) is based on greenness of plants and other data collected where 1 = highly tolerant, 2 = tolerant, 3 = moderately tolerant, 4 = intolerant and 5 = highly intolerant.

Table 2. Screening sugarcane clones against drought stress (Location: Rajshahi)

Varieties / Clones	Millable cane ($x10^3$ ha^{-1})	Yield (TCH)	Brix (%)	Grading (1-5)*
ZYT-III				
BSRI Akh 45	90.58 a	81.48 b	19.22 bc	2
BSRI Akh 46	79.85 b	75.70 cd	18.81 c	2
I 49-17	90.86 a	96.54 a	21.01 a	1
I 75-17	76.72 b	80.42 bc	17.18 d	2
I 78-17	81.59 b	94.91 a	17.81 d	1
I 94-16	76.72 b	73.84 d	19.50 b	3
LSD (0.05)	8.56	5.19	0.63	
ZYT-II				
BSRI Akh 45	90.58	81.48 bc	19.22 a	2
BSRI Akh 46	79.85	75.70 c	18.81 a	3
I 141-18	87.95	90.76 ab	17.45 b	2
I 182-18	89.11	94.90 a	17.58 b	1
I 71-18	77.59	82.82 bc	16.30 c	2
I 75-18	75.12	89.64 ab	19.50 a	1
I 56-18	90.58	81.48b c	19.22 a	2
LSD (0.05)	NS	9.50	0.72	

* Tolerance rating scale (1-5) is based on greenness of plants and other data collected, where 1 = highly tolerant, 2 = tolerant, 3 = moderately tolerant, 4 = intolerant and 5 = highly intolerant.

Table 3. Performance of BSRI bred clones under drought stress conditions (PVC pipe experiment)

Varieties/Clones	Brix (%)	Pol % cane	Purity %	R.S.%
ZYT-III				
BSRI Akh 45	18.33 a	12.49 a	86.22 a	0.30 f
BSRI Akh 46	15.10 cd	9.71 cd	81.41 ab	0.97 c
I 49-17	16.76 b	11.30 b	85.33 a	0.63 e
I 75-17	15.23 c	10.01 c	83.16 ab	0.70 d
I 78-17	14.06 d	8.73 d	78.42 b	1.32 a
I 94-16	14.70 cd	9.21 cd	79.27 b	1.08 b
LSD (0.05)	1.04	1.15	4.96	0.03
ZYT-II				
BSRI Akh 45	18.33 a	12.49 a	86.22 a	0.30 d
BSRI Akh 46	15.10 c	9.71 c	81.41 b	0.97 c
I 141-18	16.66 b	11.10 b	84.29 ab	1.36 b
I 182-18	18.23 a	12.45 a	86.48 a	0.84 c
I 71-18	16.40 bc	11.02 b	85.07 ab	1.98 a
I 75-18	15.60 bc	10.26 bc	83.25 ab	0.85 c
I 56-18	13.46 d	8.27 d	77.39 c	0.93 c
LSD (0.05)	1.48	1.27	3.86	0.13

WATER-LOGGING TOLERANCE IN SUGARCANE

Screening trials were conducted at four locations such as BSRI farm, Ishwardi (Pakshi), and Kurigram locations during 2023-2024 cropping season with BSRI bred clones under ZYT I, II and III test stages. These trails were carried out at both pot and field conditions. In case of pot trial, sugarcane plants were grown in plastic pots. The pots having six months old plants were placed in a concrete water tank and filled with tap water. A trial was also conducted at BSRI farm under induced water-logging stress condition. Trials under natural water-logging stress condition were carried out at farmers' field in Ishwardi (Pakshi), and Kurigram. The results have been presented in Tables 4-12. It was observed from the table 4 that the genotype I 141-18 was found highly tolerant (having tolerance rating 1), having 50.08 per cent green leaves at the end of 120 d water-logging stress period. The highest primordial water roots were recorded from the genotype I 49-17 followed by the genotypel I 141-18 (Table 5). The highest Pol % cane were recorded from the genotype I 70-19 (15.73%) and I 71-19 (15.71 %) in BSRI yard (Table.7) whereas I 71-18 was recorded with higher pol % cane (15.37%) at BSRI farm (Table 9). Highest growth rate was observed in clone I 182-19 and I 92-19 in pot (Table 6) and I 75-18 field conditions (Table 10), respectively. From BSRI farm (Table 8) the genotypes BSRI Akh 45 and I 141-18 were found highly tolerant (having tolerance rating scale 1) with 32.18% and 31.67% green leaves, respectively at the end of 120 d water-logging stress period. The genotypes BSRI Akh 45, I 56-18 followed by I 141-18 showed highly tolerant reaction against induced water-logging stress at BSRI farm condition, and estimated cane yield were recorded 83.37,93.93, and 82.98t ha^{-1} respectively (Table 9). On the other hand, the genotypes I 141-18 and BSRI Akh 46 manifested higher yield in Kurigram (73.70 and 79.54 t ha^{-1}) and Ishwardi (Pakshi) BSRI Akh 46 (83.10 t ha^{-1}) location. Among the tested genotypes, the genotype I 141-18 and BSRI Akh 46 were identified as highly tolerant against water logging stress condition at all locations including farmer's field of Ishwardi (Pakshi), and Kurigram.

Table 4. Performance of BSRI bred sugarcane clones under induced water logging stress condition (Pot experiment)

Varieties / Clones	Water logging stress period (Days)				
	60		120		
	Dry leaf(%)/ Plant	Green leaf (%)/ Plant	Dry leaf(%)/ Plant	Green leaf (%)/ Plant	Tolerance rating scale (1-5)*
ZYT-III					
BSRI Akh 45	61.56 ab	41.76 a	71.29 bc	28.70 ab	2
BSRI Akh 46	59.96 b	40.03 ab	77.31 ab	22.68 bc	1
I 49-17	58.02 b	41.97 a	80.82 a	19.16 c	3
I 75-17	72.90 a	27.09 b	77.11 ab	22.88 bc	2
I 78-17	56.04 b	43.96 a	69.02 c	30.98 a	1
I 94-16	62.68 ab	37.32 ab	70.18 bc	29.81 ab	1
LSD (0.05)	12.70	13.69	7.82	7.81	
ZYT-II					
BSRI Akh 45	61.56 ab	41.76 ab	71.29	28.70 b	1
BSRI Akh 46	59.96 ab	40.03 ab	77.31	22.68 b	2
I 141-18	64.04 a	35.95 b	66.55	50.08 a	1
I 182-18	62.02 ab	37.97 ab	70.67	29.32 b	1
I 71-18	57.73 ab	42.29 ab	69.70	30.29 b	2
I 75-18	57.83 ab	42.16 ab	70.02	29.98 b	1
I 56-18	53.25 b	46.74 a	66.09	33.90 b	3
LSD (0.05)	9.17	10.71	NS	11.81	
ZYT-I					
BSRI Akh 45	60.04 abc	40.15 cde	67.80 bcd	32.18 ab	2
BSRI Akh 46	65.64 a	34.35 e	70.78 abc	29.20 bcd	1
I 138-19	65.29 ab	34.69 de	75.63 a	24.35 d	2
I 149-19	51.21 cd	49.34 ab	75.75 a	24.23 d	2
I 182-19	55.76 cd	44.23 bc	68.53 bcd	30.12 abc	3
I 185-19	60.29 abc	46.36 abc	65.69 cd	34.30 ab	1
I 190-19	56.13 bcd	43.85 bc	64.39 d	35.60 a	2
I 70-19	59.21 abc	40.77 cd	73.51 ab	26.47 cd	1
I 71-19	48.07 d	51.92 a	63.08 d	33.57 ab	1
I 92-19	56.77 abcd	43.22 bc	68.51 bcd	31.47 abc	3
LSD (0.05)	9.37	6.24	6.02	5.51	

* Tolerance rating scale (1-5) is based on greenness of plants and other data collected, where 1 = highly tolerant, 2 = tolerant, 3 = moderately tolerant, 4 = intolerant and 5 = highly intolerant.

Table 5. Performance of BSRI bred sugarcane clones under induced water logging stress condition (pot experiment)

Varieties/clones	Fresh weight of PWR/Plant (g)	Dry weight of PWR/Plant (g)	Volume of PWR/ Plant (ml)
ZYT-III			
BSRI Akh 45	67.22 b	15.22 b	62.22 bc
BSRI Akh 46	67.11 b	17.27 b	50.83 c
I 49-17	201.79 a	57.50 a	158.33 a
I 75-17	85.33 b	27.66 ab	85.00bc
I 78-17	100.17 b	19.00 b	85.50 bc
I 94-16	106.89 b	24.66 ab	113.33 ab
LSD (0.05)	41.79	35.54	54.67
ZYT-II			
BSRI Akh 45	67.22 c	15.22 d	62.22 bc
BSRI Akh 46	67.11 c	17.27 cd	50.83 bc
I 141-18	135.67 a	42.33 ab	99.33 a
I 182-18	83.00 c	52.00 a	82.50 ab
I 71-18	65.04 c	31.50 bc	38.00 c
I 75-18	129.56 ab	32.66 b	101.11 a
I 56-18	117.83 b	16.66 d	101.00 a
LSD (0.05)	17.57	14.51	32.26
ZYT-I			
BSRI Akh 45	67.22 de	15.22 d	62.22 cd
BSRI Akh 46	67.11 de	17.27 d	50.83 cd
I 138-19	101.33 c	19.00 d	106.67 b
I 149-19	128.44 b	25.05 bcd	126.67 ab
I 182-19	46.67 e	16.33 d	39.27 d
I 185-19	62.50 e	34.16 b	59.17 cd
I 190-19	109.67 bc	31.50 bc	111.28 ab
I 70-19	96.11 c	23.11 cd	38.28 d
I 71-19	90.19 cd	45.72 a	68.33 c
I 92-19	163.67 a	35.00 b	132.67 a
LSD (0.05)	20.75	10.59	24.26

Table 6. Growth rate performance of BSRI bred sugarcane clones under induced water-logging stress condition (Pot experiment)

Varieties/Clones	Upto 60 days	Upto 120 days
ZYT-III		
BSRI Akh 45	0.96	0.88
BSRI Akh 46	0.94	0.82
I 49-17	1.03	0.82
I 75-17	0.77	0.89
I 78-17	0.87	0.77
I 94-16	1.00	0.78
LSD (0.05)	NS	NS
ZYT-II		
BSRI Akh 45	0.96	0.88
BSRI Akh 46	0.94	0.82
I 141-18	0.83	0.76
I 182-18	0.83	0.79
I 71-18	0.97	0.81
I 75-18	0.89	0.75
I 56-18	1.00	0.99
LSD (0.05)	NS	NS
ZYT-I		
BSRI Akh 45	0.48 d	0.70 d
BSRI Akh 46	0.51 d	0.70 d
I 138-19	0.85 b	1.00 ab
I 149-19	0.98 a	0.93 abc
I 182-19	1.06 a	1.09 a
I 185-19	0.83 b	0.78 cd
I 190-19	1.01 a	1.07 a
I 70-19	0.75 bc	0.85 bcd
I 71-19	0.66 c	0.85 bcd
I 92-19	1.01 a	1.01 ab
LSD (0.05)	0.13	0.17

Table 7. Performance of BSRI bred sugarcane clones under induced water logging stress condition (pot experiment)

Varieties/clones	Brix %	Pol % cane	Purity %	R.S. %
ZYT-III				
BSRI Akh 45	18.83 b	12.93 b	86.84 b	0.63 c
BSRI Akh 46	19.96 a	14.06 a	89.17 a	0.45 e
I 49-17	17.33 c	11.78 c	86.05 b	0.96 a
I 75-17	18.43 b	12.51 bc	85.93 b	0.90 b
I 78-17	19.96 a	14.00 a	88.78 a	0.52 d
I 94-16	20.56 a	14.47 a	89.07 a	0.40 f
LSD (0.05)	0.81	0.81	1.90	0.03
ZYT-II				
BSRI Akh 45	18.83 cd	12.93 b	86.84 ab	0.63 b
BSRI Akh 46	19.96 abcd	14.06 ab	89.17 a	0.45 c
I 141-18	20.63 ab	14.36 a	88.09 ab	0.33 e
I 182-18	20.36 abc	14.06 ab	87.40 ab	0.36 d
I 71-18	19.06 bcd	12.83 b	85.18 b	0.72 a
I 75-18	20.73 a	14.07 ab	85.89 b	0.36 d
I 56-18	18.76 d	12.90 b	87.01 ab	0.47 c
LSD (0.05)	1.57	1.34	3.14	0.02
ZYT-I				
BSRI Akh 45	19.25 f	13.38 e	87.99 b	0.60 ef
BSRI Akh 46	20.10 e	14.05 d	88.49 b	0.27 h
I 138-19	20.96 cd	14.77 c	89.29 b	0.69 c
I 149-19	20.46 e	14.33 d	88.73 b	1.16 a
I 182-19	21.36 bc	14.92 c	88.46 b	0.96 b
I 185-19	20.46 e	14.34 d	88.75 b	0.38 g
I 190-19	20.50 de	14.36 d	88.69 b	0.58 f
I 70-19	22.56 a	15.73 a	88.34 b	0.60 de
I 71-19	21.56 b	15.71 a	92.41 a	0.22 i
I 92-19	21.80 b	15.30 b	88.84 b	0.62 d
LSD (0.05)	0.47	0.36	2.36	0.02

Table 8. Performance of BSRI bred sugarcane clones under induced water logging stress condition (BSRI field)

Varieties / Clones	Water logging stress period (Days)				Tolerance rating scale (1-5)*
	60		120		
	Dry leaf(%)/ Plant	Green leaf (%)/ Plant	Dry leaf(%)/ Plant	Green leaf (%)/ Plan	
ZYT-III					
BSRI Akh 45	60.04 b	40.15 a	67.80 d	32.18 a	1
BSRI Akh 46	65.64 ab	34.35 ab	70.78 cd	29.20 ab	1
I 49-17	68.93 a	31.05 b	77.95 ab	22.03 cd	2
I 75-17	61.06 b	38.93 a	82.01 a	17.97 d	2
I 78-17	59.96 b	40.03 a	77.25 ab	22.74 cd	3
I 94-16	65.03 ab	34.95 ab	73.44 bc	26.54 bc	1
LSD (0.05)	7.65	7.78	4.89	4.89	
ZYT-II					
BSRI Akh 45	60.04 ab	40.15 ab	67.80 c	32.18 a	1
BSRI Akh 46	65.64 a	34.35 b	70.78 c	29.20 a	2
I 141-18	56.78 b	43.21 a	68.62 c	31.67 a	1
I 182-18	64.46 a	35.52 b	77.75 ab	22.23 bc	3
I 71-18	60.20 ab	38.79 ab	78.93 a	20.97 bc	2
I 75-18	57.09 b	42.90 a	80.78 a	19.20 c	3
I 56-18	57.21 b	42.77 a	73.09 bc	23.56 b	1
LSD (0.05)	5.80	5.87	5.42	4.13	

* Tolerance rating scale (1-5) is based on greenness of plants and other data collected, where 1 = highly tolerant, 2 = tolerant, 3 = moderately tolerant, 4 = intolerant and 5 = highly intolerant.

Table 9. Performance of BSRI bred sugarcane clones under induced water- logging stress condition at BSRI farm (field)

Varieties/Clones	Brix %	Pol % cane	Purity %	Yield (TCH)	R.S. %
ZYT-III					
BSRI Akh 45	19.25 c	13.38 b	87.99	83.37 a	0.60 a
BSRI Akh 46	20.10 bc	14.05 ab	88.490	78.91 a	0.27 d
I 49-17	20.85 ab	14.61 ab	88.71	77.04 ab	0.30 c
I 75-17	19.80 bc	13.68 b	87.42	78.49 a	0.39 b
I 78-17	20.15 bc	14.00 ab	87.86	70.00 b	0.11 e
I 94-16	21.70 a	15.18 a	88.58	75.87 ab	0.28 d
LSD (0.05)	1.46	1.23	NS	7.52	0.01
ZYT-II					
BSRI Akh 45	19.25 c	13.38 e	87.99 bc	83.37 b	0.60 d
BSRI Akh 46	20.10 bc	14.05 c	88.49 bc	78.91 b	0.27 e
I 141-18	19.96 bc	13.20 e	83.90 c	82.98 b	1.17 b
I 182-18	21.70 a	14.61 b	85.38 bc	65.14 c	2.61 a
I 71-18	20.80 ab	15.37 a	93.88 a	80.30 b	0.24 e
I 75-18	19.50 c	13.79 d	89.52 ab	68.97 c	0.65 c
I 56-18	21.10 ab	14.63 b	87.78 bc	93.93 a	0.57 d
LSD (0.05)	1.28	0.25	5.13	4.94	0.03

Table 10. Growth performance of BSRI bred sugarcane clones under induced water logging stress condition at BSRI farm (field)

Varieties/Clones	60d (cm/day)	120d (cm/day)
ZYT-III		
BSRI Akh 45	0.48 bc	0.70 ab
BSRI Akh 46	0.51 bc	0.70 ab
I 49-17	0.49 bc	0.67 ab
I 75-17	0.82 a	0.78 a
I 78-17	0.61 b	0.60 ab
I 94-16	0.40 c	0.49 b
LSD (0.05)	0.15	0.22
ZYT-II		
BSRI Akh 45	0.48 b	0.70 cd
BSRI Akh 46	0.51 b	0.70 cd
I 141-18	0.87 ab	0.96 ab
I 182-18	0.65 b	0.55 d
I 71-18	0.72 ab	0.83 bc
I 75-18	0.84 ab	1.00 a
I 56-18	1.10 a	0.86 abc
LSD (0.05)	0.43	0.17

Table 11. Screening sugarcane against water logging stress (Location:Kurigram)

Varieties/Clones	Millable cane ($x10^3$ ha^{-1})	Yield (TCH)	Brix %	Grading
ZYT-III				
BSRI Akh 45	63.61 b	76.47 ab	20.66	1
BSRI Akh 46	62.53 b	79.54 a	18.00	1
I 49-17	64.99 b	70.79 ab	20.66	2
I 75-17	68.61 b	69.83 b	21.33	3
I 78-17	69.16 b	68.18 b	20.66	2
I 94-16	78.94 a	68.83 b	21.33	2
LSD (0.05)	8.61	9.59	NS	
ZYT-II				
BSRI Akh 45	63.61	76.47 ab	20.66 a	2
BSRI Akh 46	62.53	79.54 a	18.00 b	1
I 141-18	71.80	73.70 ab	21.00 a	2
I 182-18	74.99	61.24 bc	16.66 b	3
I 71-18	74.16	61.18 bc	22.66 a	2
I 75-18	71.07	54.45 c	17.66 b	3
I 56-18	66.24	71.83 abc	20.66 a	1
LSD (0.05)	NS	17.72	2.33	

* Tolerance rating scale (1-5) is based on greenness of plants and other data collected, where 1 = highly tolerant, 2 = tolerant, 3 = moderately tolerant, 4 = intolerant and 5 = highly intolerant.

Table 12. Screening sugarcane against water logging stress (Location:Pakshi)

Varieties/Clones	Millable cane ($x10^3$ ha^{-1})	Yield (TCH)	Brix %	Grading
ZYT-III				
BSRI Akh 45	89.33 ab	75.96	19.66 a	1
BSRI Akh 46	72.83 c	83.10	18.16 b	1
I 49-17	70.16 c	76.54	17.16 b	2
I 75-17	73.83 bc	69.13	19.83 a	3
I 78-17	96.66 a	73.48	19.66 a	2
I 94-16	66.83 c	75.68	20.50 a	1
LSD (0.05)	15.68	NS	1.37	
ZYT-II				
BSRI Akh 45	89.33 ab	75.96 ab	19.66 a	2
BSRI Akh 46	72.83 ab	83.10 a	18.16 b	1
I 141-18	54.17 b	48.63 c	20.33 a	3
I 182-18	96.00 ab	63.83 bc	13.83 d	2
I 71-18	92.33 ab	61.98 bc	20.66 a	3
I 75-18	111.17 a	76.23 ab	17.66 b	1
I 56-18	75.17 ab	77.75 ab	16.16 c	1
LSD (0.05)	42.53	17.08	1.03	

FLOOD TOLERANCE IN SUGARCANE

Flood tolerance tests with BSRI bred advanced genotypes under ZYT- I, II and III test stages were carried out under induced flood stress conditions. Similar test was carried out with ZYT- II and III test stages under natural flood stress conditions at farmer's field and results have been shown in the Tables 13-18. It is observed from the table 13 that higher green leave% was recorded in the genotypes BSRI Akh 45 followed by I 49-17 under ZYT-III, while the genotypes I 75-18 followed by I 141-18 performed better under ZYT-II stages at the end of 120 d flood stress period and recorded as highly tolerant (having tolerance rating 1). Among the tested clones, higher pol % cane was recorded from the genotype I 94-16 (15.48%) followed by I 49-17 (13.14%) under ZYT-III and I 182-18 (15.42%), I 75-18 (14.18%) under ZYT-II. The genotypes BSRI Akh 45 followed by BSRI Akh 46 under ZYT-III (72.29t ha^{-1} and 70.34 tha^{-1} respectively) and I 71-18 (76.88 tha^{-1}) followed by BSRI Akh 45 (72.20%) under ZYT-II were recorded with higher yield in Natore location (Table 17). The genotypes I 75-17 followed by BSRI Akh 46 under ZYT-III (110.74t ha^{-1} and 96.57 t ha^{-1} respectively) and BSRI Akh 46 (96.57 t ha^{-1}) followed by I 56-18 (95.64%) under ZYT-II were recorded with higher yield in Sirajgonj location (Table 18). It may be concluded that the genotypes BSRI Akh 45 and BSRI Akh 46 followed by I 71-18 have potential to grow under flood stress condition.

Table 13. Performance of BSRI bred sugarcane clones under induced Flood stress condition (Pot experiment)

Varieties / Clones	Flood stress period (Days)				
	60		120		Tolerance rating scale (1-5)*
	Dry leaf (%)/ plant	Green leaf (%) plant	Dry leaf (%)/ plant	Green leaf (%) plant	
ZYT-III					
BSRI Akh 45	54.04 b	47.61 ab	66.07	33.91	1
BSRI Akh 46	58.42 ab	41.57 ab	71.11	28.88	2
I 49-17	59.74 ab	50.25 a	69.51	30.48	1
I 75-17	64.10 a	35.89 b	76.08	23.90	3
I 78-17	51.32 b	48.66 a	70.23	26.42	2
I 94-16	57.01 ab	45.64 ab	71.28	28.71	1
LSD (0.05)	9.44	12.20	NS	NS	
ZYT-II					
BSRI Akh 45	54.04 ab	47.61 ab	66.07 b	33.91 a	1
BSRI Akh 46	58.42 ab	41.57 abc	71.11 ab	28.88 ab	2
I 141-18	48.68 b	48.08 a	64.63 b	34.76 a	1
I 182-18	62.08 a	37.90 c	69.12 ab	30.87 ab	1
I 71-18	55.23 ab	44.76 abc	68.95 ab	31.04 ab	2
I 75-18	61.06 a	38.93 bc	65.00 b	34.99 a	1
I 56-18	53.80 ab	46.19 abc	78.45 a	21.54 b	3
LSD (0.05)	10.92	8.80	10.89	11.05	
ZYT-I					
BSRI Akh 45	54.04 abc	47.61 bc	66.07	33.91	1
BSRI Akh 46	58.42 a	41.57 c	71.11	28.88	2
I 138-19	55.11 ab	44.87 c	70.13	29.85	1
I 149-19	46.42 bcd	53.23 ab	63.60	36.38	2
I 182-19	60.09 a	42.56 c	73.31	26.68	3
I 185-19	45.74 cd	54.24 ab	68.00	31.99	1
I 190-19	57.58 a	42.40 c	66.01	33.98	1
I 70-19	44.38 d	52.30 ab	62.57	36.70	2
I 71-19	43.78 d	56.21 a	61.77	38.21	1
I 92-19	54.59 abc	45.40 c	65.23	34.76	3
LSD (0.05)	9.32	6.89	NS	NS	

Tolerance rating scale (1-5) is based on greenness of plants and other data collected, Where, 1= Highly tolerant, 2=Tolerant, 3=Moderately tolerant, 4=Intolerant and 5= Highly intolerant.

Table 14. Performance of BSRI bred sugarcane clones under induced flood stress condition (Pot experiment)

Varieties/Clones	Fresh weight of PWR/Plant (g)	Dry weight of PWR/Plant (g)	Volume of PWR/Plant (ml)
ZYT-III			
BSRI Akh 45	75.06 d	21.72 cd	70.00 c
BSRI Akh 46	110.83 b	12.90 e	65.51 cd
I 49-17	81.85 cd	17.66 de	74.33 c
I 75-17	83.83 c	40.76 a	203.67 a
I 78-17	204.60 a	33.16 ab	144.53 b
I 94-16	50.00 e	25.66 bc	50.33 d
LSD (0.05)	8.48	7.87	16.60
ZYT-II			
BSRI Akh 45	75.06 d	21.72 a	70.00 de
BSRI Akh 46	110.83 b	12.90 bc	65.51 e
I 141-18	145.37 a	17.09 abc	152.70 b
I 182-18	54.54 e	12.23 c	83.53 d
I 71-18	143.97 a	19.00 ab	198.70 a
I 75-18	90.47 c	18.50 abc	80.94d e
I 56-18	139.90 a	17.66 abc	125.40 c
LSD (0.05)	15.20	6.43	15.48
ZYT-I			
BSRI Akh 45	75.06 ef	21.720 bc	70.00 cd
BSRI Akh 46	110.83 de	12.90 def	65.51 d
I 138-19	66.93 f	25.00 b	82.57 cd
I 149-19	201.67 b	15.890 cde	174.53 a
I 182-19	60.27 f	7.86 f	40.77 e
I 185-19	52.94 f	9.31e f	43.99 e
I 190-19	187.63 bc	22.64 bc	176.88 a
I 70-19	125.78 d	18.87 bcd	137.43 b
I 71-19	148.62 cd	20.66 bc	176.77 a
I 92-19	244.13 a	53.40 a	85.84 c
LSD (0.05)	38.08	7.33	17.58

Table 15. Growth Performance of BSRI bred sugarcane clones under induced flood stress condition (Pot experiment)

Varieties/Clones	GR (cm/day) Upto 60 days	GR (cm/day) Upto 120 days
ZYT-III		
BSRI Akh 45	1.27 a	1.02 a
BSRI Akh 46	0.90 b	0.72 c
I 49-17	0.99 ab	0.96 ab
I 75-17	1.04 ab	0.79 bc
I 78-17	0.92 b	0.85 abc
I 94-16	0.84 b	0.96 ab
LSD (0.05)	0.29	0.21
ZYT-II		
BSRI Akh 45	1.27 a	1.02 a
BSRI Akh 46	0.90 b	0.72 b
I 141-18	0.88 b	1.07 a
I 182-18	0.84 b	0.87 ab
I 71-18	1.01 ab	1.04 a
I 75-18	0.99 ab	0.87 ab
I 56-18	1.05 ab	0.89 ab
LSD (0.05)	0.34	0.23
ZYT-I		
BSRI Akh 45	1.27 a	1.02
BSRI Akh 46	0.90 abc	0.72
I 138-19	1.12 ab	1.01
I 149-19	1.03 abc	0.94
I 182-19	0.94 abc	0.89
I 185-19	0.78 bc	0.71
I 190-19	1.18 ab	0.98
I 70-19	0.64 c	0.70
I 71-19	0.89 abc	0.86
I 92-19	1.18 ab	0.98
LSD (0.05)	0.42	NS

Table 16. Qualitative performance of BSRI bred sugarcane clones under induced flood stress condition (pot experiment)

Varieties/clones	Brix %	Pol % cane	Purity %	R.S.%
ZYT-III				
BSRI Akh 45	19.16 b	13.04 bc	86.120	0.14 c
BSRI Akh 46	18.26 cd	12.29 cd	85.197	0.24 a
I 49-17	19.10 bc	13.14 b	87.080	0.26 a
I 75-17	17.66 d	11.99 d	85.950	0.19 b
I 78-17	18.20 d	13.01 bc	90.677	0.18 b
I 94-16	21.83 a	15.48 a	89.727	0.24 a
LSD (0.05)	0.85	0.77	NS	0.02
ZYT-II				
BSRI Akh 45	19.16 c	13.04 c	86.12 bc	0.14 d
BSRI Akh 46	18.26 d	12.29 d	85.19 bc	0.24 c
I 141-18	20.06 b	14.03 b	88.52 a	0.38 ab
I 182-18	22.00 a	15.42 a	88.74 a	0.34 b
I 71-18	18.70 cd	12.85 cd	86.98 ab	0.35 b
I 75-18	20.26 b	14.18 b	88.58 a	0.23 c
I 56-18	16.36 e	10.97 e	84.89 c	0.42 a
LSD (0.05)	0.69	0.65	1.79	0.04
ZYT-I				
BSRI Akh 45	19.16 d	13.04 d	86.12 cd	0.14 e
BSRI Akh 46	18.26 e	12.29 e	85.19 d	0.24 d
I 138-19	20.53 a	14.43 a	88.98 a	0.35 b
I 149-19	19.26 d	13.30 cd	87.40 abc	0.50 a
I 182-19	20.76 a	14.59 a	88.93 a	0.27 d
I 185-19	20.20 ab	14.05 ab	88.07 ab	0.31 c
I 190-19	20.10 abc	14.09 ab	88.73 a	0.16 e
I 70-19	19.66 bcd	13.76 bc	88.59 a	0.35 bc
I 71-19	20.66 a	14.44 a	88.44 a	0.23 d
I 92-19	19.40 cd	13.30 cd	86.75 bcd	0.24 d
LSD (0.05)	0.77	0.65	1.57	0.03

Table 17. Screening sugarcane against flood stress (Location: Natore)

Varieties/Clones	Millable cane ($x10^3$ ha^{-1})	Yield (TCH)	Brix %	Grading (1-5)*
ZYT-III				
BSRI Akh 45	56.93 bcd	72.29 a	21.00	1
BSRI Akh 46	53.40 d	70.34 ab	19.00	2
I 49-17	61.60 ab	70.21 ab	21.33	2
I 75-17	59.83 abc	54.89 c	21.66	3
I 78-17	56.00 cd	65.36 b	20.00	3
I 94-16	64.00 a	67.65 ab	19.33	2
LSD (0.05)	5.50	5.24	3.57	
ZYT-II				
BSRI Akh 45	56.93 d	72.29 ab	21.00 ab	1
BSRI Akh 46	53.40 d	70.34 abc	19.00 bc	2
I 141-18	78.40 c	71.35 abc	20.33 abc	1
I 182-18	90.13 a	63.15 c	18.33 c	3
I 71-18	82.00 bc	76.88 a	21.00 ab	1
I 75-18	85.60 ab	66.70 bc	20.66 ab	2
I 56-18	51.86 d	66.38 bc	21.66 a	3
LSD (0.05)	7.01	8.48	2.16	

Tolerance rating scale (1-5) is based on greenness of plants and other data collected, Where, 1= Highly tolerant, 2=Tolerant, 3=Moderately tolerant, 4=Intolerant and 5= Highly intolerant.

Table 18. Screening sugarcane against flood stress (Location: Sirajgonj)

Varieties/Clones	Millable cane ($x10^3$ ha^{-1})	Yield (TCH)	Brix %	Grading (1-5)*
ZYT-III				
BSRI Akh 45	114.44 a	84.79 bc	17.33 ab	1
BSRI Akh 46	100.18 bc	96.57 ab	17.16 bc	1
I 49-17	95.18 c	75.92 cd	16.16 c	2
I 75-17	114.63 a	110.74 a	17.33 ab	1
I 78-17	110.37 ab	74.59 cd	18.33 a	2
I 94-16	103.15 abc	62.81 d	14.66 d	3
LSD (0.05)	12.56	14.50	1.13	
ZYT-II				
BSRI Akh 45	114.44 a	84.79 abc	17.33 ab	2
BSRI Akh 46	100.18 ab	96.57 a	17.16 ab	1
I 141-18	78.15 c	55.25 d	16.33 abc	3
I 182-18	105.93 a	76.18 bc	15.66 bc	2
I 71-18	82.04 c	90.15 ab	18.00 a	1
I 75-18	86.48 bc	69.96 cd	16.33 abc	3
I 56-18	84.07 c	95.64 a	15.00 c	1
LSD (0.05)	15.46	15.53	1.942	

*Tolerance rating scale (1-5) is based on greenness of plants and other data collected, where, 1 = highly tolerant, 2 = tolerant, 3 = moderately tolerant, 4 = intolerant and 5 = highly

SALINITY TOLERANCE IN SUGARCANE

A trial was conducted at BSRI yard and Shatkhira (Ashasuni) location with BSRI released sugarcane variety BSRI Akh 45 and BSRI Akh 46 including the clones under ZYT II and III during 2023-2024 cropping season. It is observed from the table 19,20,21 that higher pol % cane were recorded from the genotypes BSRI Akh 45 (14.03%) followed by I 94-16 (13.25%) at 8 dS/m, BSRI Akh 45 (14.83%) followed by I 94-16 (14.43%) at 10 dS/m and BSRI Akh 45 (13.83%) at 12 dS/m under ZYT III. However, BSRI Akh 45 (14.03%) followed by I 182-18 (13.91%)at 8 dS/m, BSRI Akh 45 (14.83%) followed by I 71-18 (14.36%) at 10 dS/m, and I 182-18 (14.80%) followed by I 71-18 (14.11%) at 12 dS/m under ZYT II manifested higher pol% cane. On the other hand, the BSRI Akh 46 (102.37 tha^{-1}) followed by I 94-16 (95.29 tha^{-1}) under ZYT III, and BSRI Akh 46 (102.37 tha^{-1}) followed by I 56-18 (84.01 tha^{-1}) under ZYT II performed better considering their yield performance (tha^{-1}) at Shatkhira (Ashasuni) location. It was also observed that performance of a variety or clone had great impact on date of planting and level of management. It may be concluded that the genotypes BSRI Akh 46 followed by I 94-16 under ZYT III and I 56-18 under ZYT II have potentiality to grow under salinity stress condition.

Table 19. Performance of BSRI bred clones under Salinity stress conditions (Yard Tank T_1=8 dS/m)

Varieties/clones	Brix (%)	Pol % cane	Purity (%)	R.S. %
ZYT-III				
BSRI Akh 45	19.93 a	14.03 a	89.12 a	0.23 c
BSRI Akh 46	19.26 b	13.07 b	85.87 b	0.23 c
I 49-17	17.86 c	12.02 c	85.16 b	0.44 b
I 75-17	19.13 b	13.09 b	86.60 b	0.65 a
I 78-17	18.26 c	12.47 c	86.41 b	0.29 c
I 94-16	19.30 b	13.25 b	86.91 b	0.43 b
LSD (0.05)	0.4945	0.4529	1.9744	0.0649
ZYT-II				
BSRI Akh 45	19.93 a	14.03 a	89.12 a	0.23 de
BSRI Akh 46	19.26 ab	13.07 bc	85.87 b	0.23 de
I 141-18	18.26 c	12.44 c	86.19 b	0.75 a
I 182-18	20.13 a	13.91ab	87.40 ab	0.54 b
I 71-18	19.36 ab	13.14 bc	85.92 b	0.30 c
I 75-18	18.53 bc	12.65 c	86.42 b	0.21 e
I 56-18	18.63 bc	12.93 c	87.84 ab	0.28 cd
LSD (0.05)	0.8941	0.8708	2.1056	0.0514

Table 20. Performance of BSRI bred clones under Salinity stress conditions (Yard Tank; T_2= 10 dS/m)

Varieties/clones	Brix (%)	Pol % cane	Purity (%)	R.S. %
ZYT-III				
BSRI Akh 45	21.30 a	14.83 a	88.14 ab	0.27 c
BSRI Akh 46	19.26 bc	13.46 bc	88.42 a	0.63 a
I 49-17	18.56 c	12.59 c	85.84 b	0.65 a
I 75-17	18.40 c	12.61 c	86.84 ab	0.39 b
I 78-17	19.56 bc	13.69 bc	88.60 a	0.24 c
I 94-16	20.56 ab	14.43 ab	88.72 a	0.71 a
LSD (0.05)	1.3702	1.1234	2.5189	0.0877
ZYT-II				
BSRI Akh 45	21.30 a	14.83 a	88.14 ab	0.27 e
BSRI Akh 46	19.26 cd	13.46 cd	88.42 ab	0.63 b
I 141-18	19.83 bc	13.91 bc	88.72 a	0.60 bc
I 182-18	20.40 b	14.26 abc	88.50 ab	0.50 d
I 71-18	20.30 b	14.36 ab	89.52 a	0.25 e
I 75-18	18.50 d	12.50 e	85.54 c	1.32 a
I 56-18	18.83 d	12.86d e	86.49 bc	0.56 c
LSD (0.05)	0.8766	0.8455	2.1006	0.0624

Table 21. Performance of BSRI bred clones under Salinity stress conditions (Yard Tank; T_3= 12 dS/m)

Varieties/clones	Brix %	Pol % cane	Purity (%)	R.S. %
ZYT-III				
BSRI Akh 45	19.83 a	13.83 a	88.27 a	0.33 f
BSRI Akh 46	17.60 c	11.95 d	85.96 b	1.35 c
I 49-17	18.63 b	12.53 bcd	85.13 b	2.08 a
I 75-17	18.70 b	12.77 bc	86.43 ab	1.10 e
I 78-17	18.86 b	12.96 b	86.93 ab	1.25 d
I 94-16	18.26b c	12.31 cd	85.33 b	1.52 b
LSD (0.05)	0.7038	0.6300	2.1651	0.0680
ZYT-II				
BSRI Akh 45	19.83 b	13.83 b	88.27 a	0.33 e
BSRI Akh 46	17.60 cd	11.95 c	85.96 bc	1.35 b
I 141-18	17.20 de	11.71 c	86.16 b	1.42 ab
I 182-18	21.10 a	14.80 a	88.81 a	1.07 c
I 71-18	20.20 b	14.11 b	88.42 a	0.66 d
I 75-18	16.73 e	11.20 d	84.76 c	1.38 ab
I 56-18	17.86 c	12.12 c	85.92 bc	1.61 a
LSD (0.05)	0.6598	0.4875	1.3323	0.2530

Table 22. Screening sugarcane against Salinity stress. (Location: Ashasuni, Shatkhira)

Varieties/Clones	Millable cane ($x10^3$ ha^{-1})	Yield (tha^{-1})	Brix %	Grading (1-5)*
ZYT-III				
BSRI Akh 45	115.33 a	69.34 bc	20.50 a	3
BSRI Akh 46	84.44 c	102.37 a	17.66 b	1
I 49-17	102.00 b	75.66 b	18.16 b	1
I 75-17	106.67 ab	72.92 bc	16.16 c	3
I 78-17	79.11 c	65.29 c	17.83 b	2
I 94-16	88.89 c	95.29 a	20.00 a	1
LSD (0.05)	10.796	9.7958	1.1586	
ZYT-II				
BSRI Akh 45	115.33 a	69.34 c	20.50 a	2
BSRI Akh 46	84.44 c	102.37 a	17.66 c	1
I 141-18	78.22 cd	62.34 c	14.83 d	3
I 182-18	98.00 b	70.66 c	18.33 bc	2
I 71-18	118.67 a	63.20 c	19.00 b	3
I 75-18	117.56 a	80.02 b	15.66 d	1
I 56-18	74.45 d	84.01 b	19.00 b	1
LSD (0.05)	9.3680	8.5273	0.9343	

* Tolerance rating scale (1-5) is based on greenness of plants and other data collected, where , 1 = highly tolerant, 2 = tolerant, 3 = moderately tolerant, 4 = intolerant and 5 = highly intolerant

SUGARCANE GERMINATION UNDER LOW TEMPERATURE STRESS

An investigation was carried out to get germination potential of different advanced clones during 2023-2024 cropping season. Results have been presented in Table 23. The highest mean germination per cent was recorded from the clones I78-17 at 01 Feb batch and the lowest from the clone I 94-16 at 1 December batch.

Table 23. Effects of ambient temperature on sugarcane germination

Planting Date / Clones	16 Nov	01 Dec	16 Dec	01 Jan	16 Jan	01 Feb
I 94-16	27	18	37	38	75	78
I 49-17	20	32	56	50	82	84
I 75-17	59	62	71	68	72	80
I 78-17	25	20	58	71	82	85

SUGAR CHEMISTRY SECTION:

SCREENING SUGARCANE CLONES BASED ON MATURITY BEHAVIOR AND *GUR* QUALITY

The maturity of sugarcane is essentially a varietal character though maturity is largely regulated by environmental factors and management practice. The early maturing potential sugarcane varieties have direct impact for higher sugar and *gur* recovery at early stage of crushing. A variety suitable for sugar production may not be equally suitable for *gur* production. Selection of sugarcane

clones suitable for good quality *gur* production on the basis of high sugar and low reducing sugars content, medium stalk diameter, low fibre content are important. In some areas of Bangladesh early *gur* making starts from August. Due to lack of suitable *gur* making early maturing variety, *gur* makers are manufacturing *gur* from old indigenous degenerated varieties. As a result, *gur* production is low and quality of *gur* is poor. The *gur* makers use chemical clarificants to improve the colour of *gur*. Chemical clarificants are hazardous for human health. Therefore, it is important to identify early maturing sugarcane varieties/clones for production of sugar and good quality *gur*. With this concern an experiment had undertaken in Physiology and sugar chemistry division for the cropping season 2023-24 with the objectives that determining the maturity behaviour of sugarcane varieties/clones to find out peak maturity period, screening sugarcane clones suitable for *gur* production and determining the quality of *gur* after preparation. Selected sugarcane clones under ZYT- II & III test stages and standard variety BSRI Akh 45 and BSRI Akh 46 planted at BSRI farm in the month of November 2023. Necessary intercultural operations and management practices will be followed for all the clones. Chemical analysis for brix (%), pol % juice, purity%, reducing sugars per cent and pol % cane will be determined starting from mid September 2024 and to be continued up to March 2025. During 2023-2024 cropping season (2024-2025 crushing season,) two types of sugarcane clones i.e ZYT-III (I 94-16, I 49-17, I 75-17 and I 78-17) & ZYT-II (I 56-18, I 71-18, I 75-18, I 141-18 and I 182-18) test stage including two standard variety BSRI Akh 45 and BSRI Akh 46 planted at BSRI have been chemically analyzed at 15 days intervals beginning from mid-September 2024 to mid-March 2025. The clones were evaluated based on pol % cane, reducing sugar content, and fibre content and grouped as early, mid, and late maturing potential clones. Results of chemical analysis under the ZYT-II and ZYT-III test stage have been shown in figures 1a & 1b. In the case of pol % cane under ZYT-III test stage - the trends of all the clones were observed similar with the standard variety BSRI Akh 45 and BSRI Akh 46 beginning from mid-October 2024 to mid February 2025. But the clone I 78-17 had higher pol % cane upto late January, 2025. After that, all the clones and also the standard variety had a trend of declined mood (Fig. 1a). For the clones under ZYT-II test stage the clone I 71-18 had the highest pol% cane in mid January and the clone I 182-18 had the highest pol% cane in mid February. but all the clones had achieved it in late February. The standard variety BSRI Akh 45 and BSRI Akh 46 had the peak value of pol % cane in mid January. Among the five clones, I 75-18 had a slower increasing trend of pol % cane and also had the peak value in november and December, 2024 (Fig. 2a). In case of reducing sugar % under ZYT-III test stage, all the clones I 75-17 and I 78-17 had the lowest value in mid February, 2025. At the same time, the standard variety BSRI Akh 45 and BSRI Akh 46, othre clones had the peak value of RS % in mid January. After that period the RS% was increasing with the time (Fig. 1b). The standard variety BSRI Akh 45 and BSRI Akh 46 had the slower increasing rate of RS% compare to other clones. The clones under ZYT-II test stage, BSRI Akh 45, BSRI Akh 46 and the clone I 182-18 had the lowest value in mid February, 2025. But the other clones had the lowest value in mid January. After late february, the RS% was increasing with the time (Fig. 2b). Here also the standard variety BSRI Akh 45 and BSRI Akh 46 had the slower increasing rate of RS% compare to other clones similar to under ZYT-III test stage. All the clones were found quadratic in pol % cane in nature creating peaks in February (Fig. 1a). Similar but opposite trends were observed in the case of reducing sugar content. The reducing sugar content (%) of all clones was found higher compared to standard variety BSRI Akh 45 BSRI Akh 46. The lowest reducing sugars percent of all the varieties/clones were observed in the month of January and

February (Figure 1b, 2b). Considering the pol % cane and reducing sugar percent, it was found that standard variety BSRI Akh 45 has the early maturing potentiality and BSRI Akh 46 has the mid maturing potentiality. For the clones under ZYT-III test stage, the clones I 75-17, I 49-17 and I 78-17 ware mid maturing potential (Mid November, 2024). Another clone I 94-16 under ZYT-III test stage was late maturing potential (Last December). The same chemical analyses have been performed on the five clones including two standard variety BSRI Akh 45 and BSRI Akh 46 under the ZYT-II test stage (Fig. 2a and 2b). From the above analysis and the graphical data, it is clear it was found that standard variety BSRI Akh 45 has the early maturing potentiality and BSRI Akh 46 has the mid maturing potentiality that is early mentioned. The clones I 56-18 and I 75-18 were mid maturing potential (Mid November, 2024) and the clones I 71-18, I 141-18 and I 182-18 were late maturing potential in last December 2024 under ZYT-II test stage. There is no early maturing potential clones were found both in ZYT-III & ZYT-II test stage.

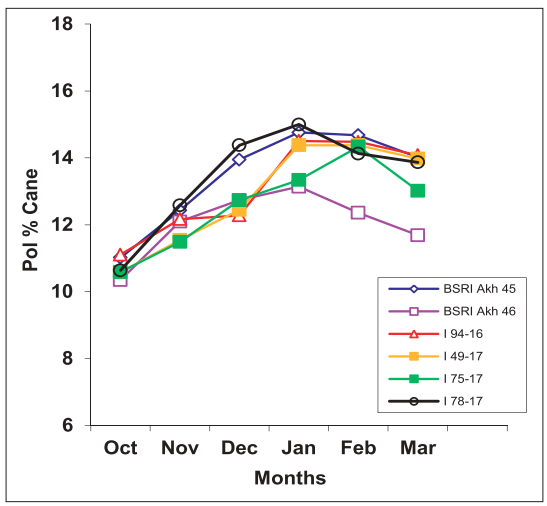


Fig. 1a: Pol % Cane under ZYT-III test stage

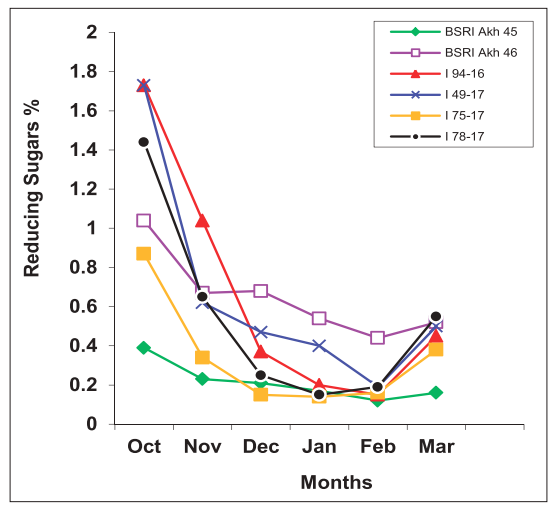


Fig. 1b: RS % Cane under ZYT-III test stage

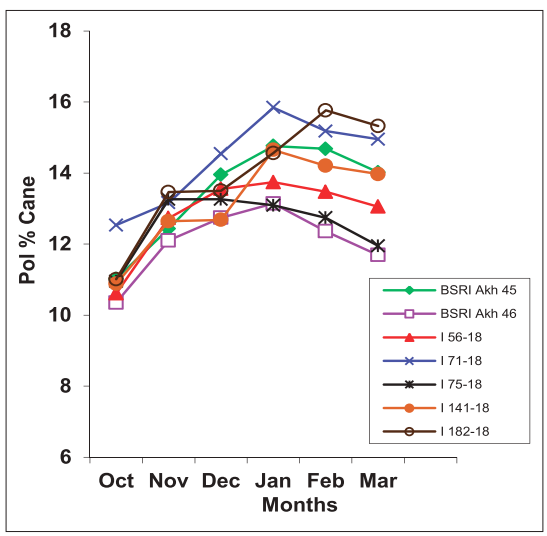


Fig. 2a: Pol % Cane under ZYT-II test stage

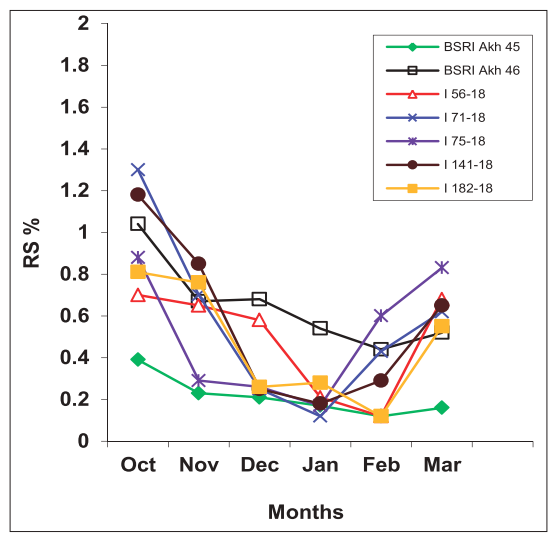


Fig. 2b: RS % under ZYT-II test stage

FIBRE CONTENT

In 2023-2024 cropping season (2024-2025 crushing season), the fibre content of sugarcane is directly related with cane quality. The higher the fibre content lower the cane quality. It is recognized that the quality of sugarcane is good when sucrose content is high and fibre and other impurities are low. The fibre content of seven sugarcane clones under ZYT-III & II test stages including two standard variety (BSRI Akh 45 & BSRI Akh 46) have been determined. The results have been shown in bar diagram (Fig. 3a & 3b). The trends of all the clones were found increasing in fibre content beginning from the month November to January. The highest fibre content under ZYT-III test stage was found from the standard variety BSRI Akh 45 (14.80%) followed by the clones I 78-17 (14.33%), BSRI Akh 46 (13.82%), I 94-16 (13.72%), I 75-17 (12.69%) and lastly I 49-17 (11.46%) in the month of November. In November, the fibre percent for the clone I 78-17 under ZYT-III test stages was observed higher than the standard variety BSRI Akh 46. The lowest fibre% was found from the clone I 49-17 which value was lower than the two standard variety (BSRI Akh 45 & BSRI Akh 46) in November. The fibre % of two standard variety (BSRI Akh 45 & BSRI Akh 46) and all the clones under ZYT-III test stage were increasing from November to January. The highest fibre content under ZYT-II test stage was found from the clone I 71-18 (14.81%) followed by BSRI Akh 45 (14.80%), I 75-18 (14.16%), I 56-18 (14.08%), BSRI Akh 46 (13.82%), I 141-18 (13.70%) and at the end I 182-18 (12.34%). The lowest fibre% was found from the clone I 182-18 which value was lower than the two standard variety (BSRI Akh 45 & BSRI Akh 46) in November. The fibre % of two standard variety (BSRI Akh 45 & BSRI Akh 46) and all the clones under ZYT-II test stage were increasing from November to January that is similar to ZYT-III test stage. Among the clones under ZYT-III & ZYT-II test stages, the lowest fibre % was found from the clone I 49-17 (11.46%) followed by I 141-18 (13.70%) and I 182-18 (12.34%) which value were than the two standard variety (BSRI Akh 45 & BSRI Akh 46) in the month of November.

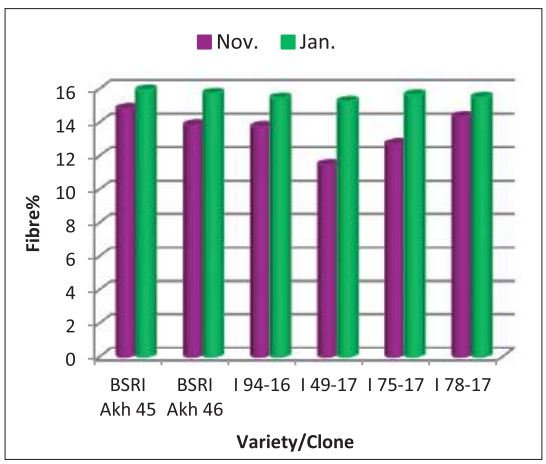


Fig. 3a: Fibre % Cane under ZYT-III test stage

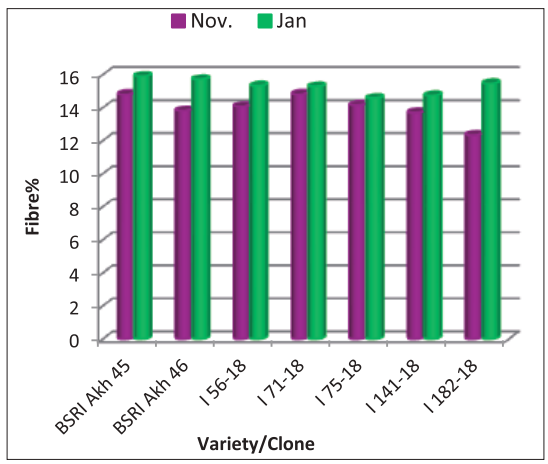


Fig. 3b: Fibre % Cane under ZYT-II test stage

SCREENING SUGARCANE CLONES FOR *GUR* PRODUCTION

In 2023-2024 cropping season (2024-2025 crushing season), nine sugarcane clones including two standard variety (BSRI Akh 45 & BSRI Akh 46) under ZYT-III and II test stages were evaluated for *gur* quality. *Gur* was prepared by open pan boiling method without adding any hazardous chemical

clarificants. The physical and chemical properties of *gur* have been studied immediately after its preparation. *Gur* is normally priced in the market for its color. The higher color unit indicates the better the quality of the *gur*. In case of physical properties, all the clones under the ZYT-III and ZYT-II test stages including BSRI Akh 45 & BSRI Akh 46 were observed for color, texture and crystalline nature for *gur* making (Table 1). All samples have lucrative color, hard texture and good crystalline nature. The chemical properties of *gur* have been shown in the bar diagram (Fig. 4a-4f). The highest sucrose content of *gur* was observed from the clone I 49-17 (80.90%) followed by I 94-16 (81.38%), BSRI Akh 45 (79.73%), I 75-17 (75.29%), BSRI Akh 46 (74.38%), and lastly I 78-17 (73.78%) under ZYT-III test stages. On the other hand, the highest sucrose content of *gur* under ZYT-II test stages was found from the clone I 182-18 (83.62%) follwed by I 75-18 (79.91%), BSRI Akh 45 (79.73%), I 71-18 (77.77%), I 56-18 (76.65%), BSRI Akh 46 (74.38%), and lastly I 141-18 (72.91%). Among the clones under ZYT-III & ZYT-II test stages, the highest sucrose% was found from the clone I 49-17 (80.90%) followed by I 94-16 (81.38%), I 182-18 (83.62%), I 75-18 (79.91%), which values were higher than the two standard variety (BSRI Akh 45 & BSRI Akh 46). For reducing sugar content, the lowest RS% was observed in the clone I 94-16 (4.26%) followed by BSRI Akh 45 (4.65%), I 78-17 (5.41%), I 49-17 (6.17%), I 75-17 (6.99%), and lastly BSRI Akh 46 (10.53%) under ZYT-III test stages. On the other hand, the RS% of ascending order is as follow I 182-18 (3.75%), BSRI Akh 45 (4.65%), I 71-18 (7.14%), I 141-18 (8.33%), I 75-18 (9.52%) and lastly BSRI Akh 46 (10.53%) under ZYT-II test stage. Among the clones under ZYT-III & ZYT-II test stages, the lowest RS% was found from the clones I 94-16 (4.26%) followed by I 182-18 (3.75%), BSRI Akh 45 (4.65 which values were higher than the the standard variety BSRI Akh 46. From the above discussion, it is clear that the clones I 94-16 and I 182-18 performed better than the other clones under ZYT-III & ZYT-II test stages. Because these clones have higher sucrose content and lower RS content. From the figure 4c, the pH content and the values of pH in ascending order under ZYT-III test stages were BSRI Akh 46 (5.30), BSRI Akh 45 (5.14) follwed by I 49-17 (5.09), I 75-17 (5.07), I 94-16 (5.05) and I 78-17 (4.98) respectively. Besides this values of pH in ascending order under ZYT-II test stages were I 56-18 (5.45), I 182-18 (5.41), I 71-18 (5.40), I 141-18 (5.37), BSRI Akh 45 (5.14) and BSRI Akh 46 (5.30). From the above data, it was very clear that all the clones along with the check variety were slightly acidic. But the standard variety BSRI Akh 45 (5.14) and BSRI Akh 46 (5.30) had the lowest pH value and also more acidic than the others in both ZYT-III & ZYT-II test stages. . From the figure 4d, the moisture% of check variety and clones under ZYT-III test stages in ascending order were I 94-16 (7.80%), I 49-17 (8.30%), BSRI Akh 45 (8.76%), I 75-17 (8.95%), BSRI Akh 46 (9.09%), and I 75-17 (9.58%) respectively. On the other hand, the values of moisture% stages in ascending order under ZYT-II test stages were I 141-18 (6.20%), I 75-18 (7.80%), I 71-18 (7.95%), I 56-18 (8.03), I 182-18 (8.33), BSRI Akh 45 (8.76%), and lastly BSRI Akh 46 (9.09%). Here the moisture% of the clones has the lower value compared to two check variety (BSRI Akh 45 & BSRI Akh 46) under ZYT-II test stages. The clones I 94-16 (7.80%) under ZYT-III test stages and I 75-18 (7.80%) under ZYT-II test stages had the same result as well as lower moisture content. The higher the moisture% the lower the shelf life. The lowest moisture content was found from the clone I 141-18 (6.20%), So definitely the shelf life of this clone will be higher. The peak value and bottom value of color transmittance (from figure 4e) were recorded from the clones I 78-17 (60.79%) and I 94-16 (43.66%) respectively under ZYT-III test stages. With the same process the peak and bottom value of color transmittance were recorded from the clones I 182-18 (66.81%) and I 71-18 (52.12%) respectively under ZYT-II test stages. The standard variety BSRI Akh 45 &

BSRI Akh 46 had the value of color transmittance 45.87% & 42.35% respectively. The highest value of *gur* recovery% (from figure 4f) was noticed from the standard variety BSRI Akh 45 (9.50%) followed by the clone I 94-16 (8.65%), I 78-17 (8.38%), BSRI Akh 46 (8.33%), I 49-17 (7.69%) and I 75-17 (6.36%) respectively under ZYT-III test stages. On the other hand, the highest value of *gur* recovery% was identified from the standard variety BSRI Akh 45 (9.50%), followed by the clone I 75-18 (8.93%), I 71-18 (8.45%), BSRI Akh 46 (8.33%), I 141-18 (6.89%), 56-18 (6.79%) and lastly I 182-18 (6.67%). Here the standard variety BSRI Akh 45 gave the highest recovery 9.50%. The sugarcane clones I 94-16 & I 78-17 under ZYT-III test stage were found suitable for *gur* making. The clones I 75-18 & I 71-18 under ZYT-II test stage were found suitable for *gur* making.

Table 1. Physical Properties of *Gur* under ZYT-III & ZYT-II

Test Stage	Variety/Clones	Texture	Crystalline Nature	Color in Solid State
Standard	BSRI Akh 45	Hard	Good	Golden
ZYT- III	I 132-14	Soft	Good	Brown
	I 27-16	Hard	Good	Golden
	I 94-16	Hard	Good	Golden
ZYT- II	I 49-17	Hard	Good	Golden
	I 68-17	Hard	Good	Golden
	I 75-17	Hard	Good	Golden
	I 78-17	Hard	Good	Golden

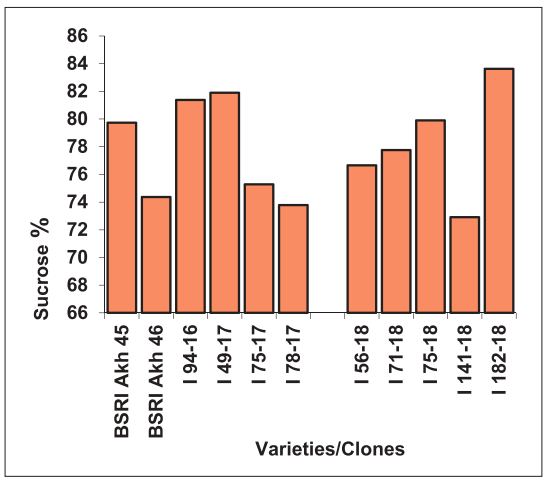


Fig. 4a: Sucrose per cent of *Gur*

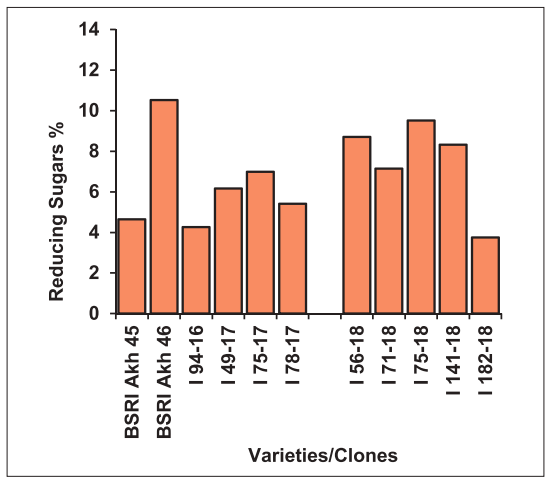


Fig. 4b: Reducing Sugars per cent of *Gur*

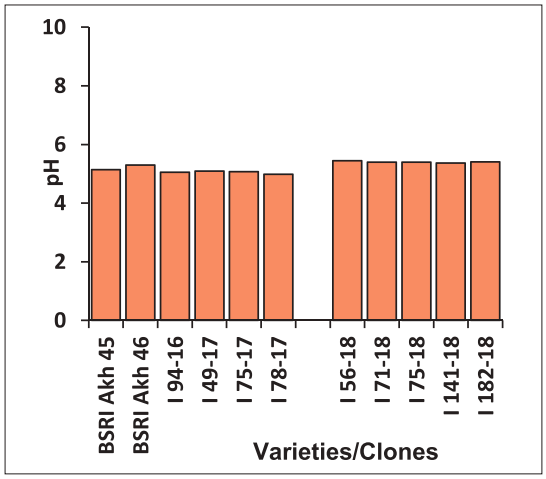


Fig. 4c: pH of *Gur*

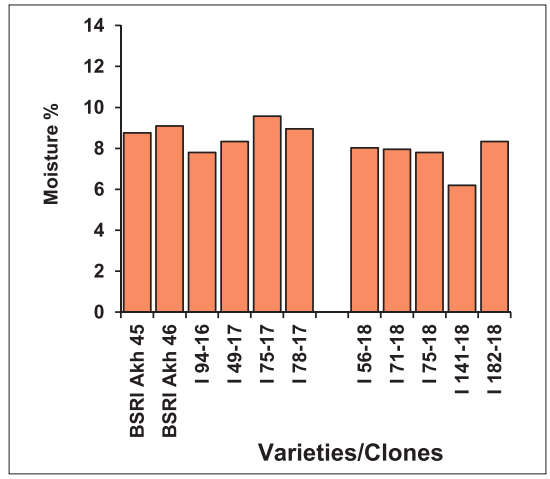


Fig. 4d: Moisture percent of *Gur*

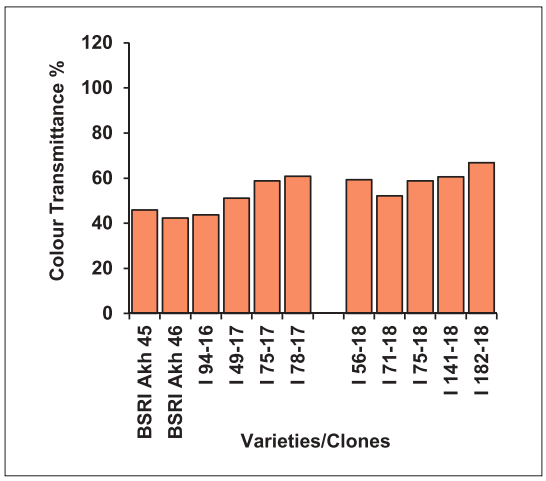


Fig. 4e: Color transmittance of *Gur*

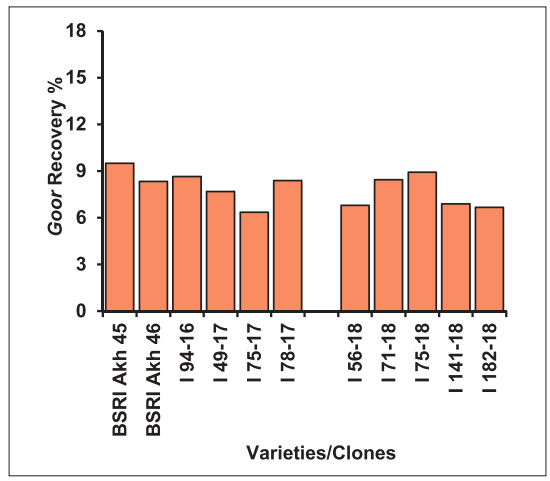


Fig. 4f: Recovery percent of *Gur*

STUDIES ON PRESERVATION TECHNIQUES OF SUGARCANE JUICE

At present, annually, the total production of sugarcane in Bangladesh is around 7.0-7.5 million tons. 23-27% of the total production of sugarcane is utilized for sugar production; 53-57% is used for '*gur*' production and the remaining 14-24% for seed, chewing, and drinking juice purposes. Sugarcane juice is available almost throughout the country. But the juice extracted from the canes turns dark brown and marked sedimentation appears during storage. Conventional heat processing imparts the taste of '*gur*', and the delicate flavor of the juice is adversely affected. Sugarcane variety and cultivation practices also affect the juice characteristics. Bucheli and Robinson (1994) reported that the polyphenol oxidase is the major enzyme involved in the discoloration of sugarcane juice which can be improved by heat inactivation of the enzyme. The addition of citric acid or ascorbic acid to the juice also gave a good, pleasant dull orange color to the juice. The addition of lemon, pudina and ginger followed by pasteurization and preservation with sulphur dioxide also reduced physico-chemical changes during

storage of ready-to-serve bottled sugarcane juice. In order to preserve fresh sugarcane juice an experiment was conducted in Physiology and sugar chemistry lab for the cropping season 2024-25 with the objectives that optimizing the techniques for preservation of ready-to-serve bottled sugarcane juice of consumer acceptability and observing the shelf life of preserved sugarcane juice. The experiment was conducted during the 2024-2025 cropping season in CRD design. In this experiment, we have taken four treatments such as T_1 = Pasteurization at 70°C for 20 min (Control,) T_2 = Juice heated at 50°C + Black Pepper @ 1 g/L + Ginger Juice @ 4.0 ml/L + Citric Acid @ 0.05%+ KMS @ 300 ppm + Pasteurization at 70°C for 20 min, T_3 = Juice heated at 50°C + Black Pepper @ 2 g/L + Ginger Juice @ 5 ml/L + Citric Acid @ 0.05%+.

KMS @ 300 ppm + Pasteurization at 70°C for 20 min , T_4 = Juice heated at 50°C + Clove @ 1 g/L + Ginger Juice @ 4 ml/L + Citric Acid @ 0.05%+ KMS @ 300 ppm + Pasteurization at 70°C for 20 min, T_5 = Juice heated at 50°C + Clove @ 2 g/L + Ginger Juice @ 5 ml/L + Citric Acid @ 0.05%+ KMS @ 300 ppm + Pasteurization at 70°C for 20 min.

The chemical properties of cane juice have been examined at every 07 days of intervals. Data has presented by line graph. The fig. 5. showed that the brix% has decreased gradually as the time has increasd in all treatments. But the decreasing rate is slower in T_2, T_3, T_4 and T_5. But the decreasing rate is higher in T_1 (control). All the treatments has more or less similar decreasing rate. In figure 6. it was observed that the RS% has increased as the time has increasd in all treatments. The graphical presentation showed that the increasing rate of RS% is faster in T_1 (control) compared to others. Upto 15 days the graphical trend for all the treatments was similar. After that period, the RS% of all the treatments has increased rapidly. Here figure 7 described another parameter named pH. The pH value has decreased gradually as the time has increasd in all treatments. But the decreasing rate of pH was very slow and seemed to be alike. Among all the treatments, the T_1 has higher decreasing rate of pH. All the treatments turned into acidic. From the above disscussion, It was clearly appeared that all the treatments showed the same result for the Brix%, RS% and pH content except T_1 (control) and was preserved for 50 days after preparation at room temperature. The physico-chemical properties of preserved juice were unchanged in that period.

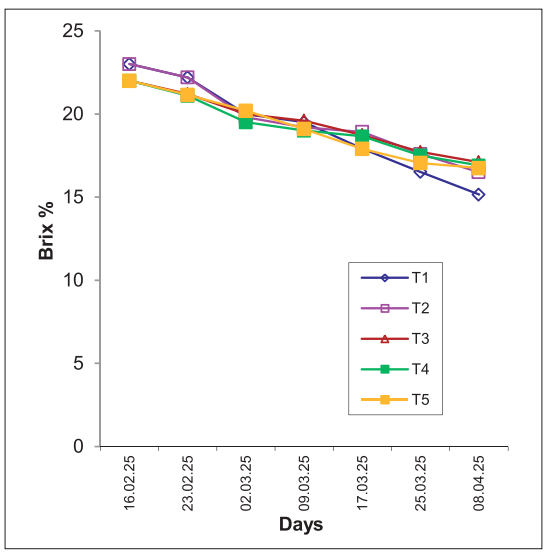


Fig. 5: Brix (%) of preserved sugarcane juice in room temperature

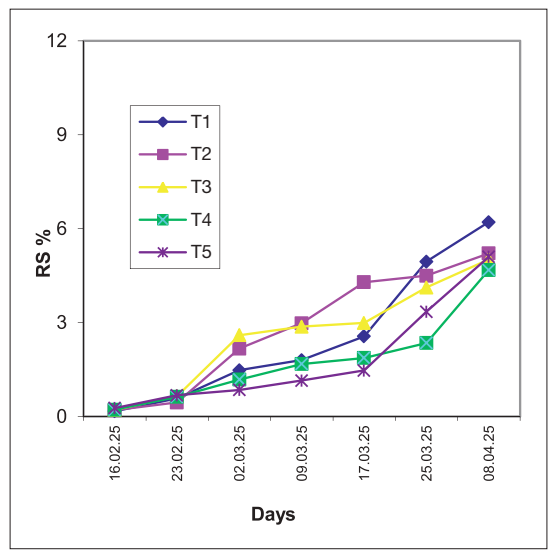


Fig. 6: RS (%) of preserved sugarcane juice in room temperature

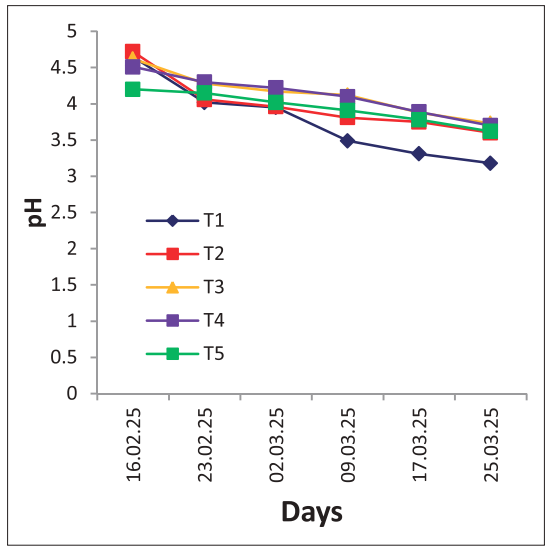


Fig. 7: pH of preserved sugarcane juice in room temperature

INTEGRATED USE OF ORGANIC AND CHEMICAL FERTIZERS ON JUICE AND *GUR* QUALITY OF SUGARCANE

Application of organic and chemical fertilizer at proper level in any crops is directly related for its growth, yield, maturity and quality of the product. Proper application of organic and chemical fertilizer to fulfill the deficiencies of nutritional status of soil for any crop production is effective. Now a days sugarcane is cultivated in marginal and poor fertile land in our country. Use of fertilizer for sugarcane is not applied on soil health basis. Varied doses of organic and chemical fertilizers are also applying by the farmers to cultivate sugarcane. Sometimes low and over doses of chemical fertilizers are also used in sugarcane for growth and productivity of sugarcane which are hampered for quality juice and *gur* production. Farmers in *gur* zones areas start *gur* making in the month of September and they are facing troubles for quality *gur* production in the early crushing season due to application of low and over doses of organic and chemical fertilizers. There is no study so far to determine the quality of cane juice and gur due to application of combined use of organic and chemical fertilizers. Therefore, this investigation was undertaken in physiology and sugar chemistry division, BSRI with the objectives to determine economic use of fertilizer for juice and quality gur production, to find out combined effects of organic and chemical fertilizers on juice and *gur* quality and to find out combined effects of organic and chemical fertilizers on juice and *gur* quality in the cropping season 2023-24. All the chemical analysis was conducted in the laboratory of physiology and sugar chemistry division, BSRI. Selected sugarcane variety BSRI Akh 48 planted at BSRI farm in the month of November 2023. Two budded sett of the variety BSRI Akh 48 will be planted during November, 2023. The Plot size is 8m x 6m. The trial will be set up following randomized complete block design with four replications .Necessary intercultural operations and management practices was followed for all the clones. The field data i.e. tiller, millable cane, cane height, plant height, cane yield, brix %, cane diameter and internodes was collected December/2024. Chemical analysis for brix (%), pol % juice, purity % and pol % cane was determined after harvesting. There were six treatments for this experiment and these are: T_1 = Control (no

fertilizer), T_2 = RFD (recommended fertilizer dose) + Cowdung @ 10 tha^{-1}, T_3 = RFD (recommended fertilizer dose) + Mustard Oil cake @ 0.5 tha^{-1}, T_4 = RFD (recommended fertilizer dose) + Poultry Litter @ 5 tha^{-1}, T_5 = RFD (recommended fertilizer dose) + Trash Mulching @ 5 tha^{-1}, T_6 = Present recommended fertilizer dose (RFD) .

Table 1. different growth attributes in six treatments

Treatments	Tiller (x 10^3 ha^{-1})	Millable Cane (x 10^3 ha^{-1})	Plant height (meter/cane)	Stalk height (meter/cane)	Cane diameter (c.m.)	No. of Internode
T_1 = Control	202.5 c	65.66	4.99	3.10	20.00	23.25
T_2 = RFD+ Cowdung	218 bc	68.33	4.86	3.07	20.45	23.50
T_3 = RFD + Mustard Oil cake	229.75 abc	70.5	4.91	2.99	18.87	23.25
T_4 = RFD + Poultry Litter	255.25 a	73.91	4.94	3.10	20.07	23.75
T_5 = RFD + Trash Mulching	239.5 ab	73.83	5.10	3.04	19.71	22.75
T_6 = RFD	216.5 bc	69.24	4.65	3.00	19.59	22.25
LSD (0.05)	30.33	NS	NS	NS	NS	NS

Growth Attributes

Significant variation ($p \leq 0.05$) was observed in tiller population among treatments, whereas millable cane count, plant height, stalk height, cane diameter, and internodes number were statistically non-significant (Table 1). The highest tiller number (255.25 × 10^3 ha^{-1}) was recorded in T_4 (RFD + Poultry litter @ 5 t ha^{-1}), which was significantly superior to T_1 (Control: 202.5 × 10^3 ha^{-1}), T_2, and T_6. Integrated nutrient management treatments such as T_3 (RFD + Mustard oil cake) and T_5 (RFD + Trash mulching) also produced higher tiller counts compared to control and sole chemical fertilizer treatments. Millable cane number ranged from 65.66 × 10^3 ha^{-1} in T_1 to 73.91 × 10^3 ha^{-1} in T_4 (T_4 = RFD (recommended fertilizer dose) + Poultry Litter @ 5 tha^{-1}), but the differences were non-significant. Plant height varied between 4.65 m (T_6) and 5.10 m (T_5), and stalk height ranged from 2.99 m (T_3) to 3.10 m (T_1, T_4), with no significant differences.

Cane Yield

Cane yield varied notably among treatments (Figure 1). The highest yield (92.0 t ha^{-1}) was recorded in T_4 (T_4 = RFD (recommended fertilizer dose) + Poultry Litter @ 5 tha^{-1}), followed by T_3 (88.0 tha^{-1}), while the lowest yield (78.0 tha^{-1}) occurred in T_2 (RFD + Cowdung). The yield advantage of T_4 is attributed to poultry litter's higher nutrient content, particularly nitrogen and phosphorus, its rapid decomposition rate, and its contribution to improving soil microbial activity and cation exchange capacity. Mustard oil cake in T_3 also performed well due to its high organic nitrogen and phosphorus content, though its slower mineralization rate compared to poultry litter may have limited yield potential.

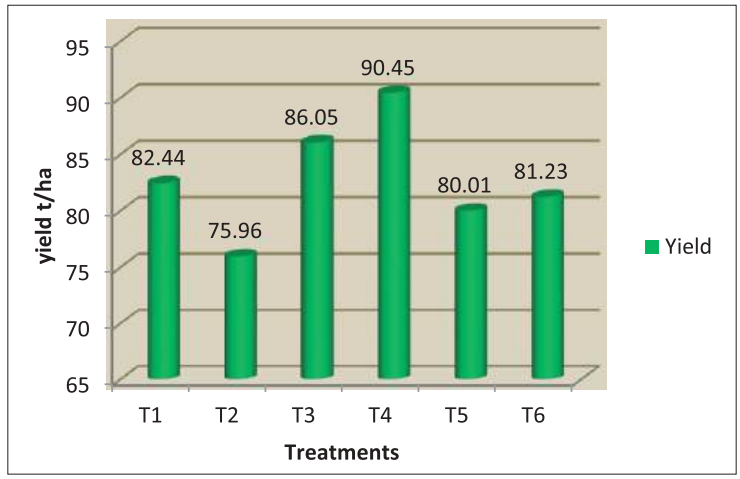


Fig 1: Yield of sugarcane in different treatments

Pol % cane

Pol % cane ranged from 11.2% (T_1) to 13.4% (T_6), with T_4 recording a competitive value of 13.2%. High pol % in T_6 reflects the role of inorganic fertilizers, particularly potassium, in enhancing sucrose accumulation during ripening. However, T_4 (T_4 = RFD (recommended fertilizer dose) + Poultry Litter @ 5 tha^{-1})'s combination of high pol and superior yield results in the highest overall sugar output per hectare.

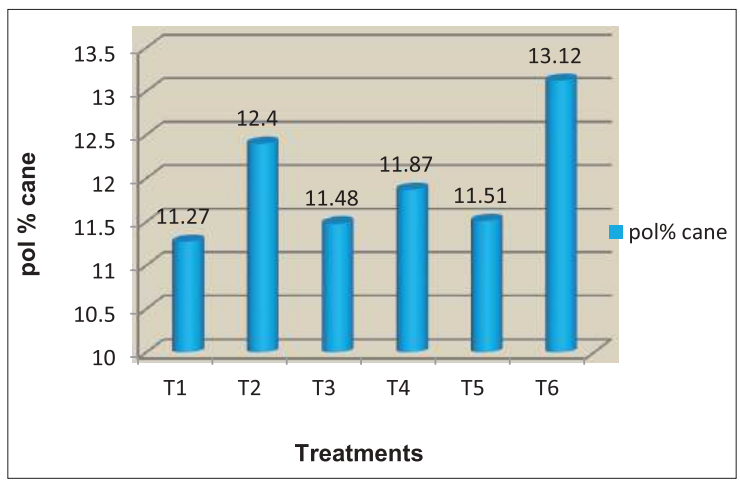


Fig 2: Pol% cane in different treatments

Brix %

Brix values varied from 16.1% (T_1) to 18.9% (T_6). T_2 (18.3%) and T_4 (T_4 = RFD (recommended fertilizer dose) + Poultry Litter @ 5 tha^{-1}) (17.5%) followed closely. While chemical fertilizer alone (T_6) produced the highest brix, integrated nutrient treatments maintained competitive values while delivering higher yields, offering a better balance between productivity and quality.

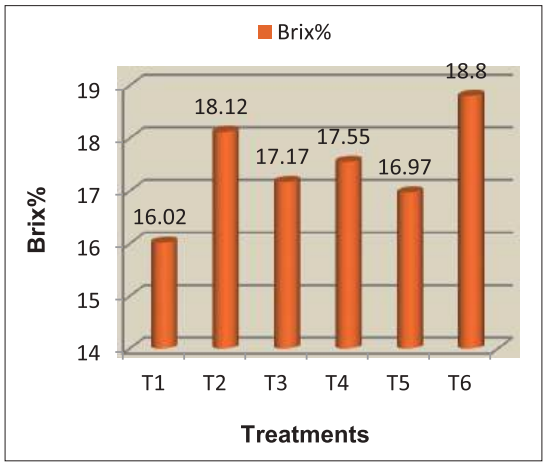


Fig 3: Brix % of sugarcane in different treatments

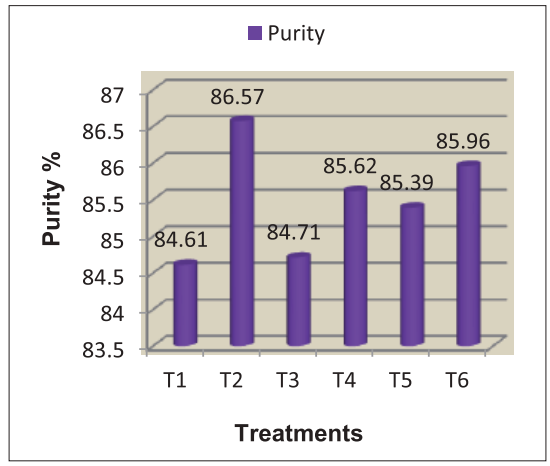


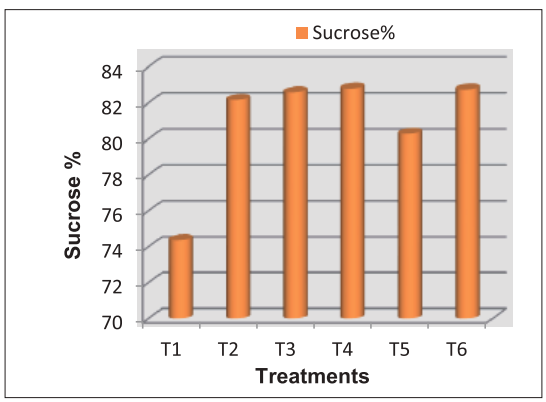
Fig 4: Purity % of sugarcane in different treatments

Purity %

Purity % ranged from 84.4% (T_1) to 86.7% (T_2). Higher purity reflects lower levels of non-sugar impurities, which is particularly important for gur production. Cow dung in T_2 may have promoted more gradual nutrient release, reducing impurities in juice. T_4 (T_4 = RFD (recommended fertilizer dose) + Poultry Litter @ 5 tha^{-1}) 's purity (85.9%) was slightly lower than T_2 but still within acceptable standards for high-quality gur. The findings clearly indicate that integrated nutrient management (INM), especially combining poultry litter with chemical fertilizers (T_4), can achieve the highest cane yield while maintaining good juice quality.

Sucrose Content and Reducing Sugars (RS) Content

In this study, sucrose percentage in *gur* varied notably across treatments. The highest sucrose content was observed in RFD (recommended fertilizer dose) + Poultry Litter @ 5 t ha^{-1} (T_4), followed closely by RFD + Mustard Oil Cake @ 0.5 t ha^{-1} (T_3) and RFD + Cowdung @ 10 t ha^{-1} (T_2). The control (T_1; no fertilizer) recorded the lowest sucrose levels, reflecting nutrient deficiency effects on cane quality. Reducing sugar percentage, which negatively affects storage stability by increasing hygroscopicity was lowest in T_4 and T_3, indicating superior storability. The highest RS content was recorded in Present Recommended Fertilizer Dose (RFD) only (T_6), suggesting that sole inorganic fertilization may accelerate sucrose inversion post-harvest due to physiological stress or less balanced nutrient supply.



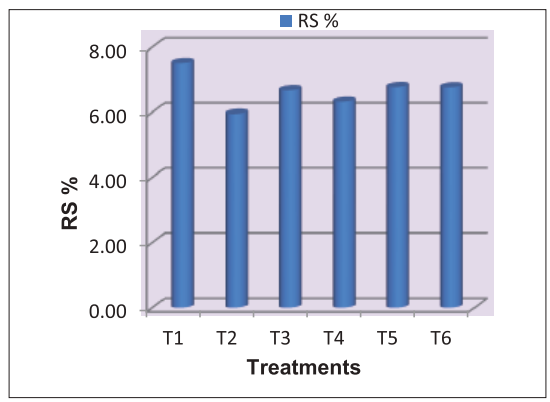


Fig 5: Sucrose % and RS % of sugarcane in different treatments

pH and Colour Transmittance

The highest pH values were found in T_4 and T_3, suggesting a more stable product compared to the control (T_1), which had the lowest pH. Colour transmittance, an indicator of visual appeal and consumer acceptability was highest in T_4 and T_5 (RFD + Trash Mulching @ 5 t ha^{-1}), producing an attractive golden hue. The control (T_1) produced darker brown jaggery, indicating the effect of nutrient deficiency on colour development during boiling.

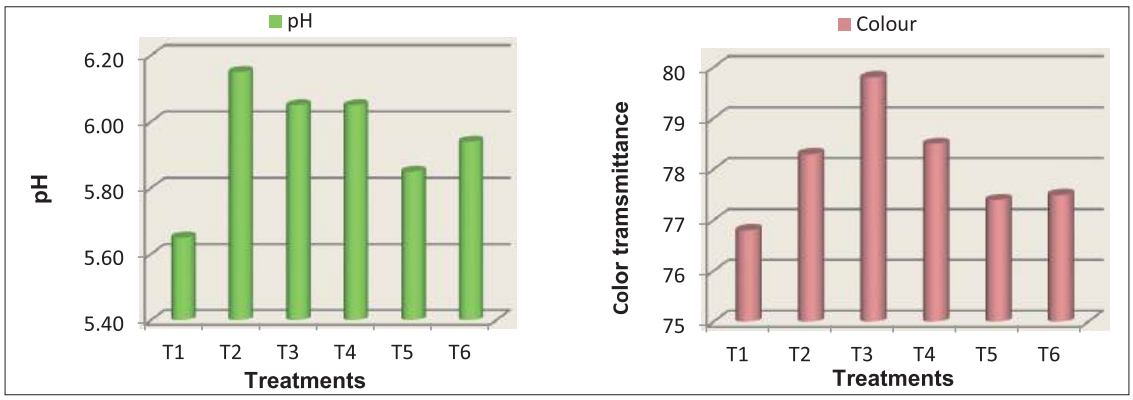


Fig 6: pH & Color transmittance % of sugarcane in different treatments

Moisture Content and *Gur* Recovery

Moisture content, a critical factor for shelf life, was lowest in T_4, followed closely by T_3 and T_2, indicating better storability compared to the control and T6. High moisture content in T_1 and T_6 suggests greater susceptibility to microbial spoilage and reduced market life.

Gur recovery percentage, representing the conversion efficiency of juice to solid jaggery, was highest in T_4, followed by T_3 and T_5, aligning with their higher sucrose content and lower RS. The control had the lowest recovery, reflecting both lower cane quality and juice yield.

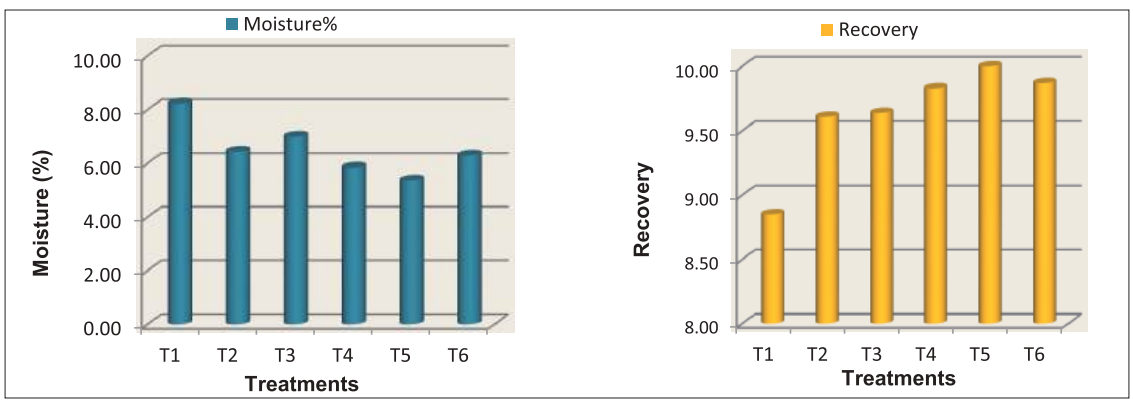


Fig 7: Moisture% & Recovery of sugarcane in different treatments

Physical Quality (Texture, Crystalline Nature, and Solid-State Colour)

Texture was “hard” for all treatments except T_1 (slightly soft), confirming that adequate nutrient supply promotes proper

crystallization and hardness in jaggery. Crystalline nature was rated "good" across all treatments, showing no adverse effect from organic amendments.

Colour in solid state was golden for T_2, T_3, T_4, and T_5, golden-brown for T_6, and brown for the control. This colour enhancement in organically integrated treatments is likely due to reduced non-sugar impurities and controlled caramelization during processing.

Table 2. different *gur* parameters in six treatments

Treatments (variety-BSRI Akh 48)	Texture	Crystalline Nature	Color in Solid State
T_1 = Control	Slightly Soft	Good	Brown
T_2 = RFD (recommended fertilizer dose) + Cowdung @ 10 tha^{-1}	Hard	Good	Golden
T_3 = RFD (recommended fertilizer dose) + Mustard Oil cake @ 0.5 tha^{-1}	Hard	Good	Golden
T_4 = RFD (recommended fertilizer dose) + Poultry Litter @ 5 tha^{-1}	Hard	Good	Golden
T_5 = RFD (recommended fertilizer dose) + Trash Mulching @ 5 tha^{-1}	Hard	Good	Golden
T_6 = Present recommended fertilizer dose (RFD)	Hard	Good	Golden Brown

Considering all measured parameters- sucrose content, RS percentage, pH, colour transmittance, moisture, recovery, and physical attributes- T_4 (RFD + Poultry Litter @ 5 t ha^{-1}) emerged as the best treatment for producing high-quality jaggery. T_3 (RFD + Mustard Oil Cake @ 0.5 t ha^{-1}) and T_2 (RFD + Cowdung @ 10 t ha^{-1}) also performed well, offering competitive quality traits. The control (T_1) and T_6 (sole RFD) lagged behind in key quality attributes, underscoring the advantage of integrating organic manures with inorganic fertilizers. Among the nutrient management practices tested, RFD + Poultry litter @ 5 t ha^{-1} (T_4) was the most effective, producing the highest cane yield (92.0 t ha^{-1}) and competitive juice quality (Pol: 13.2%, Brix: 17.5%, Purity: 85.9%). Although the present recommended fertilizer dose (T_6) yielded slightly higher sucrose concentration, its lower yield makes it less profitable. These results demonstrate that integrating poultry litter with chemical fertilizers is a practical, eco-friendly, and profitable approach for sugarcane production in Bangladesh.

AGRONOMY & FARMING SYSTEMS DIVISION

RESEARCH HIGHLIGHTS

- BSRI Akh 45 and I 94-16 appear most promising when planted in November, as they balance high cane yield with acceptable juice quality, whereas late planting (January) and clones like I 49-17 or I 75-17 are less suitable due to poor yield performance.
- Sugarcane intercropped with Mustard (BINA Sarisha-11) was identified as the most profitable combination which consisted the highest LER (1.34), GMV (5.83 lakh Tk), MAI (1.37 lakh Tk), SEY (106.15 t ha^{-1}), and BCR (2.24), with cane yield of 101.00 t ha^{-1}.
- Isd 34 variety showed the highest ratoon performance with tillers (202.3×10^3 ha^{-1}), millable cane (125.3×10^3 ha^{-1}), and ratoon yield (74.8 tha^{-1} in 2022–23; 72.1 tha^{-1} in 2023–24) when planted with two-budded soil bed settlings. Among new BSRI varieties, BSRI Akh 48 showed the lowest ratoon yield (47.9 and 45.36 tha^{-1} across cycles), followed by BSRI Akh 46 and BSRI Akh 43 with weaker tillering ability. Soil bed settlings performed better than conventional setts across varieties, particularly in terms of tiller production, millable cane survival, and ratoon yield.
- Harvesting time at 165 DAS, showed the highest yield (77.47 tha^{-1}, followed by 180 DAS (76.45 tha^{-1}). Early harvesting time at 135 DAS, significantly reduced yield. KWS Danicia harvested at 165 DAS (V_3T_3) attained the highest yield (85.11 tha^{-1}).
- Hand weeding (T_2) showed the highest weed control efficiency (91.33%) and a comparable yield (115.96 tha^{-1}) to the best herbicide treatments, but is labor-intensive. Treatment T_8, involving Lifeline 28 SL (Glufosinate) at 2.0 Lha^{-1}, produced the highest tiller count (129.8 × 10^3 ha^{-1}), millable cane (105.1 × 10^3 ha^{-1}), and cane yield (116.8 tha^{-1}).
- Sole sugarcane (T_1) gave the highest germination (38.0%) and tiller number (86.5×10^3 ha^{-1}), but yield (99.5 tha^{-1}) and profitability were lower than intercropped systems. Sugarcane + Pea (T_8) was the most productive and profitable, with the highest cane yield (114.9 tha^{-1}), SEY (187.6 tha^{-1}), GMV (10.32 lakh Tk), MAI (5.21 lakh Tk), LER (2.04), BCR (3.36) and BCR (2.36).

AGRONOMIC EVALUATION OF BSRI DEVELOPED PROMISING SUGARCANE CLONES AT DIFFERENT PLANTING DATES

Before recommending promising clones of sugarcane as commercial variety, it is required to be studied in respect of their yield production ability and quality following proper management practices. A field experiment was conducted at Bangladesh Sugarcrop Research Institute (BSRI) farm, Ishwardi (AEZ-11) during 2023-2024 cropping season with a view to evaluate BSRI developed sugarcane clones in agronomic aspect. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications having two factors where promising clone was a factor and planting date was another factor. In this experiment conventional two budded setts were used having a plot size of 6m x 6m. The key findings of the experiment are stated below:

Table 1. Interaction effect of variety/clone and planting date on yield attributes of sugarcane

Clone	Planting Date	Germination%	Tiller ($\times 10^3$ ha^{-1})	Millable Cane ($\times 10^3$ ha^{-1})	Yield (tha^{-1})	Pol % Cane
I 94-16	Nov-23	40.33±1.58 c-f	109.72±3.80	91.39±3.53 ab	87.98±1.34 ab	11.35±0.27
	Dec-23	32.33±1.35 gh	108.75±3.55	88.90±1.33 ab	83.69±1.13 bc	13.01±0.55
	Jan-24	40.00±1.15 d-f	85.70±2.78	79.84±1.98 c-f	75.43±2.02 d-f	13.09±0.24
I 49-17	Nov-23	35.67±0.69 fg	97.92±3.67	75.89±2.41 ef	81.93±2.67 b-e	13.25±0.19
	Dec-23	37.00±1.45 fg	84.72±2.99	64.89±2.07 h	69.69±2.98 fg	12.55±0.17
	Jan-24	27.00±0.88 h	65.83±2.66	49.89±1.27 i	66.87±1.15 g	13.04±0.25
I 75-17	Nov-23	50.00±0.33 ab	95.00±2.84	76.67±1.55 d-f	66.85±2.17 g	10.78±0.07
	Dec-23	44.33±1.35 b-e	94.86±4.29	74.83±1.95 fg	66.55±1.57 g	11.32±0.54
	Jan-24	39.00±1.00 ef	84.58±1.97	67.23±2.23 gh	64.2±1.53 g	11.66±0.21
I 78-17	Nov-23	37.67±1.17 fg	104.17±3.23	84.17±3.61 b-e	78.02±2.65 c-e	10.87±0.05
	Dec-23	34.67±0.84 fg	112.22±2.73	94.99±1.54 a	80.8±1.16 cd	10.82±0.53
	Jan-24	35.33±1.35 fg	95.83±2.10	85.16±1.67 bc	74.1±1.90 ef	10.87±0.31
BSRI Akh 45	Nov-23	52.00±0.88 a	114.17±1.19	95.00±2.50 a	91.52±1.43 a	12.50±0.22
	Dec-23	46.33±1.58 a-c	112.64±3.54	84.48±3.51 b-d	83.27±2.37 bc	12.45±0.33
	Jan-24	45.67±1.35 b-d	96.39±1.81	89.89±1.78 ab	77.83±1.87 c-e	10.95±0.20
Level of Significance		**	NS	**	**	NS
(LSD 0.05)		6.10	12.11	8.34	6.50	1.61

In Table 1, results showed that BSRI Akh 45 gave highest germination (52.00%) in November plantation. Among clones, I 75-17 planted in November gave highest germination (50.00%). The lowest germination was observed in January plantation of I 49-17 (27.00%). Similar to germination, tiller number was also found highest (114.17 x 10^3 ha^{-1}) in November plantation of BSRI Akh 45 although data of tiller number was statistically non-significant. In case of clones, I 78-17 gave higher (112.22 x 10^3 ha^{-1}) tiller number in December plantation followed by November (109.72 x 10^3 ha^{-1}) and December plantation (108.75 x 10^3 ha^{-1}) of I 94-16. The lowest tiller number was found in I 49-17 planted in January (65.83 x 10^3 ha^{-1}). Millable cane was found highest (95.00 x 10^3 ha^{-1}) in November plantation of BSRI Akh 45 followed by December plantation of I 78-17 (94.99 x 10^3 ha^{-1}) and November plantation of I 94-16 (91.39 x 10^3 ha^{-1}). The lowest millable cane was found in January plantation of I 49-14 (49.89±1.05 x 10^3 ha^{-1}). In case of yield, November plantation of BSRI Akh 45 (91.52 tha^{-1}) followed by I 94-16 (87.98 tha^{-1}). The lowest yield was obtained from December plantation of I 75-17 (64.2 tha^{-1}) followed by January plantation of I 49-17 (66.87 tha^{-1}). Pol% cane was non-significant among all of the treatment combinations but numerically the highest Pol% cane was attained from November plantation of I 49-17 (13.25) and the lowest Pol% cane was attained from November plantation of I 75-17 (10.78).

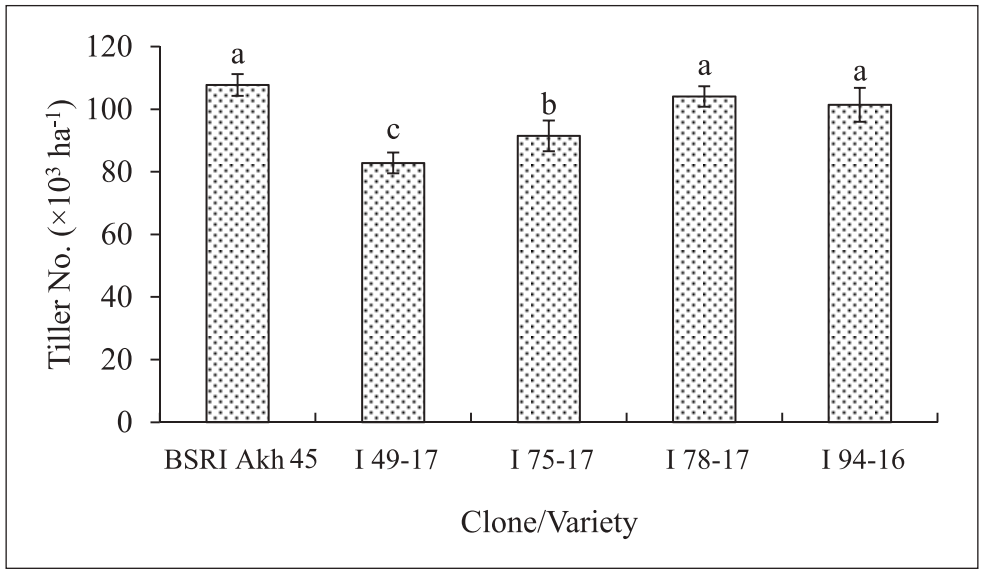


Figure 1. Number of tillers as affected by different clones

Figure 1 is showing number of tillers affected by different clones where the highest (107.73 x 10^3 ha^{-1}) tiller number was found in BSRI Akh 45. In case of tested clones, I 78-17 showed higher (104.07 x 10^3 ha^{-1}) tiller number followed by I 94-16 (101.39 x10^3 ha^{-1}). The lowest tiller number (82.82 x 10^3 ha^{-1}) was observed in I 49-17.

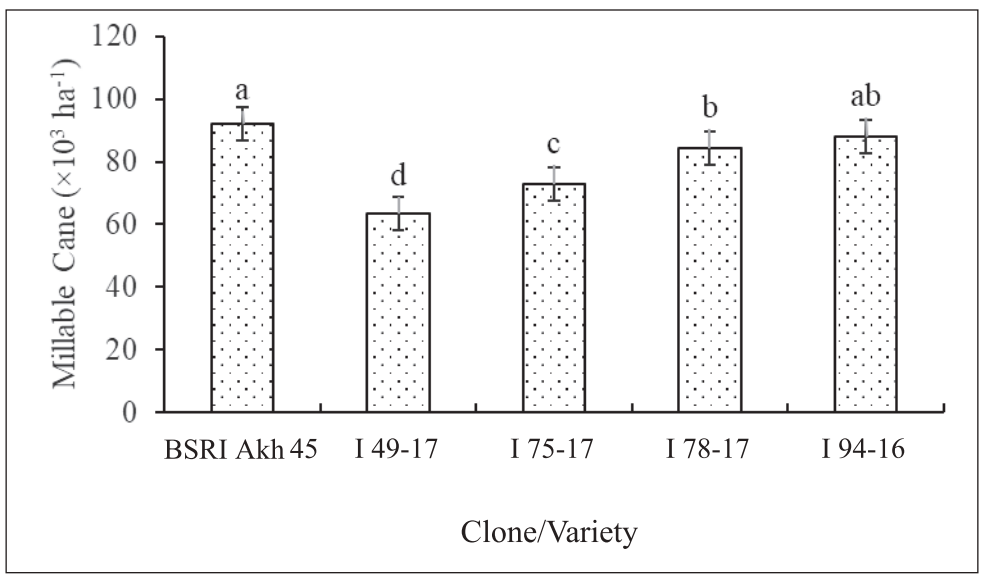


Figure 2. Number of millable cane as affected by different clones

Figure 2 is showing number of millable cane affected by different clones where the highest (92.09 x 10^3 ha^{-1}) millable cane was found in BSRI Akh 45. In case of tested clones, I 94-16 showed higher (88.10 x 10^3 ha^{-1}) millable cane. The lowest millable cane (63.55 x 10^3 ha^{-1}) was observed in I 49-17.

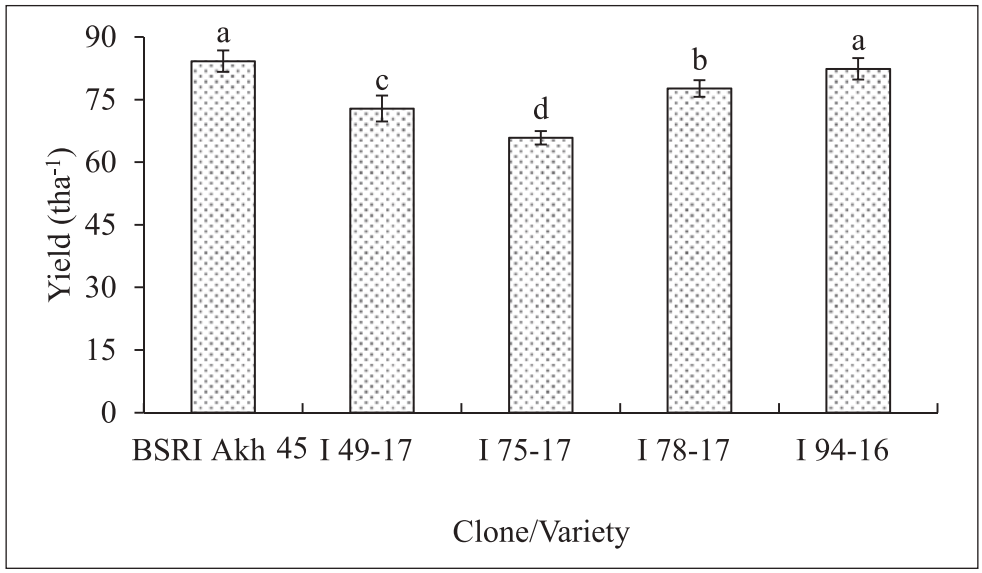


Figure 3. Yield of cane as affected by different clones

Figure 3 is showing yield of cane affected by different clones where the highest (84.20 tha^{-1}) yield was found in BSRI Akh 45 followed by I 94-16 (82.37 tha^{-1}). The lowest yield of 65.86 tha^{-1} was observed in I 75-17.

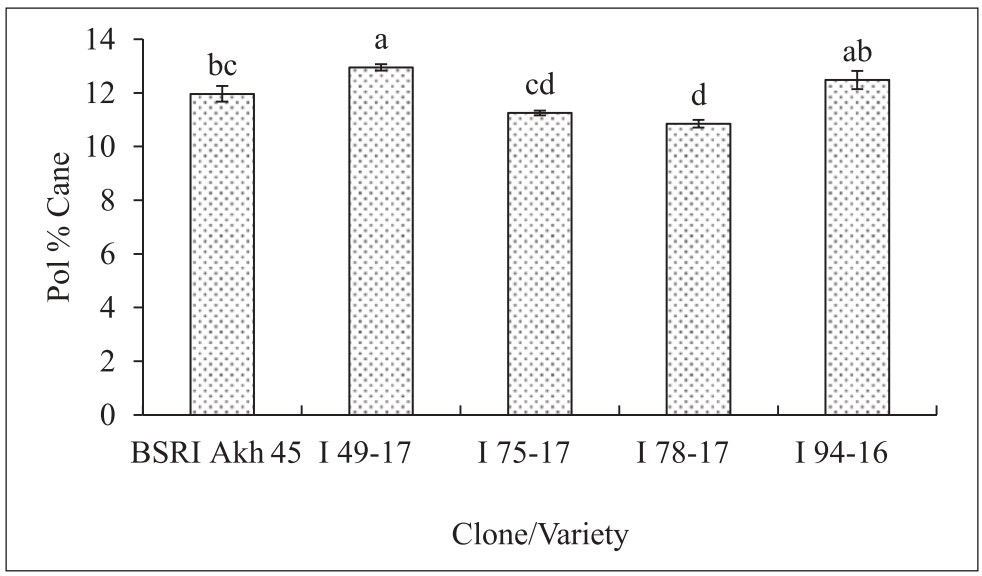


Figure 4. Pol% cane as affected by different clones

Figure 4 is showing pol% cane affected by different clones where the highest (12.94%) yield was found in I 49-17 followed by I 94-16 (12.48%). The lowest pol% of 10.85 was observed in I 78-17.

CONCLUSIONS

BSRI Akh 45 and I 94-16 appear most promising when planted in November, as they balance high cane yield with acceptable juice quality, whereas late planting (January) and clones like I 49-17 or I 75-17 are less suitable due to poor yield performance.

SEQUENTIAL INTERCROPPING OF OIL CROPS WITH SUGARCANE

A suitable package of sequential intercropping of oil crops should be developed for profitable cultivation of sugarcane but at present there is no available package of such oil crops in the sugarcane growing areas of the country. An experiment was conducted in 2023-24 cropping year at BSRI farm with a view to screening most suitable mustard variety as first intercrop with single row transplanted cane. The study was laid out in RCB design with three replications by using 2 budded soil bed settlings of cane variety BSRI Akh 45 using recommended doses of fertilizers and cultural practices were applied as and when required. The salient results of the experiment has been presented below:

Table 2. Tiller, millable cane and mustard yield gained from different treatment

Treatment	Tiller ($\times 10^3$ ha^{-1})	Millable cane ($\times 10^3$ ha^{-1})	Mustard Yield (tha^{-1})
T_1 : Sugarcane Only	232.41±7.30 a	106.17±2.77 a	-
T_2 : Sugarcane + Mustard (Tori 7)	189.81±6.13 b-d	94.07±1.87 bc	0.48±0.009 b-d
T_3 : Sugarcane + Mustard (BARI Sarisha-9)	181.67±7.07 c-e	86.67±0.96 cd	0.43±0.009 cd
T_4 : Sugarcane + Mustard (BARI Sarisha-14)	158.20±6.07 de	80.33±2.05 d	0.45±0.014 cd
T_5 : Sugarcane + Mustard (BARI Sarisha-15)	194.81±3.64 bc	96.96±1.94 ab	0.42±0.003 d
T_6 : Sugarcane + Mustard (BARI Sarisha-17)	194.26±4.73 bc	96.19±2.95 bc	0.49±0.018 bc
T_7 : Sugarcane + Mustard (BARI Sarisha-18)	154.26±7.37 e	77.70±1.50 d	0.46±0.022 cd
T_8 : Sugarcane + Mustard (BINA Sarisha-9)	173.89±5.47 c-e	86.85±0.21 cd	0.74±0.011 a
T_9 : Sugarcane + Mustard (BINA Sarisha-11)	215.55±8.25 ab	98.15±1.68 ab	0.54±0.016 b
Level of Significance	**	***	**
(LSD 0.05)	33.73	9.81	0.07

In Table 2, results showed that T_1 (Sugarcane only) gave highest number of tillers of (232.41 x 10^3 ha^{-1}) followed by T_9 [Sugarcane + Mustard (BINA Sarisha-11)] (215.55 x 10^3 ha^{-1}). The lowest tiller number was observed in T_7 [Sugarcane + Mustard (BARI Sarisha-18)] (154.26 x 10_3 ha^{-1}). Millable cane was also found highest (106.17 x 10^3 ha^{-1}) in T_1 (Sugarcane only) followed by T_9 [Sugarcane + Mustard (BINA Sarisha-11)] (98.15 x 10^3 ha^{-1}) and T_5 [Sugarcane + Mustard (BARI Sarisha 15)] (96.96 x 10^3 ha^{-1}). The highest mustard yield was found in T_8 [Sugarcane + Mustard (BINA Sarisha-9)] (0.74 tha^{-1}) and the lowest mustard yield was found in T_5 [Sugarcane + Mustard (BARI Sarisha 15)] (0.42 tha^{-1}) treatment.

Table 3. Some efficiency and economic indices gained from different treatments

Treatment	LER	GMV (Lakh Tk.)	MAI (Lakh Tk.)
T_1 : Sugarcane Only	1.00±0.00 ef	5.76 ab	0 d
T_2 : Sugarcane + Mustard (Tori 7)	1.06±0.02 de	5.24 bc	0.31 c
T_3 : Sugarcane + Mustard (BARI Sarisha-9)	1.09±0.02 de	5.02 c	0.42 bc
T_4 : Sugarcane + Mustard (BARI Sarisha-14)	1.15±0.02 cd	5.15 c	0.68 b
T_5 : Sugarcane + Mustard (BARI Sarisha-15)	0.94±0.02 f	4.99 c	0.30 c
T_6 : Sugarcane + Mustard (BARI Sarisha-17)	1.21±0.01 bc	5.39 a-c	0.96 b
T_7 : Sugarcane + Mustard (BARI Sarisha-18)	1.12±0.05 cd	4.92 c	0.50 bc
T_8 : Sugarcane + Mustard (BINA Sarisha-9)	1.28±0.03 ab	5.33 a-c	1.27 ab
T_9 : Sugarcane + Mustard (BINA Sarisha-11)	1.34±0.03 a	5.83 a	1.37 a
Level of Significance	**	***	*
(LSD 0.05)	0.09	0.51	0.29

In Table 3, results showed that T_9 [Sugarcane + Mustard (BINA Sarisha-11)] showed the highest LER of 1.34 followed by T_8 [Sugarcane + Mustard (BINA Sarisha-9)] (1.28) and the lowest LER was found in T_5 [Sugarcane + Mustard (BARI Sarisha 15)] (0.94) treatment. Monetary value obtained from different treatments were also statistically significant where the highest GMV of 5.83 Lakh Tk was found in T_9 [Sugarcane + Mustard (BINA Sarisha-11)] treatment and the lowest GMV of 4.92 Lakh Tk was observed in T_7 [Sugarcane + Mustard (BARI Sarisha-18)] treatment. Again, the highest MAI (1.37 Lakh Tk) was found also in T_9 [Sugarcane + Mustard (BINA Sarisha-11)] treatment and the lowest MAI (0) was found in T_1 (Sugarcane only) treatment.

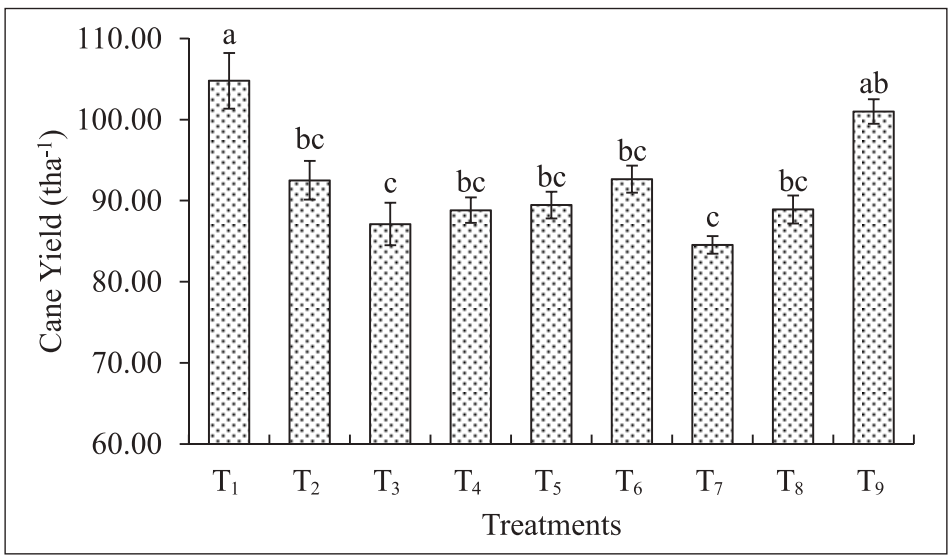


Figure 5. Cane yield as affected by different treatments

Figure 5 is showing effect of different intercropping combination on cane yield where the highest (104.79 tha^{-1}) was found in T_1 [Sugarcane only] treatment followed by T_9 [Sugarcane + Mustard (BINA Sarisha-11)] (101.00 tha^{-1}). The lowest cane yield was observed in T_7 [Sugarcane + Mustard (BARI Sarisha-18)] treatment (84.54 tha^{-1}) followed by T_3 [Sugarcane + Mustard (BARI Sarisha-9) treatment (87.11 tha^{-1}).

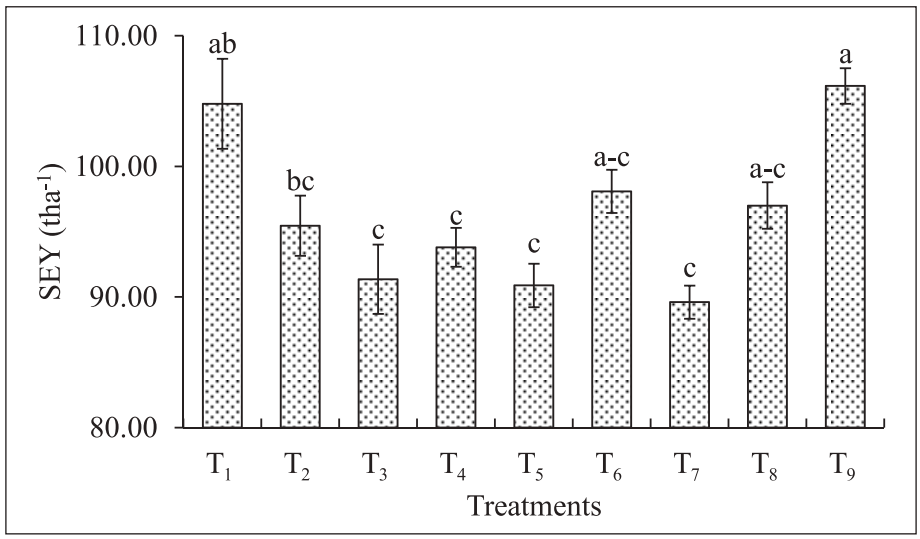


Figure 6. Sugarcane equivalent yield (SEY) as affected by different treatments

Figure 6 is showing effect of different intercropping combination on Sugarcane Equivalent Yield (SEY) where the highest (106.15 tha^{-1}) SEY was found in T_9 [Sugarcane + Mustard (BINA Sarisha-11)] treatment followed by T_1 (Sugarcane Only) (104.79 tha^{-1}). The lowest SEY of 89.60 tha^{-1} was observed in T_7 [Sugarcane + Mustard (BARI Sarisha-18)] treatment followed by T_5 [Sugarcane + Mustard (BARI Sarisha-15)] (90.88 tha^{-1}), T_3 [Sugarcane + Mustard (BARI Sarisha-9)] (91.35 tha^{-1}) and T_4 [Sugarcane + Mustard (BARI Sarisha-14)] treatment (93.79 tha^{-1}).

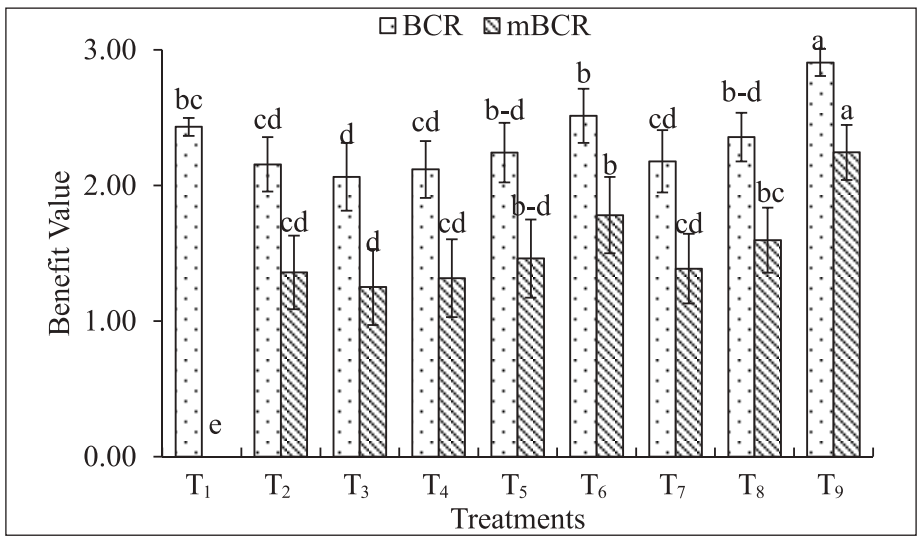


Figure 7. BCR and mBCR obtained from different treatments

Figure 7 is showing effect of different intercropping combination on BCR and mBCR where the highest BCR (2.91) was found in T_9 [Sugarcane + Mustard (BINA Sarisha-11)] treatment and the lowest BCR of 2.06 was observed in T_3 [Sugarcane + Mustard (BARI Sarisha-9)] treatment. In case of mBCR, the highest value of 2.24 was

found in T_9 [Sugarcane + Mustard (BINA Sarisha-11)] treatment and the lowest mBCR of 0 was observed in T_1 (Sugarcane only).

CONCLUSIONS

Sugarcane intercropped with Mustard (BINA Sarisha-11) was identified as the most profitable combination which consisted the highest LER (1.34), GMV (5.83 lakh Tk), MAI (1.37 lakh Tk), SEY (106.15 t ha^{-1}), and BCR (2.24), with cane yield of 101.00 t ha^{-1}.

RATOONING ABILITY OF NEWLY RELEASED SUGARCANE VARIETIES IN RESPONSE TO PLANTING MATERIAL IN HIGH GANGES RIVER FLOODPLAIN SOILS (AEZ 11)

The experiment was conducted at BSRI farm during 2021-24 cropping season to observe the performance of ratooning potentiality of some sugarcane varieties. For the experiment seven sugarcane varieties viz. V_1: Isd 34, V_2: Isd 39, V_3: BSRI Akh 43, V_4: BSRI Akh 44, V_5: BSRI Akh 45, V_6: BSRI Akh 46 and V_7: BSRI Akh 48 along with two types of planting material viz. T_1: two budded sett and T_2: two budded soilbed settlings had been selected. Setts and soilbed settlings of 45 days old were planted and transplanted in November 2021 to study their agronomic performances. The plant spacing was 100 cm × 30 cm. The experiment was conducted in Randomized Complete Block (RCB) design with three replications. Recommended doses of fertilizer and other cultural practices were done as and when required. The results of the study are presented below:

Table 4. Interaction effect of variety and planting material on Number of tillers, Millable cane, Yield and Pol % cane

Variety	Planting Material	Tiller ($\times 10^3$ ha^{-1})	Millable Cane ($\times 10^3$ ha^{-1})	Yield (tha^{-1})	Pol % Cane
Isd 34	Two-budded sett	181.33±2.78 b	97.00±3.86 b	62.53±3.22 b	10.86±0.39
	Two-budded soilbed sett	223.33±2.55 a	125.33±5.26 a	81.66±1.80 a	11.43±0.33
Isd 39	Two-budded sett	95.19±3.98 h	58.07±1.31 h	34.71±1.66 fg	11.91±0.41
	Two-budded soilbed sett	128.15±4.08 cd	72.93±0.86 d-f	58.10±2.19 bc	11.56±0.21
BSRI Akh 43	Two-budded sett	108.89±5.16 f-h	66.67±1.13 e-h	53.33±2.24 cd	11.46±0.23
	Two-budded soilbed sett	114.07±5.37 d-g	68.00±2.67 e-g	53.66±2.00 cd	11.06±0.47
BSRI Akh 44	Two-budded sett	104.33±2.01 gh	68.44±2.23 e-g	56.33±1.72 b-d	11.22±0.47
	Two-budded soilbed sett	127.00±2.85 c-e	80.00±2.76 cd	57.83±1.36 bc	12.14±0.22
BSRI Akh 45	Two-budded sett	115.73±4.55 c-g	65.18±1.75 f-h	48.30±1.65 d	12.19±0.33
	Two-budded soilbed sett	132.60±2.63 c	75.04±1.82 de	54.00±2.12 cd	12.04±0.25
BSRI Akh 46	Two-budded sett	104.37±4.12 gh	62.59±2.88 gh	51.48±2.32 cd	10.39±0.39
	Two-budded soilbed sett	109.63±5.32 e-h	66.19±2.21 e-h	50.00±1.66 cd	11.58±0.27
BSRI Akh 48	Two-budded sett	109.93±4.32 e-h	55.55±2.49 de	40.00±1.70 e	12.99±0.32
	Two-budded soilbed sett	122.33±1.95 c-f	85.67±0.85 c	50.72±0.25 cd	12.64±0.61
Level of Significance		*	*	**	NS
(LSD 0.05)		17.73	9.42	8.11	2.90

In Table 4, results showed that two budded soilbed settlings of Isd 34 (223.33 x 10^3 ha^{-1}) produced highest number of tillers. The lowest tiller number was observed in two budded sett of Isd 39 (95.19 x 10^3 ha^{-1}). Millable cane was also found highest (125.33 x 10^3 ha^{-1}) two budded soilbed settlings of Isd 34 and the lowest millable cane was found in two budded sett of Isd 39 (58.07 x 10^3 ha^{-1}). Yield was also highest (81.66 tha^{-1}) in two budded soilbed settlings of Isd 34 and the lowest yield was obtained from two budded sett of Isd 39 (34.71 tha^{-1}). Pol % cane was non-significant across the treatment combinations.

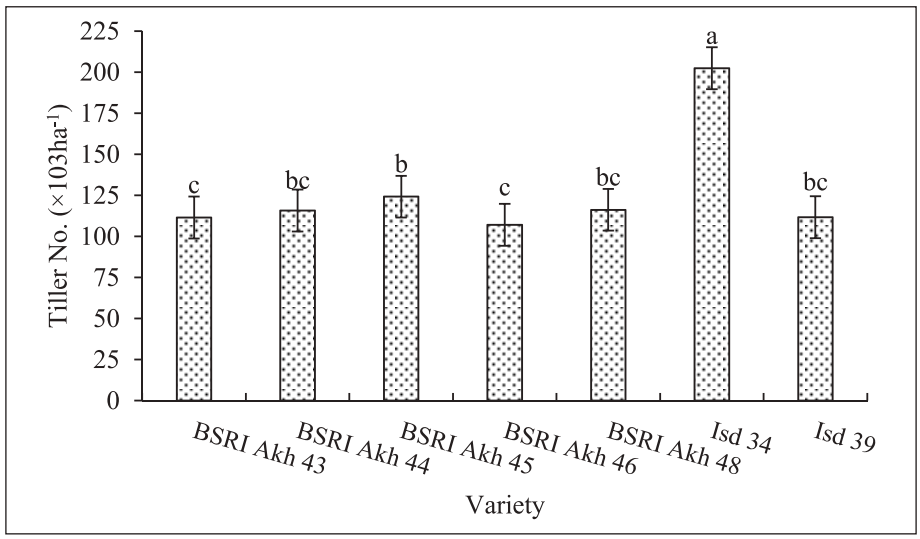


Figure 8. Tiller number of ratoon cane as affected by different variety

Figure 8 is showing tiller number of ratoon cane affected by different variety where the highest (202.33 x 10^3 ha^{-1}) tiller was found in Isd 34 and the lowest (107.00 x 10^3 ha^{-1}) tiller was found in BSRI Akh 46 followed by BSRI Akh 43 (111.48 x 10^3 ha^{-1}).

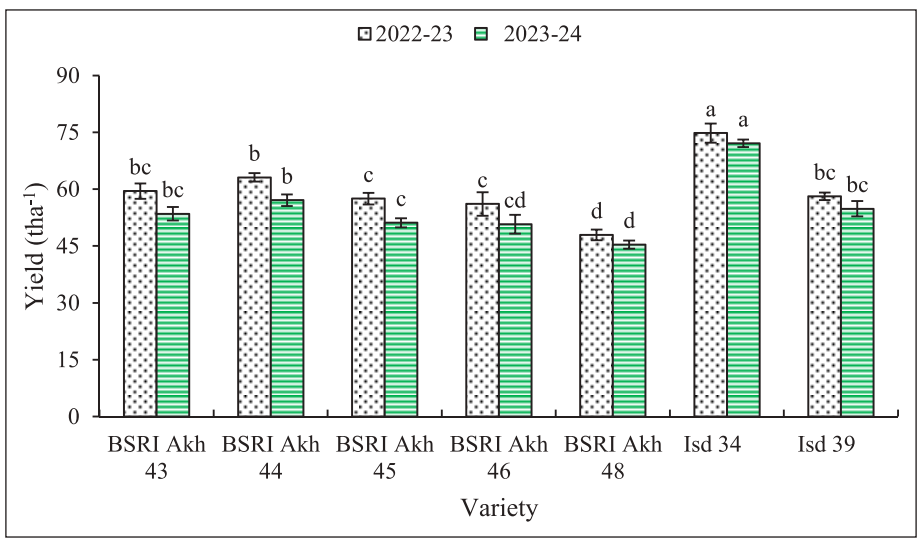


Figure 9. Yield of ratoon cane as affected by different variety

Figure 9 is showing yield of ratoon cane affected by different variety where the highest yield was found in Isd 34 (74.8 tha^{-1} in 2022-23 CY and 72.1 tha^{-1} in 2023-24 CY) and the lowest yield was found in BSRI Akh 48 (47.9 tha^{-1} in 2022-23 CY and 45.36 tha^{-1} in 2023-24 CY).

CONCLUSIONS

Isd 34 variety showed the highest ratoon performance with tillers (202.3×10^3 ha^{-1}), millable cane (125.3×10^3 ha^{-1}), and ratoon yield (74.8 tha^{-1} in 2022–23; 72.1 tha^{-1} in 2023–24) when planted with two-budded soil bed settlings. Among new BSRI

varieties, BSRI Akh 48 showed the lowest ratoon yield (47.9 and 45.36 tha^{-1} across cycles), followed by BSRI Akh 46 and BSRI Akh 43 with weaker tillering ability. Soil bed settlings performed better than conventional setts across varieties, particularly in terms of tiller production, millable cane survival, and ratoon yield.

YIELD AND QUALITY OF SUGARBEET UNDER DIFFERENT HARVESTING TIME

Sugarbeet (*Beta vulgaris* L.) is a temperate crop. But now-a-days it is cultivating in different tropical and sub-tropical regions of the world. Sugarbeet is a promising crop in our country to mitigate sugar deficit. Yield as well as quality of sugarbeet is depending upon the variety and harvesting time. By considering these facts an experiment was conducted in 2023-24 cropping year at BSRI farm to determine yield and quality of sugarbeet as affected by different harvesting time. The experiment was carried out in a two factorial RCB design where four levels of harvesting time and four levels of variety served as factors:

The major findings of the experiment is given below:

Harvesting Time

T_1: 135 DAS
T_2: 150 DAS
T_3: 165 DAS
T_4 : 180 DAS

Variety

V_1: KWS Allanya
V_2: KWS Gregoria
V_3: KWS Danicia
V_4: KWS Serenada

Table 5. Interaction effect of variety and harvesting time on different parameters of sugarbeet

Variety	Harvesting Time	Germination (%)	Yield (tha^{-1})	Pol% Beet
V_1: KWS Allanya	T_1: 135 Days after sowing	97.00±0.98	59.93±2.98 de	13.70±0.26
	T_2: 150 Days after sowing	87.00±3.31	62.47±1.16 c-e	12.87±0.44
	T_3: 165 Days after sowing	90.33±0.68	72.84±3.60 a-d	13.33±0.17
	T_4: 180 Days after sowing	95.00±1.36	75.17±2.38 a-d	13.27±0.17
V_2: KWS Gregoria	T_1: 135 Days after sowing	88.67±1.10	48.27±2.36 ef	15.03±0.30
	T_2: 150 Days after sowing	89.33±2.04	73.18±2.78 a-d	12.13±0.17
	T_3: 165 Days after sowing	87.00±3.31	71.35±1.85 a-d	14.43±0.51
	T_4: 180 Days after sowing	84.67±3.42	76.70±3.09 a-c	13.00±0.14
V_3: KWS Danicia	T_1: 135 Days after sowing	77.00±2.83	35.40±1.64 f	13.30±0.25
	T_2: 150 Days after sowing	91.00±1.44	66.12±2.57 b-d	12.07±0.20
	T_3: 165 Days after sowing	88.67±0.31	85.11±1.30 a	13.30±0.07
	T_4: 180 Days after sowing	87.00±0.47	71.98±2.23 a-d	12.40±0.09
V_4: KWS Serenada	T_1: 135 Days after sowing	89.67±0.79	35.45±1.45 f	13.67±0.24
	T_2: 150 Days after sowing	84.33±3.40	66.18±2.74 b-d	12.13±0.49
	T_3: 165 Days after sowing	94.33±1.40	80.61±3.96 ab	14.40±0.20
	T_4: 180 Days after sowing	85.33±4.09	81.98±3.30 ab	12.30±0.21
(LSD 0.05)		13.82	16.16	1.72
Level of Significance		NS	*	NS

Table 5 showed that there were no significant differences among the treatment combinations in case of germination. But numerically the highest germination of 97% was observed in the V_1T_1 (KWS Allanya× Harvested 135 DAS) treatment combination. The lowest germination of 77% was observed in the treatment combination of V_3 T_1 (KWS Danicia×Harvested 135 DAS). In case of yield, the highest (85.11 tha^{-1}) was

attained in V_3T_3 treatment combination (KWS Danicia×Harvested 165 DAS) and the lowest (35.40 tha^{-1}) was attained in V_3T_1 (KWS Danicia×Harvested 135 DAS) treatment combination. Pol% beet was also non-significant among the treatment combinations where numerically the highest Pol% beet was observed in the V_2T_1 (KWS Gregoria×Harvested 135 DAS) treatment combination (15.03) and the lowest Pol% beet of 12.07 was observed in the treatment combination of V_3T_2 (KWS Danicia× Harvested 150 DAS).

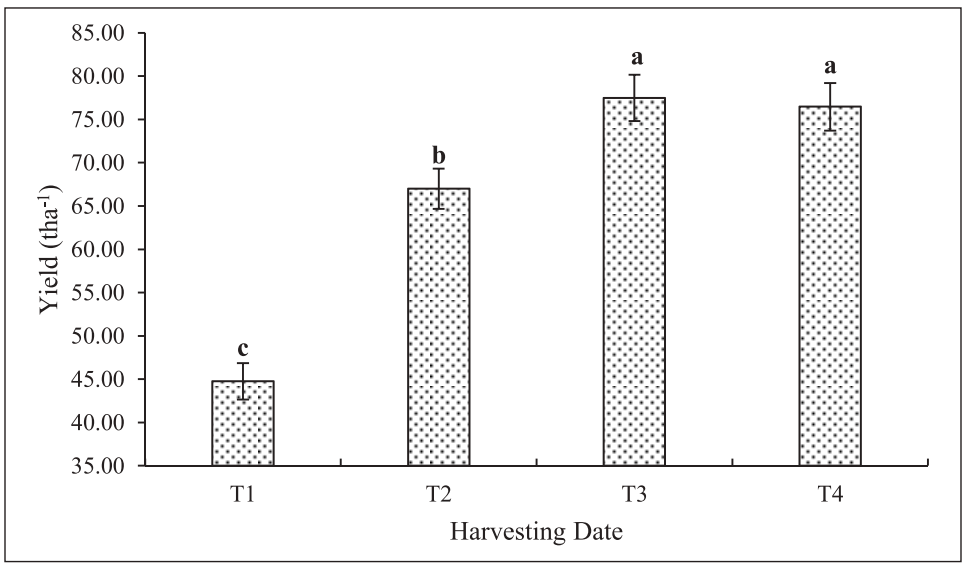


Figure 10. Sugarbeet yield as affected by different harvesting date

Figure 10 is showing sugarbeet yield affected by different harvesting time where the highest (77.47 tha^{-1}) yield was found in T_3 (165 DAS) followed by T_4 (180 DAS) (76.45 tha^{-1}).

CONCLUSIONS

Harvesting time at 165 DAS, showed the highest yield (77.47 tha^{-1}, followed by 180 DAS (76.45 tha^{-1}). Early harvesting time at 135 DAS, significantly reduced yield. KWS Danicia harvested at 165 DAS (V_3T_3) attained the highest yield (85.11 tha^{-1}).

WEED CONTROL EFFICIENCY OF SOME SELECTED HERBICIDE IN SUGARCANE

A field experiment was conducted at Bangladesh Sugarcrop Research Institute (BSRI) farm, Ishwardi (AEZ-11) during 2023-2024 cropping season under irrigated condition to find out the efficacy of using herbicides in sugarcane field and increase sugarcane yield and economic benefit by successful weed management. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Two budded soil bed settlings of variety BSRI Akh 43 were transplanted in mid-November, 2023. Cane planting was done in deep furrows at row distance of 100 cm and plant to plant distance 45 cm, keeping plot size was 6m x 6m. Major findings of the experiment is stated below:

There were 16 treatments namely:

T_1 : Control (no weeding)
T_2 : Hand weeding
T_3 : Ricotra 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 Lha^{-1}
T_4 : Ricotra 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.0 Lha^{-1}
T_5 : Siper 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 Lha^{-1}

T_6 : Siper 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.0 Lha^{-1}

T_7 : Lifeline 28 SL (Glufosinate 28 %) @ 2.5 Lha^{-1}

T_8 : Lifeline 28 SL (Glufosinate 28 %) @ 2.0 Lha^{-1}

T_9 : Mestra 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 Lha^{-1}

T_{10}: Mestra 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.0 Lha^{-1}

T_{11}: Simanto 20 SL (Glufosinate 20%) @ 2.5 L ha^{-1}

T_{12} : Simanto 20 SL (Glufosinate 20%) @ 2.0 L ha^{-1}

T_{13}: Gachang 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 Lha^{-1}

T_{14}: Gachang 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.0 Lha^{-1}

T_{15}: Tethodaza 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 Lha^{-1}

T_{16}: Tethodaza 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.0 Lha^{-1}

Table 6. Tiller, Millable cane and Pol % as affected by different weed management practices in sugarcane field

Treatment	Tiller ($\times 10^3$ ha^{-1})	Millable cane ($\times 10^3$ ha^{-1})	Pol (%)
T_1: Control (No weeding)	95.60±4.41 e	92.40±0.54 e	11.94±0.25
T_2: Hand weeding	119.20±3.55 a-c	95.87±1.94 b-e	11.17±0.35
T_3: Ricotra 55 SC (Atrazine+ Mesotrione) @ 2.5 Lha^{-1}	121.87±2.39 a-c	98.80±0.58 a-e	12.48±0.08
T_4: Ricotra 55 SC (Atrazine+ Mesotrione) @ 2.0 Lha^{-1}	119.20±3.84 a-c	98.67±1.97 a-e	11.89±0.36
T_5: Siper 55 SC (Atrazine+ Mesotrione) @ 2.5 Lha^{-1}	108.53±3.30 c-e	103.20±0.74 ab	12.26±0.49
T_6: Siper 55 SC (Atrazine+ Mesotrione) @ 2.0 Lha^{-1}	124.13±0.63 a-c	96.13±0.31 b-e	11.88±0.18
T_7: Lifeline 28 SL (Glufosinate) @ 2.5 Lha^{-1}	116.93±1.53 a-c	96.80±1.80 b-e	12.21±0.19
T_8: Lifeline 28 SL (Glufosinate) @ 2.0 Lha^{-1}	129.87±3.48 a	105.11±3.19 a	12.17±0.31
T_9: Mestra 55 SC (Atrazine+ Mesotrione) @ 2.5 Lha^{-1}	127.60±1.04 ab	102.27±2.48 ab	11.28±0.55
T_{10}: Mestra 55 SC (Atrazine+ Mesotrione) @ 2.0 Lha^{-1}	121.33±2.75 a-c	101.53±0.60 a-c	12.04±0.21
T_{11}: Simanto 20 SL (Glufosinate) @ 2.5 Lha^{-1}	100.27± 4.89 de	93.87±1.00 de	12.75±0.07
T_{12}: Simanto 20 SL (Glufosinate) @ 2.0 Lha^{-1}	126.13±1.50 ab	100.73±1.02 a	12.03±0.37
T_{13}: Gachang 55 SC (Atrazine+ Mesotrione) @ 2.5 Lha^{-1}	127.33±1.21 ab	92.53±1.07 e	12.06±0.57
T_{14}: Gachang 55 SC (Atrazine+ Mesotrione) @ 2.0 Lha^{-1}	112.53±5.12 b-d	94.53±0.41 c-e	11.90±0.49
T_{15}: Tethodaza 55 SC (Atrazine+ Mesotrione) @ 2.5 Lha^{-1}	119.40±4.71 a-c	100.67±1.69 a-d	11.20±0.10
T_{16}: Tethodaza 55 SC (Atrazine+ Mesotrione) @ 2.0 Lha^{-1}	124.00±1.83 a-c	94.40±1.01 c-e	10.42±0.38
Level of Significance	**	*	NS
LSD (0.05)	16.5	7.62	1.47

In Table 6, results showed that a significant statistical data was acquired in terms of tiller number among all of the treatments where the highest tiller number was achieved in T_8 (129.87 x 10^3 ha^{-1}) followed by T_{12} (127.33 x 10^3 ha^{-1}), T_{13} (126.13 x 10^3 ha^{-1}) and the lowest tiller number of 95.60 x 10^3 ha^{-1} was observed in T_1 (Control). Millable cane was also found highest in T_8 (105.11 x 10^3 ha^{-1}) followed by T_{12} (100.73 x 10^3 ha^{-1}) and the lowest millable cane (92.40 x 10^3 ha^{-1}) was found in T_1 (Control) followed by T_{13} (92.53x 10^3 ha^{-1}). In case of pol% cane, the highest 12.75 was found in T_{11} and the lowest 10.42 was found in T_{16} although pol% cane was statistically non-significant.

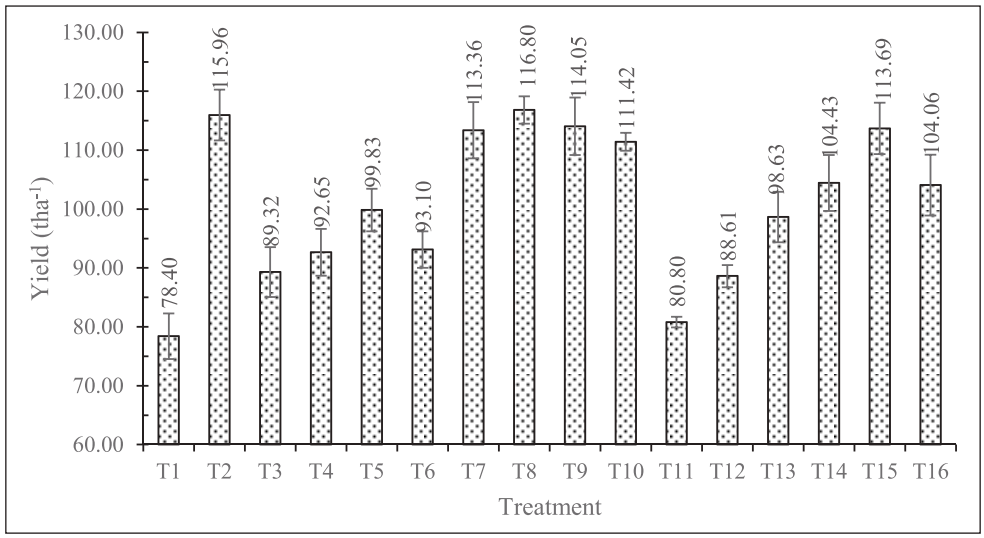


Figure 11. Effect of different weed management practices on cane yield

In Figure 11, results showed effect of different weed management practices on cane yield where the highest yield of 116.80 tha^{-1} was observed in T_8. A statistically equivalent yield was obsereved in T_2 (115.96 tha^{-1}), T_9 (114.05 tha^{-1}), T_{15} (113.69 tha^{-1}) and T_7 (113.36 tha^{-1}) treatment also. The lowest yield of 78.40 tha^{-1} was observed in T_1 treatment followed by T_{11} (80.80 tha^{-1}).

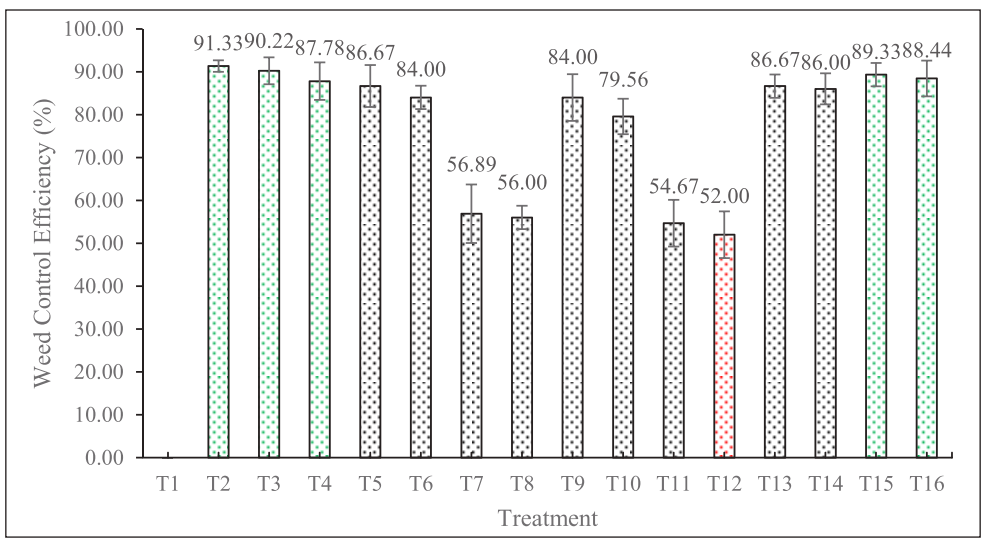


Figure 12. Weed Control Efficiency (%) of the tested herbicides

In Figure 12, results showed weed control efficiency of tested herbicides where the highest efficiency of 91.33% was observed in T_2 (Hand weeding). A statistically similar weed control eficiency was also observed in T_3 (90.22%), T_{15} (89.33%), T_{16} (88.44%) and T_4 (87.78%) treatment. The lowest weed control efficiency of 0% was observed in T_1 (Contol: No weeding) treatment. Among the tested herbicides, the lowest weed control efficiency of 52.00% was observed in T_{12}.

CONCLUSIONS

Hand weeding (T_2) showed the highest weed control efficiency (91.33%) and a comparable yield (115.96 tha^{-1}) to the best herbicide treatments, but is labor-intensive. Treatment T_8, involving Lifeline 28 SL (Glufosinate) at 2.0 L ha^{-1}, produced the highest tiller count (129.8 × 10^3 ha^{-1}), millable cane (105.1 × 10^3 ha^{-1}), and cane yield (116.8 t ha^{-1}).

PRODUCTIVITY OF CHEWING CANE WITH DIFFERENT HIGH VALUE INTERCROPS

Sugarcane is a key industrial crop grown globally for sugar and biofuel production. Its wide row spacing (80–150 cm) and slow early growth phase (100–110 days) make it suitable for intercropping, allowing efficient use of space, nutrients, moisture, and light. Intercropping with short-duration crops like vegetables, legumes, or oilseeds can boost productivity and income, especially where land expansion is limited. In Bangladesh, many small farmers cannot sustain the long 10–14 months cane cycle, leading to reduced cane cultivation. Intercropping offers a practical solution to enhance production and income. This study explored the effects of intercropping high-value crops with chewing cane on growth, yield, and profitability. The study was laid out in RCB design with three replications by using 2 budded setts of cane variety BSRI Akh 42 using recommended doses of fertilizers and cultural practices were applied as and when required. The salient result of the experiment has been presented below:

Treatments:

T_1 : Sugarcane only
T_2 : Sugarcane + Carrot
T_3 : Carrot only
T_4 : Sugarcane + Spinach
T_5 : Spinach only
T_6 : Sugarcane + Cauliflower
T_7 : Cauliflower
T_8 : Sugarcane + Pea
T_9 : Pea

Table 7. Data on different parameters of sugarcane

Treatment	Germination %	Tiller number ($\times 10^3 ha^{-1}$)	Chewable Cane ($\times 10^3 ha^{-1}$)	Cane Height (m)	Average No. of internode	Cane Yield (tha^{-1})	Average Internode Length (cm)	Pol % Cane
T_1 : Sugarcane only	38.00±0.67 a	86.5±2.62 a	67.17±1.55 a	2.68±0.03 c	22.44±0.48 a	99.48±3.49 a	11.95±0.14	10.43±0.10
T_2 : Sugarcane + Carrot	29.67±0.77 b	71.5±1.20 c	58.67±1.11 b	2.52±0.04 c	19.00±0.35 b	76.91±2.53 b	13.30±0.12	10.86±0.11
T_3 : Carrot only	-	-	-	-	-	-	-	-
T_4 : Sugarcane + Spinach	30.33±0.84 b	79.00±2.33 b	69.33±1.11 a	2.75±0.05 bc	21.46±0.28 a	102.02±3.29 a	12.86±0.34	11.25±0.28
T_5 : Spinach only	-	-	-	-	-	-	-	-
T_6 : Sugarcane + Cauliflower	30.67±0.84 b	77.67±2.25 b	66.33±0.51 a	3.03±0.05 a	22.06±0.19 a	98.08±2.31 a	13.76±0.35	9.38±0.43
T_7 : Cauliflower	-	-	-	-	-	-	-	-
T_8 : Sugarcane + Pea	33.00±1.00 b	81.5±2.18 ab	68.84±1.69 a	2.97±0.01 ab	22.6±0.35 a	114.9±2.37 a	13.17±0.17	10.47±0.25
T_9 : Pea	-	-	-	-	-	-	-	-
LSD (0.05)	4.18	5.99	6.37	0.23	2.02	17.89	1.49	1.55
Level of Significance	**	**	*	**	*	*	NS	NS

In Table 7, results showed that T_1 (Sugarcane only) gave highest number of germinations % (38.00%) and the remaining treatments where sugarcane was a component have had the statistically similar germination percentage. The highest tiller number also observed in T_1 (Sugarcane only) treatment (86.5×10^3 ha^{-1}) followed by T_8 treatment (81.5×10^3 ha^{-1}). The lowest tiller number was observed in T_2 (71.5×10^3 ha^{-1}). Chewable cane was found highest (69.33×10^3 ha^{-1}) in T_4 followed by T_8 (68.84×10^3 ha^{-1}), T_1 (67.17×10^3 ha^{-1}) and T_6 (66.33×10^3 ha^{-1}). The lowest millable cane was observed in T_2 (58.67×10^3 ha^{-1}). Cane height was found highest in T_6 (3.03 m) followed by T_8 (2.97 m) treatment. The lowest cane height was seen in T_2 (2.52 m) and T_1 (2.68 m) treatment. In terms of average number of internodes highest was found in T_8 (22.6) followed by T_1 (22.44), T_6 (22.06) and T_4 (21.46) and the lowest internode was found in T_2 (19.00). In terms of yield, the highest yield was found in T_8 (114.9 tha^{-1}) followed by T_4 (102.02 tha^{-1}), T_1 (99.48 tha^{-1}) and T_6 (98.08 tha^{-1}) and the lowest yield was found in T_2 (76.91 tha^{-1}). Average internode length and pol% cane had a non-significant statistical relationship was seen among the treatments.

Table 8. Yield, equivalent yield and economic advantage of intercropping systems

Treatment	Intercrop Yield (tha^{-1})	SEY (tha^{-1})	GMV (Lac Tk.)	MAI (Lac Tk.)
T_1	-	99.48±6.76 d	5.43 d	0 d
T_2	10.33±0.19 de	99.20±8.33 d	7.33 c	2.89 c
T_3	12.17±0.42 d	66.36±2.29 e	3.65 e	0 d
T_4	15.83±0.54 c	159.59±5.09 b	8.78 b	4.14 b
T_5	18.50±0.44 bc	67.27±1.60 e	3.70 e	0 d
T_6	20.17±0.42 b	134.75±2.81 c	7.41 c	2.64 c
T_7	36.17±1.42 a	65.76±2.58 e	3.61 e	0 d
T_8	6.67±0.25 f	187.63±2.90 a	10.30 a	5.21 a
T_9	8.00±0.17 ef	87.27±1.82 de	4.80 d	0 d
Significance Level	***	***	**	***
LSD (0.05)	3.32	23.18	6.07	0.97

In table 8 results showed that, the highest intercrop yield was observed in T_7 treatment (36.17 tha^{-1}) and the lowest intercrop yield was found in T_8 treatment (6.67 tha^{-1}). In case of Sugarcane Equivalent Yield (SEY) the highest SEY (187.63 tha^{-1}) was found in T_8 treatment. The lowest SEY of 65.76 tha^{-1} was observed in T_7 followed by T_3 (66.36 tha^{-1}) and T_5 (67.27 tha^{-1}) treatment. The highest GMV 10.32 lac Tk was found in T_8 treatment. The lowest GMV was observed in T_7 (3.61 lac Tk) followed by T_3 (3.65 lac Tk) and T_5 (3.70 lac Tk) treatment. Again, the highest MAI (5.21 lac Tk) was found also in T_8 treatment and the lowest MAI (0) was found in T_1, T_3, T_5, T_7 and T_9 treatment.

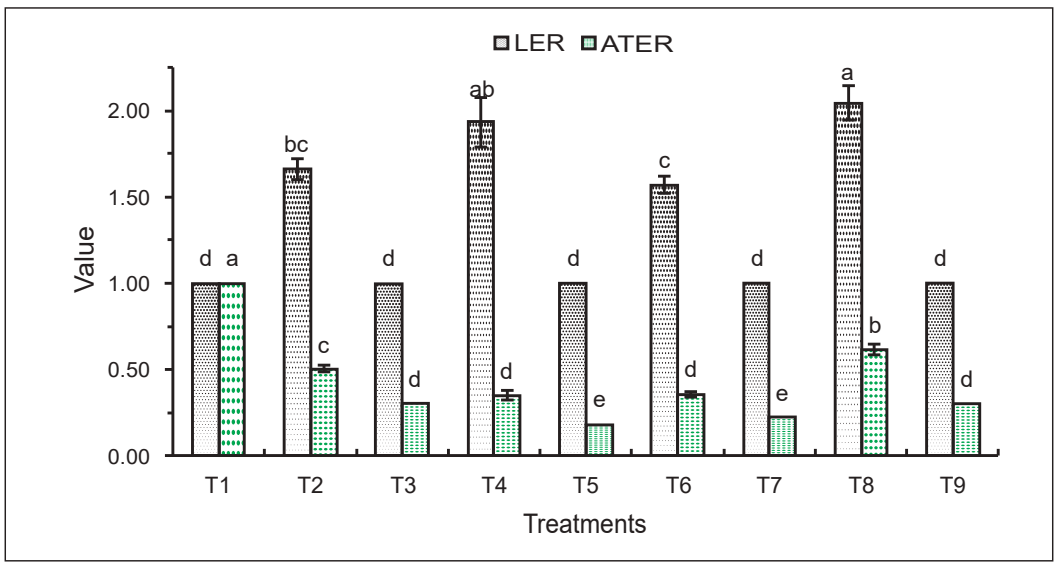


Figure 13. Effect of different Intercropping combination on LER and ATER

Figure 13 is showing Land Equivalent Ratio (LER) and Area Time Equivalent Ratio (ATER) value obtained from different treatments where the highest LER of 2.04 was found in T_8 followed by T_4 (1.93). The lowest LER of 1.00 was found in T_1, T_3, T_5, T_7 and T_9 treatments. The highest ATER of 1.00 was found in T_1 treatment and the lowest ATER of 0.18 was found in T_5 followed by T_7 (0.22) treatment.

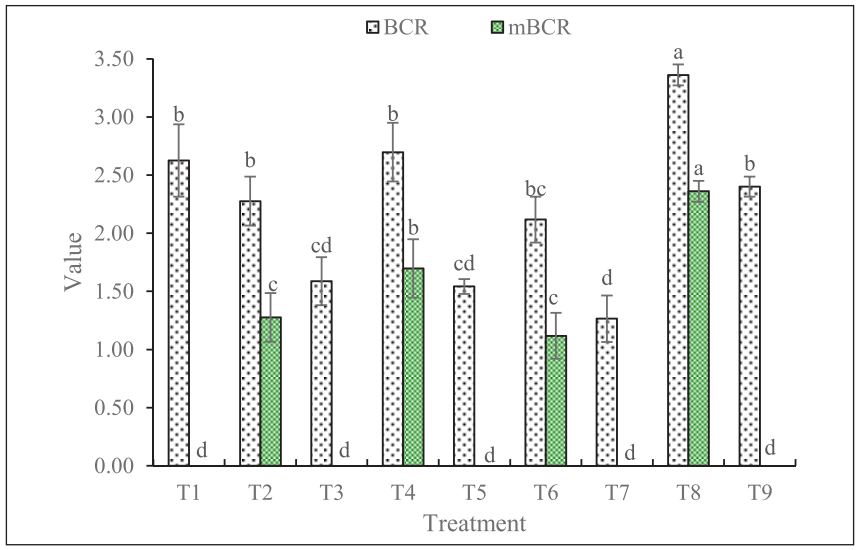


Figure 14. BCR and mBCR obtained from different treatments

Figure 14 is showing BCR and mBCR value obtained from different treatments where the highest BCR of 3.36 was found in T_8 and the lowest BCR of 1.26 was found in T_7 treatment. The highest mBCR of 2.36 was found in T_8 treatment and the lowest mBCR of 0 was found in all of the sole treatments.

CONCLUSIONS

Sole sugarcane (T_1) gave the highest germination (38.0%) and tiller number (86.5×10^3 ha^{-1}), but yield (99.5 tha^{-1}) and profitability were lower than intercropped systems. Sugarcane + Pea (T_8) was the most productive and profitable, with the highest cane yield (114.9 tha^{-1}), SEY (187.6 tha^{-1}), GMV (10.32 lakh Tk.), MAI (5.21 lakh Tk), LER (2.04), BCR (3.36) and BCR (2.36).

SOILS AND NUTRITION DIVISION

RESEARCH HIGHLIGHTS

- At Chapainawbgonj and Chuadanga site application of 125% Recommended dose of fertilizers perform better regarding tiller, millable cane and Brix (%) cane of sugarcane. Therefore, 125% of Recommended Dose of Fertilizers may be recommended for Chapainawbgonj (AEZ 26) and Chuadanga (AEZ 11) location for higher yield of sugarcane.
- At Thakurgaon and Ishwardi the interaction of spacing and doses of fertilizer application showed significant effect on growth and yield parameters of sugarcane. Highest yield of cane was recorded in interaction of 125 % of RFD with 80 cm spacing at both the location.
- At BSRI farm the highest yield (102.33 t ha^{-1}) of cane was recorded with RFD + Carew's organic fertilizer @ 4.0 tha^{-1} with a benefit cost ratio (3.4) and at Thakurgaon area T_2 (RFD + Carew's organic fertilizer @ 2.0 tha^{-1} shows cane yield (90.5 tha^{-1}) with a benefit cost ratio (3.83). Although, only Recommended Fertilizer Dose shows highest benefit cost ratio, the post-harvest nutrient status increased through Carew's organic fertilizer application. Therefore, Recommended Fertilizer Dose with 4 t ha^{-1} Carew's organic fertilizer for AEZ-11 and Recommended Fertilizer Dose with 2 t ha^{-1} Carew's organic fertilizer for AEZ-1 may be recommended for better yield and profit of sugarcane.
- At Ishwardi site (AEZ 11) better Germination 69.16%, highest tiller (104.33 x 10^3 ha^{-1}), Chewable cane (67.67 x 10^3 ha^{-1}), Yield (102.03 t ha^{-1}), Height (2.21m), Girth (2.9 cm) number of internodes/plant 21.38 obtained from treatment T_7 (N_{207} P_{200} K_{375} S_{90} Zn_9 Mg_5 B9 $Kgha^{-1}$) with 2.5 t/ha FYM. Therefore, these dose can be considered for recommendation of black ruby cultivation.
- At BSRI site application of VC @ 5 t/ha + IPNS based N_{80} P_{57} K_{68} S_8 Zn_3 and $B_{1.5}$ + Biofertilizer (PGPB) perform better regarding millable cane (119.0 x 10^3 ha^{-1}), cane yield (122.8 t ha^{-1}) and intercrop onion yield (8.1 t ha^{-1}). Therefore, IPNS based N_{80} P_{57} K_{68} S_8 Zn_3 and $B_{1.5}$ with VC @ 5 t/ha and Biofertilizer (PGPB) may be recommended for BSRI (AEZ 11) location for higher yield of sugarcane with intercrop onion.
- Highest cane yield (122.8 t ha^{-1}) obtained from T_3 (PM @ 5 t/ha + IPNS based N_{97} P_{52} K_{50} S_{12} Zn_3 and $B_{1.5}$ + Biofertilizer (PGPB), followed by T_4 (VC @ 5 t/ha + IPNS based N_{80} P_{57} K_{68} S_8 Zn_3 and $B_{1.5}$ + Biofertilizer (PGPB), T_6 (MOC @ 500 kg ha^{-1}+ IPNS based N_{161} P_{51} K_{84} S_{27} Zn_3 and $B_{1.5}$+ Biofertilizer (PGPB), T_2 (FYM @10 t/ha + IPNS based N_{68} P_{56} K_{52} $S_{13.5}$ Zn_3 and $B_{1.5}$ + Biofertilizer (PGPB), T_5 (GM @ 20 (DM) t ha^{-1}+ IPNS based N_{111} P_{50} K_{60} S_{21} Zn_3 and $B_{1.5}$+ Biofertilizer (PGPB) and highest onion yield (8.16 t ha^{-1}) were recorded from treatment T_2 followed by T_4, T_5, T_3, T_1. Considering both sugarcane and intercrop onion yield treatments T_3, T_4, T_2, T_5 can be suggested for higher yield and soil fertility status.
- At RSRS, Gazipur site application of FYM @10 t/ha + IPNS based N_{67} P_{36} K_{52} Mg_{10} $Zn_{1.5}$ and $B_{1.5}$+ Biofertilizer (PGPB) perform better regarding millable cane (77.7×103 ha^{-1}), cane yield (94.87 t ha^{-1}) and intercrop onion yield (7.7 t ha^{-1}). Therefore, FYM @10 t/ha + IPNS based N_{67} P_{36} K_{52} Mg_{10} $Zn_{1.5}$ and $B_{1.5}$ + Biofertilizer (PGPB) may be recommended for RSRS, Gazipur (AEZ 28) location for higher yield of sugarcane with intercrop onion.
- At BSRI site application of 2 t ha^{-1} manure with soil test basis (STB) @ N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) fertilizer perform better in case of sweet sorghum yield

- (40.5 tha^{-1}) and yield attributing characters: Germination (94.3%), girth (12.1mm), crushable stick (158.6 × 10^3 ha^{-1}). Therefore, 2 tha^{-1} manure with N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) fertilizer may be recommended for BSRI (AEZ 11) location for higher sweet sorghum yield.
- At Noakhali region (AEZ 18) application of 75% of N_{184} P_{60} K_{55} S_{15} $Zn_{2.5}$ and $B_{1.5}$ (STB) perform better regarding sugarcane yield. Therefore, 75% of N_{184} P_{60} K_{55} S_{15} $Zn_{2.5}$ and $B_{1.5}$ (STB) fertilizer may be recommended for Noakhali region (AEZ 18) location for higher sugarcane yield.
- At Ishwardi site (AEZ 11), the highest number of tiller (62. 5 x 10^3 ha^{-1}), yield of cane (59.5 t ha^{-1}) were obtained from clone I 182-18 in N stressed field condition. Therefore, clone I 182-18 may have potential nitrogen fixing bacteria and further study is needed for confirmation.
- At Ishwardi site (AEZ 11) application of *Bacillus pumilus* with 50% N of RFD produced highest tiller (124.1 × 10^3 ha^{-1}), on the other hand, combined application *Kocuria rosea* and *Bacillus pumilus* with 50% N of RFD offered highest number of millable cane (111.0 × 10^3 ha^{-1}). Therefore, application of *Kocuria rosea* and *Bacillus pumilus* bacterial strain or bio-fertilizer with 50% N of RFD may be recommended for cultivation of sugarcane in Ishwardi location (AEZ 11).

NUTRIENT REQUIREMENT FOR SUSTAINABLE SUGARCANE PRODUCTION UNDER DIFFERENT AEZs

The experiment was conducted during 2023-2024 cropping season at two locations viz., Shibganj, Chapinawabganj and Chuadanga. The experiment was comprised of nine treatments and laid out in randomized complete block design having unit plot size of 48 m^2 with three replications. The treatments were T_1- No fertilizer (control), T_2- RFD, T_3- 75% of RFD, T_4- 125% of RFD, T_5- 150% of RFD T_6- Soil Test Based Fertilizer Dose (STB), T_7-75% of STB, T_8-125% of STB and T_9-150% of STB. Urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate was used as sources of N, P, K, S and Zn, respectively. Full amount of triple super phosphate, gypsum, zinc sulphate, one third of urea and muriate of potash were applied in trenches and thoroughly mixed with soil by spade prior to sett plantation. The rest amount of urea and muriate of potash were applied in two equal splits; at tillering stage (120 DAP) and at grand growth phase (150 DAP). Two budded sugarcane setts were planted on February 2023 and it were harvested on February 2024. BSRI Akh 45 Sugarcane variety was used as test crop in the experiment. Necessary intercultural operations were done when required. Juice quality parameters like brix and pol purity per cent were also measured. The data were statistically analyzed by using the computer package Statistix 10 program for Windows Version. Analysis of variance and finally adjudged by least significant difference (LSD) test.

Shibganj, Chapinawabganj Site:

Results presented in Table 1 showed that number of tiller, millable cane, yield and Brix (%) of cane responded significantly due to different fertilizer management practices.

Table 1. Effect of nutrient management on growth and yield of sugarcane at Shibganj, Chapinawabganj

Treatment	Tiller ($\times 10^3$ ha^{-1})	Millable canes ($\times 10^3$ ha^{-1})	Yield (t ha^{-1})	Brix (%)
T_1 -Control	170.78 c	53.44 b	36.11 e	15.33 a
T_2- RFD	209.11 a	99.77 a	76.99 bc	14.72 bc
T_3- 75% of RFD	176.56 bc	90.88 a	57.22 d	14.05 d
T_4- 125% of RFD	208.33 ab	94.77 a	93.2 a	14.44 cd
T_5- 150% of RFD	214.78 a	101.33 a	78.33 bc	14.02 d
T_6- STB	211.11 a	92.11 a	92.55 a	14.41 cd
T_7-75% of STB	182.67 abc	91.66 a	68.51 cd	14.36 cd
T_8-125% of STB	212.56 a	103.55 a	94.66 a	15.02 ab
T_9-150% of STB	207.33 ab	97.89 a	85.05 ab	14.66 bc
LSD (0.05)	32.49	14.52	12.07	0.55

Table 2. Initial and post-harvest soil nutrient status at Shibganj, Chapinawabganj

Treatment	pH	OC%	N%	P (ppm)	K (meq%)	S (ppm)
Initial soil	7.51	0.95	0.09	20	0.21	20
Post harvest Soil						
T_1 -Control	7.45	0.90	0.07	16	0.19	18
T_2- RFD	7.48	0.95	0.08	17	0.20	19.5
T_3- 75% of RFD	7.40	0.94	0.09	16	0.19	19
T_4- 125% of RFD	7.45	0.94	0.09	17	0.20	20
T_5- 150% of RFD	7.50	0.95	0.10	18	0.21	20
T_6- STB	7.42	0.94	0.08	17	0.20	19.5
T_7-75% of STB	7.46	0.95	0.08	16	0.19	18.5
T_8-125% of STB	7.47	0.92	0.08	18	0.20	19.5
T_9-150% of STB	7.40	0.94	0.09	19	0.21	20

RFD- Recommended Fertilizer Dose, STB-Soil Test Basis

The highest number of tiller (214.78×10^3 ha^{-1}) observed in treatment T_5 which is statistically different from control plot and T_3. On the other hand, highest millable cane (103.55×10^3 ha^{-1}) found in T_8 which is statistically similar with others treatments except control. The highest yield 94.66 tha^{-1} observed in treatment T_8 which is statistically similar with T_4, T_6 followed by treatment T_9. Finally, the highest Brix 15.33% cane was obtained in control plot which was followed by treatment T_8 (15.02%).

Chuadanga Site

Yield and its components like number of tiller, millable cane stalk, yield of cane and Brix per cent of cane were shown in Table 3. Application of inorganic fertilizer showed significantly better response in terms of number of tiller, millable cane and yield of cane and Brix (%) of cane. Treatment T_5 (150% of RFD) produced the highest number of tiller (109.03 x 10^3 ha^{-1}) followed by treatments T_2, T_7, T_6, T_9 and T_8. The highest millable cane stalks (90.62 x 10^3 ha^{-1}) observed in T_4 (125% of RFD) followed by T_8, T_3, T_2, T_9, T_6 and T_5 On the other hand,

highest yield of cane (86.66 tha^{-1}) found in T_8 (125%of STB) which was statiatically similar with other treatments except T_1 and T_3. The highest Brix % cane was obtained in treatments T_5 (17.82%) which was followed by treatment T_4 (17.23%), T_3 & T_2 (17.22 %) and T_9 (17.13 %).

Table 3. Effect of nutrient management on growth and yield of sugarcane at Chuadanga

Treatment	Number of tiller ($\times 10^3$ ha^{-1})	Number of millable Canes ($\times 10^3$ ha^{-1})	Yield (t ha^{-1})	Brix (%)
T_1-Control	78.71 c	59.79 b	53.52 c	15.14 de
T_2- RFD	104.45 ab	83.75 ab	79.25 ab	17.22 b
T_3- 75% of RFD	93.27 bc	84.58 ab	71.63 bc	17.22 b
T_4- 125% of RFD	101.32 ab	90.62 a	85.19 a	17.23 b
T_5- 150% of RFD	109.03 a	81.04 ab	77.08 ab	17.82 a
T_6- STB	100.21 ab	82.08 ab	79.27 ab	15.37 d
T_7-75% of STB	98.61 ab	76.46 ab	75.48 ab	14.85 e
T_8-125% of STB	105.49 ab	86.11 a	86.66 a	16.08 c
T_9-150% of STB	99.79 ab	82.29 ab	81.53 ab	17.13 b
LSD (0.05)	15.43	15.77	11.6	0.5

Table 4. Initial and post harvest soil nutrient status at Chuadanga

Treatment	pH	OC%	N%	P (ppm)	K (meq %)	S (ppm)
Initial soil	7.73	0.93	0.10	17	0.2	23
Post harvest Soil						
T_1 -Control	7.65	0.85	0.08	14	0.18	19
T_2- RFD	7.7	0.87	0.085	16	0.19	20
T_3- 75% of RFD	7.6	0.86	0.08	15	0.18	19
T_4- 125% of RFD	7.65	0.90	0.085	16	0.19	21
T_5- 150% of RFD	7.7	0.88	0.09	16.5	0.20	21
T_6- STB	7.65	0.89	0.09	15.5	0.19	20
T_7-75% of STB	7.6	0.87	0.08	15	0.18	19
T_8-125% of STB	7.68	0.88	0.085	16	0.20	20
T_9-150% of STB	7.7	0.90	0.09	16.5	0.20	21

RFD- Recommended Fertilizer Dose, STB-Soil Test Basis

NUTRIENT MANAGEMENT OF SUGARCANE FOR DIFFERENT SPACING

The experiment was conducted during 2023-2024 cropping season at RSRS Thakurgaon farm (AEZ 1) and BSRI farm (AEZ 11). The experiment was laid out in Randomized Complete Block Design having two factors with three replications. Factor A: Spacing (S_1= 100cm ; S_2= 90cm; S_3= 80cm) Factor B: Fertilizer Dose (F_1= Recommended Fertilizer Dose (RFD) as per FRG'2018; F_2= 110% of RFD; F_3= 125% RFD). The experimental plot size was 6m × 8m. Sugarcane variety BSRI Akh 45 was used in the experiment as test crop. Urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate was used as sources of N, P, K, S and Zn, respectively.

Full amount of triple super phosphate, gypsum, zinc sulphate and one third of muriate of potash were applied in trenches and thoroughly mixed with soil by spade prior to settling plantation. One third amount of urea was applied after 25 days after plantation. Rest of urea and muriate of potash were applied in two equal splits; at tillering stage (120 DAP) and at grand growth phase (150 DAP). Necessary intercultural operations were done throughout the cropping season for proper growth and development of the crop. Collected data were compiled and tabulated in proper form and were subjected to statistical analysis by using the computer package Statistix 10 program for Windows Version. Computation was done by the use of Microsoft Excel 2003 program.

Ishwardi site

Results showed (Table 5) that the effect of spacing and fertilizer doses showed significant effect on number of tiller, millable cane and cane yield but, Brix% and pol% cane showed non significant by the fertilizer doses. In case of interaction of doses and spacing showed significant effect on all parameter. Interaction of S_3 (80cm) spacing with 125% RFD fertilizer doses recorded the highest number of tiller (141.25 x 10^3 ha^{-1}) which was identical with S_2F_3 and S_3F_2 combination. The highest number of millable cane (125.83 x 10^3 ha^{-1}) was recorded by the combination of S_2F_3 which was significant than other treatments combination. In case of yield, the highest result (99.41 tha^{-1}) was recorded from interaction of spacing and fertilizer dose S_3F_3.

Table 5. Influence of fertilizer and spacing on Growth, Yield and Quality of sugarcane at Ishwardi site

Spacing	Tiller ($\times10^3$ ha^{-1})	Millable canes ($\times10^3$ ha^{-1})	Yield (t ha^{-1})	Brix (%)	Pol % Cane
S_1	116.30 c	105.50 b	88.037 b	18 b	12.12 b
S_2	121.51 b	113.49 a	90.213 b	19.16 a	12.98 a
S_3	132.68 a	116.51 a	94.797 a	18.52 b	12.48 b
CV %	4.24	3.05	2.83	0.53	0.46
Fertilizer					
F_1	116.14 c	104.91 c	88.203 b	18.53	12.44
F_2	123.89 b	112.05 b	89.040 b	18.61	12.63
F_3	130.45 a	118.56 a	95.803 a	18.54	12.52
CV %	4.24	3.05	2.83	NS	NS
Dose× Split					
S_1 F_1	126.04 b	117.50 b	90.39 d	17.86 c	12 b
S_1 F_2	110.00 d	97.77 d	90.88 cd	18.1 bc	12.17 b
S_1 F_3	101.83 e	97.15 d	80.84 e	18.03 bc	12.17 b
S_2 F_1	124.17 b	108.47 c	81.39 e	18.93 ab	12.65 ab
S_2F_2	121.46 bc	110.17 c	95.34 abc	19.26 a	13.17 a
S_2F_3	136.60 a	119.79 b	92.89 bcd	19.3 a	13.14 a
S_3 F_1	114.72 cd	110.26 c	91.84 bcd	18.8 ab	12.65 ab
S_3F_2	135.39 a	119.58 b	96.16 ab	18.46 abc	12.54 ab
S_3F_3	141.25 a	125.83 a	99.41 a	18.3 bc	12.25 b
CV %	7.35	5.29	4.9	0.92	0.8

Table 6. Initial and post harvest soil nutrient status at Ishwardi site

Treatment	pH	OC %	N %	P (ppm)	K (meq %)	S (ppm)
Initial soil	7.63	0.71	0.08	18	0.13	21
Post harvest Soil						
$S_1 F_1$	7.53	0.70	0.07	16.75	0.12	20
$S_1 F_2$	7.56	0.76	0.072	17.25	0.12	19.8
$S_1 F_3$	7.56	0.78	0.073	17	0.12	20
$S_2 F_1$	7.55	0.70	0.070	16.5	0.11	19.5
S_2F_2	7.53	0.72	0.070	17	0.12	20
S_2F_3	7.56	0.74	0.072	17.5	0.12	20.5
$S_3 F_1$	7.54	0.71	0.070	17	0.12	20
S_3F_2	7.56	0.73	0.071	17.5	0.13	20.5
S_3F_3	7.57	0.76	0.072	17.5	0.12	19.5

Factor A: Spacing (S_1= 100cm; S_2= 90cm; S_3= 80cm)

Factor B: Fertilizer Dose (F_1= Recommended Fertilizer Dose (RFD) as per FRG'2018; F_2= 110% of RFD; F_3= 125% RFD).

Thakurgaon site

All the parameter showed significant effect by spacing and fertilizer doses (Table 7) except Brix%. Interaction effect of doses and spacing also showed significant effect on all parameter except Brix%. The highest number of tiller (146.8 x 10^3 ha^{-1}) recorded in S_3F_3 combination, the highest data on millable cane (124.16 x 10^3 ha^{-1}) by S_3F_3 which wae statiatically significant 74.16 x 10^3 ha^{-1} and 74.16 x 10^3 ha^{-1}) showed best performance than other treatments combination. On the other hand, S_3F_2 except S_1F_3. In case of cane yield the highest yield (99.36 tha^{-1}) was observed where we used fertilizer @ 125% RFD with 80cm spacing followed by S_1F_2 combination but, significant with other treatment combinations.

Table 7. Influence of fertilizer and spacing on Growth, Yield and Quality of sugarcane at Thakurgaon site

Spacing	Tiller ($\times 10^3$ ha^{-1})	Millable canes ($\times 10^3$ ha^{-1})	Yield (t ha^{-1})	Brix (%)
S_1	122.31 b	110.36 ab	87.017 a	19.69
S_2	120.84 b	108.87 b	81.407 b	19.39
S_3	130.25 a	113.67 a	89.703 a	19.71
LSD (0.05)	3.85	4.1	3.85	NS
Fertilier Dose				
F_1	115.92 c	103.12 c	77.863 b	19.44
F_2	123.60 b	109.69 b	90.010 a	19.73
F_3	133.88 a	120.09 a	90.253 a	19.62
LSD (0.05)	3.85	4.1	3.85	NS
Dose x spacing				
S_1 F_1	117.78 cd	104.51 de	81.63 de	19.47
S_1 F_2	121.36 bc	106.93 cde	93.40 ab	19.91
S_1 F_3	127.78 b	119.65 ab	86.02 cd	19.71
S_2 F_1	112.63 d	101.33 e	72.91 f	19.24
S_2F_2	122.85 bc	108.81 cd	85.93 cd	19.7
S_2F_3	127.05 b	116.47 b	85.38 cde	19.23
S_3 F_1	117.36 cd	103.52 de	79.05 ef	19.62
S_3F_2	126.60 b	113.33 bc	90.70 bc	19.58
S_3F_3	146.80 a	124.16 a	99.36 a	19.94
LSD (0.05)	6.67	3.38	3.17	NS

Table 8. Initial and post harvest soil nutrient status at Thakurgaon site

Treatment	pH	OC%	N%	P (ppm)	K (meq%)	S (ppm)
Initial soil	5.5	0.85	0.10	25	0.14	26
Post harvest Soil						
S_1 F_1	5.45	0.80	0.08	23	0.12	22
S_1 F_2	5.4	0.83	0.08	24	0.13	24
S_1 F_3	5.35	0.83	0.09	23.5	0.13	23
S_2 F_1	5.40	0.81	0.08	22	0.12	23
S_2F_2	5.35	0.82	0.09	22.5	0.13	23.5
S_2F_3	5.45	0.81	0.08	23	0.14	24.5
S_3 F_1	5.4	0.8	0.08	23	0.11	24
S_3F_2	5.45	0.84	0.08	23.5	0.12	24.5
S_3F_3	5.45	0.83	0.075	23	0.13	24

Factor A: Spacing (S_1= 100cm ; S_2= 90cm; S_3= 80cm)

Factor B: Fertilizer Dose (F_1= Recommended Fertilizer Dose (RFD) as per FRG'2018; F_2= 110% of RFD; F_3= 125% RFD).

From the above results (Table 8) it may be concluded that at Thakurgoan interaction of spacing and doses of fertilizer application showed significant effect on growth and yield parameters of sugarcane cane. Whearas, non significant on Brix%.

Highest yield of cane was recorded in 125% of RFD with 80 cm spacing which was identical with S_1F_2.

DETERMINATION OF CAREW'S ORGANIC FERTILIZER REQUIREMENT FOR SUGARCANE CULTIVATION

The experiment was conducted at BSRI Farm, Ishwardi and RSRS Farm, Thakurgoan and in 2023-2024 cropping season and was laid out in a RCB design with three replications having seven treatments. The treatments of the experiment comprised of T_1 - RFD as per FRG'2018; T_2 - RFD + Carew's organic fertilizer @ 2.0 tha^{-1}; T_3 - RFD + Carew's organic fertilizer @ 4.0 tha^{-1}; T_4 - RFD + Carew's organic fertilizer @ 6.0 tha^{-1}; T_5 - 75% RFD + Carew's organic fertilizer @ 2.0 tha^{-1}; T_6 - 75% RFD + Carew's organic fertilizer @ 4.0 tha^{-1} and T_7 - 75% RFD + Carew's organic fertilizer @ 6.0 tha^{-1}. The experimental plot size was 5m x 6m BSRI Akh 46 was used as test crop. Necessary intercultural operations were done throughout the cropping season for proper growth and development of the crop. Collected data were compiled and tabulated in proper form and were subjected to statistical analysis by using the computer package Statistix 10 program for Windows Version. Computation was done by the use of Microsoft Excel 2003 program.

BSRI Farm, Ishwardi site:

Results presented in Table 9 revealed that the growth parameters, tiller, millable cane and yield of cane responded significantly due to different treatment. On the other hand, brix (%) and Pol % Cane showed non-significant result. The highest number of tiller (120.13 × 10^3 ha^{-1}) and millable cane (105.35 × 10^3 ha^{-1}) were recorded in treatment T_4 (RFD + Carew's organic fertilizer @ 6.0 tha^{-1}) which was statistically identical with rest of the treatment except T_5. The highest yield of cane (102.33 tha^{-1}) was recorded in treatment T_3 (RFD + Carew's organic fertilizer @ 4.0 tha^{-1}) which was statistically identical with T_4 treatment. The benefit cost ratio (2.78) of T_4 is lower than T_3 (BCR 3.4).

Table 9. Growth, yield and quality of cane as influenced by Carew's organic fertilizer at BSRI Farm, Ishwardi

Treatment	Tiller ($\times 10^3$ ha^{-1})	Millable Cane ($\times 10^3$ ha^{-1})	Yield (t ha^{-1})	Brix (%) (November)	Pol % Cane	Benefit cost ratio (BCR)
T_1	108.35 ab	96.24 ab	90.72 b	15.9	10.3	4.85
T_2	116.80 ab	102.80 a	93.62 b	17.23	11.5	3.84
T_3	117.13 ab	104.35 a	102.31 a	17.23	11.5	3.40
T_4	120.13 a	105.35 a	99.47 a	15.76	10.36	2.78
T_5	102.46 b	89.02 b	80.49 c	15.43	9.86	3.42
T_6	114.13 ab	101.35 ab	92.24 b	16.06	10.45	3.16
T_7	114.57 ab	102.57 a	94.36 b	17.83	11.95	2.71
LSD (0.05)	15.62	12.50	6.05	NS	NS	

Table 10. Initial and post harvest soil nutrient status at BSRI Farm, Ishwardi

Treatment	pH	OC%	N%	P (ppm)	K (meq%)	S (ppm)
Initial soil	7.7	0.62	0.10	16	0.12	17
Post harvest Soil						
T_1	7.6	0.58	0.08	14	0.12	15
T_2	7.45	0.60	0.07	15	0.13	16
T_3	7.5	0.63	0.08	17	0.13	18
T_4	7.5	0.65	0.09	16	0.14	17
T_5	7.55	0.60	0.08	15	0.13	16
T_6	7.5	0.62	0.09	16	0.14	17
T_7	7.45	0.63	0.10	17	0.13	18

T_1 - RFD as per FRG'2018; T_2 - RFD + Carew's organic fertilizer @ 2.0 tha^{-1}; T_3 - RFD + Carew's organic fertilizer @ 4.0 tha^{-1}; T_4 - RFD + Carew's organic fertilizer @ 6.0 tha^{-1}; T_5 - 75% RFD + Carew's organic fertilizer @ 2.0 tha^{-1}; T_6 - 75% RFD + Carew's organic fertilizer @ 4.0 tha^{-1} and T_7 - 75% RFD + Carew's organic fertilizer @ 6.0 tha^{-1}.

Thakurgaon site:

Results presented in Table 11. revealed that all the growth parameters and yield of cane responded significantly due to different treatment combinations. The highest number of tiller (120.33 × 10^3 ha^{-1}) was obtained in T_4 (RFD + Carew's organic fertilizer @ 6.0 tha^{-1}) treatment which was statistically identical with rest of the treatment and the highest number of millable cane (101.0 × 10^3 ha^{-1}) was also recorded by the treatment T_4 (RFD + Carew's organic fertilizer @ 6.0 tha^{-1}) which were statistically similar except T_5 treatment. The highest yield of cane (94.97 t ha^{-1}) was recorded in treatment T_4 (RFD + Carew's organic fertilizer @ 6.0 tha^{-1}) which was followed by other treatments except T_1 and T_5 treatments. In case of brix (%) there was no significant effect of fertilizer application.

Table 11. Growth, yield and quality of cane as influenced by Carew's organic fertilizer at Thakurgaon

Treatment	Tiller (×10^3 ha^{-1})	Millable Cane (×10^3 ha^{-1})	Yield (t ha^{-1})	Brix (%) (January)	Benefit cost ratio (BCR)
T_1	106.33 ab	90.33 ab	77.23 b	20.0	4.29
T_2	115.67 a	98.67 a	90.50 ab	20.0	3.83
T_3	116.67 a	100.00 a	94.27 a	19.7	3.21
T_4	120.33 a	101.00 a	94.97 a	19.6	2.71
T_5	100.00 b	83.33 b	71.53 c	19.5	3.11
T_6	113.33 ab	98.67 a	88.80 ab	19.5	3.10
T_7	114.67 ab	97.67 a	90.13 ab	19.5	2.63
LSD (0.05)	15.23	11.67	5.66	NS	

Table 12. Initial and post harvest soil nutrient status at Thakurgaon

Treatment	pH	OC%	N%	P (ppm)	K (meq%)	S (ppm)
Initial soil	4.95	0.85	0.12	25	0.14	0.30
Post harvest Soil						
T_1	4.9	0.82	0.10	23	0.12	0.26
T_2	5.1	0.86	0.11	24	0.14	0.28
T_3	5.25	0.88	0.12	23	0.13	0.28
T_4	5.2	0.86	0.11	22	0.15	0.30
T_5	5.05	0.85	0.10	25	0.14	0.25
T_6	5.15	0.86	0.11	23	0.13	0.27
T_7	5.1	0.85	0.12	24	0.14	0.29

Treatments:

T_1 - RFD as per FRG'2018; T_2 - RFD + Carew's organic fertilizer @ 2.0 tha^{-1}; T_3 - RFD + Carew's organic fertilizer @ 4.0 tha^{-1}; T_4 - RFD + Carew's organic fertilizer @ 6.0 tha^{-1}; T_5 – 75% RFD + Carew's organic fertilizer @ 2.0 tha^{-1}; T_6 - 75% RFD + Carew' fertilizer @ 4.0 tha^{-1} and T_7 - 75% RFD + Carew's organic fertilizer @ 6.0 tha^{-1}

From the above results it may be concluded that at both the location most of the growth parameters and yield of cane responded significantly due to different treatment combinations. At BSRI farm the highest yield (102.33 t ha^{-1}) of cane was recorded with RFD + Carew's organic fertilizer @ 4.0 tha^{-1} with a benefit cost ratio (3.4) and at Thakurgaon area T_2 (RFD + Carew's organic fertilizer @ 2.0 tha^{-1} shows cane yield (90.5 t ha^{-1}) with a benefit cost ratio (3.83). Although, only Recommended Fertilizer Dose shows highest benefit cost ratio but, the post-harvest nutrient status increased through Carew's organic fertilizer application. Therefore, Recommended Fertilizer Dose with 4 t ha^{-1} Carew's organic fertilizer for AEZ-11 and Recommended Fertilizer Dose with 2 t ha^{-1} Carew's organic fertilizer for AEZ-1 may be recommended for better yield of sugarcane and maintain soil health.

EFFECT OF FERTILIZER MANAGEMENT ON GROWTH, YIELD AND QUALITY OF CHEWING CANE BLACK RUBY

The experiment was conducted during 2023-2024 cropping season at Block A_4, BSRI farm Ishwardi-6620, Pabna. The experiments were laid out in a Randomized Complete Block Design having seven treatments with three replications. The plot size was 6m×8m. Two eye budded setts were planted in 18 December 2023 and each 8-meter line had 40 two eye budded setts. The treatment of the experiment comprised of T_1 = Control, T_2 = RFD (N_{180} P_{60} K_{90} S_{30} Zn_4 $B_{1.5}$ Kg ha^{-1}), T_3 = RFD + 5 tha^{-1} FYM, T_4 = 125% RFD (N_{225} P_{75} K_{112} S_{38} Zn_5 $B_{1.8}$ $Kgha^{-1}$) + 5 tha^{-1} FYM, T_5 = 150% RFD (N_{270} P_{90} K_{135} S_{45} Zn_6 $B_{2.25}$ Kg ha^{-1}) + 5 tha^{-1} FYM, T_6 =175% RFD (N_{315} P_{105} K157 S_{53} Zn_7 B_3 $Kgha^{-1}$) + 5 tha^{-1} FYM, T_7 = (N_{207} P_{200} K_{375} S_{90} Zn_9 Mg_5 B_9 $Kgha^{-1}$) + 2.5 tha^{-1} FYM. Urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate was used as sources of N, P, K, S and Zn, respectively. Full amount of triple super phosphate, gypsum, zinc sulphate, one third of urea and muriate of potash were applied in trenches and thoroughly mixed with soil by spade prior to sett plantation. The rest amount of urea and muriate of potash were applied in two equal splits; at tillering stage (120 DAP) and at grand growth phase (150 DAP). Boric acid was used as basal dose and spray at grand growth phase to supply micronutrient boron that prevent cracking of stem. Necessary

intercultural operation such as weeding, mulching, earthing up, tying, detrashing were done in time. The data were statistically analyzed by using the computer package Statistix 10 program for Windows Version. Analysis of variance and finally adjudged by least significant difference (LSD) test. All the parameters of cane responded significantly with control plots where fertilizer was not applied. Results showed that, highest Germination 69.16%, tiller (104.33 x 10^3 ha^{-1}), Chewable cane (67.67 x 10^3 ha^{-1}), Yield (102.03 t ha^{-1}), Height (2.21m), Grith (2.9cm), number of internode/plant 21.38 data were recorded from treatment T_7 (N_{207} P_{200} K_{375} S_{90} Zn_9 Mg_5 B_9 $Kgha^{-1}$ + 2.5 tha^{-1} FYM.

Table 13. Effect of fertilizer management on growth yield and quality of chewing cane black ruby

Treatment	Germination (%)	Tiller 150 DAP ($\times 10^3$ ha^{-1})	Chewable Cane ($\times 10^3$ ha^{-1})	Yield (t ha^{-1})	Height (m)	Girth (cm)	No. of internode /plant	Pol % Cane
T_1- Control (No Fertilizer)	63.67 b	92.17 b	39.83 c	50.65 e	1.48d	2.5d	15.93d	11.77a
T_2-100% RFD	66.33 ab	103.5 a	51.50 b	72.51 d	1.65c	2.6cd	17.6cd	11.46a
T_3- RFD + 5tha^{-1} FYM	64.16 b	103.33 a	55.50 b	74.89 d	1.70c	2.7bc	19.26abc	9.79b
T_4-125% RFD +5tha^{-1}FYM	67 ab	102.83 a	56.33 b	83.47 c	1.75bc	2.7abc	19.93ab	10.81ab
T_5- 150% RFD + 5 tha^{-1} FYM	66.83 ab	102.33 a	56.00 b	85.17 c	1.87b	2.8ab	20.4a	10.98ab
T_6- 175% RFD + 5 tha^{-1} FYM	64.5 b	102.17 a	59.50 ab	92.25b	2.06a	2.8ab	18.06bcd	10.91ab
T_7- $N_{207}P_{200}K_{375}S_{90}Zn_9Mg_5B_9$ + 2.5 tha^{-1} FYM	69.16 a	104.33 a	67.67 a	102.03a	2.21a	2.9a	21.38a	10.96ab
LSD (0.05)	4.45	3.29	9.21	5.6	0.15	0.18	2.15	1.24

T_1 = Control, T_2 = RFD (N_{180} P_{60} K_{90} S_{30} Zn_4 $B_{1.5}$ $Kgha^{-1}$), T_3 = RFD + 5 tha^{-1} FYM, T_4 = 125% RFD (N_{225} P_{75} K_{112} S_{38} Zn_5 $B_{1.8}$ $Kgha^{-1}$) + 5 tha^{-1} FYM, T_5 = 150% RFD (N_{270} P_{90} K_{135} S_{45} Zn_6 $B_{2.25}$ $Kgha^{-1}$) + 5 tha^{-1} FYM, T_6 =175% RFD (N_{315} P_{105} K_{157} S_{53} Zn_7 B_3 $Kgha^{-1}$) + 5 tha^{-1} FYM, T_7 = (N_{207} P_{200} K_{375} S_{90} Zn_9 Mg_5 B_9 $Kgha^{-1}$) + 2.5 tha^{-1} FYM.

FYM- Farm Yard Manure, RFD-Recommended Fertilizer Dose as per fertilizer recommendation guide 2018.

Table 14. Initial and post harvest soil nutrient status at BSRI

Treatment	pH	OC%	N%	P (ppm)	K (meq%)	S (ppm)
Initial soil	7.61	0.51	0.08	14	0.13	25
Post harvest Soil						
T_1	7.56	0.48	.060	12.0	0.11	20
T_2	7.60	0.50	.065	13.0	0.11	21
T_3	7.50	0.52	.070	13.0	0.12	21.5
T_4	7.55	0.51	.065	13.5	0.12	22
T_5	7.60	0.53	0.070	14	0.13	23
T_6	7.60	0.55	.075	14.5	0.13	23.5
T_7	7.56	0.50	.065	13	0.12	22

Result shows that the fertilizer dose affect the growth, yield and quality parameters significantly. The higher dose of fertilizer shows better germination, higher tiller, chewable cane, yield, longer cane with abundant internodes. So, treatment T_7

(N_{207} P_{200} K_{375} S_{90} Zn_9 Mg_5 B_9 Kgha^{-1}) with 2.5 tha^{-1} FYM may be recommended as it provides better Germination 69.16%, highest tiller (104.33 x 10^3 ha^{-1}), Chewable cane (67.67 x 10^3 ha^{-1}), Yield (102.03 t ha^{-1}), Height (2.21m), Grith (2.9cm) and number of internodes/plant 21.38.

IPNS BASED NUTRIENT MANAGEMENT FOR CULTIVATION OF SUGARCANE WITH INTERCROPS

The experiment was conducted during 2023-2024 cropping season in two locations viz. BSRI farm (AEZ 11), Ishwardi, Pabna and RSRS, Gazipur (AEZ-28). The experiment was laid out in a Randomized Complete Block Design having six treatments with three replications. The treatments of the experiment for BSRI farm (AEZ 11) comprised of T_1 (N_{180} P_{60} K_{90} S_{30} Zn_4 and $B_{1.5}$ as per FRG'18), T_2 (FYM @10 t/ha + IPNS based N_{68} P_{56} K_{52} $S_{13.5}$ Zn_3 and $B_{1.5}$ + Biofertilizer (PGPB), T_3 (PM @ 5 t/ha + IPNS based N_{97} P_{52} K_{50} S_{12} Zn_3 and $B_{1.5}$ + Biofertilizer (PGPB), T_4 (VC @ 5 t/ha + IPNS based N_{80} P_{57} K_{68} S_8 Zn_3 and B1.5 + Biofertilizer (PGPB), T_5 (GM @ 20 (DM) t ha^{-1} + IPNS based N_{111} P_{50} K_{60} S_{21} Zn_3 and $B_{1.5}$ + Biofertilizer (PGPB)) and T_6 (MOC @ 500 kg ha^{-1} + IPNS based N_{161} P_{51} K_{84} S_{27} Zn_3 and $B_{1.5}$ + Biofertilizer (PGPB). The treatments of the experiment for RSRS, Gazipur (AEZ-28) comprised of T_1 (N_{180} P_{40} K_{90} S_{15} Mg_{10} Zn_4 and $B_{1.5}$ as per FRG'18), T_2 (FYM @10 t/ha + IPNS based N_{67} P_{36} K_{52} Mg_{10} $Zn_{1.5}$ and $B_{1.5}$ + Biofertilizer (PGPB), T_3 (PM @ 5 t/ha + IPNS based N_{97} P_{32} K_{50} Mg_{10} Zn_2 and $B_{1.5}$ + Biofertilizer (PGPB), T_4 (VC @ 5 t/ha + IPNS based N_{80} P_{37} K_{68} Mg_{10} $Zn_{2.5}$ and $B_{1.5}$ + Biofertilizer (PGPB), T_5 (GM @ 20 (DM) t ha^{-1} + IPNS based N_{111} P_{30} K_{60} S_6 Mg_{10} $Zn_{2.5}$ and $B_{1.5}$ + Biofertilizer (PGPB) and T_6 (MOC @ 500 kg ha^{-1} + IPNS based N_{161} P_{31} K_{84} S_{12} Mg_{10} $Zn_{2.5}$ and $B_{1.5}$ + Biofertilizer (PGPB). At BSRI site all the growth parameters and yield of cane (BSRI Akh 41) and yield of intercrop onion responded significantly with different fertilizer treatments but number of tillers and Pol (%) did not respond significantly. Highest cane yield (122.8 t ha^{-1}) obtained from T_3, followed by T_4, T_6, T_2, T_5 and highest onion yield (8.16 t ha^{-1}) were recorded from treatment T_2 followed by T_4, T_5, T_3, T_1. Considering both sugarcane and intercrop onion yield treatments T_3, T_4, T_2, T_5 can be suggested for higher yield and soil fertility status.

Table 15. Effect of IPNS based nutrient management on sugarcane and intercrops at BSRI

Treatment	Tiller (×10^3 ha^{-1})	Millable cane (×10^3 ha^{-1})	Cane Yield (t ha^{-1})	Onion Yield (t ha^{-1})	Pol (%)
T_1- RFD	135.50	116.67 b	119.0 b	6.94 ab	10.1
T_2- FYM @10 t/ha + IPNS based NPKS & Zn B+ BF	138.33	118.33 ab	120.83 ab	8.16 a	10.0
T_3- PM@5 t/ha + IPNS based NPKS & Zn B+ BF	137.83	120.5 a	122.8 a	7.56 a	10.8
T_4- VC @5 t/ha + IPNS based NPKS and Zn B+ BF	137.33	118.8 ab	121.5 ab	7.91 a	10.1
T_5- GM @20 (DM) t ha^{-1}+ IPNS based NPKS & Zn B+ BF	138.00	118.0 ab	120.5 ab	7.85 a	10.2
T_6- MOC @500 kg ha^{-1}+ IPNS based NPKS & Zn B+ BF	137.83	119.0 ab	121.5 ab	5.95 b	9.7
LSD (0.05)	NS	2.66	3.19	1.58	NS

Table 16. Initial and post-harvest soil nutrient status at BSRI

Treatment	pH	OC%	N%	P (ppm)	K (meq%)	S (ppm)
Initial soil	7.92	0.51	0.10	18.0	0.13	22.0
Post-harvest Soil						
T_1	7.50	0.48	0.06	13.5	0.13	21.0
T_2	7.54	0.84	0.08	15.0	0.14	19.5
T_3	7.52	0.82	0.09	17.5	0.14	20.5
T_4	7.54	0.81	0.08	15.0	0.14	20.0
T_5	7.54	0.70	0.07	17.0	0.14	21.0
T_6	7.55	0.74	0.07	17.5	0.14	20.0

RFD- Recommended Fertilizer Dose, FYM-Farm Yard Manure, IPNS-Integrated Plant Nutrition System, VC- Vermicompost, MOC-Mustard Oil Cake, BF- Biofertilizer, PGPB -Plant growth promoting bacteria At Gazipur site (Table 17) all the growth parameters including yield of cane and onion responded significantly with different fertilizer treatments except tiller. The highest millable cane (77.7×10^3 ha^{-1}), cane yield (94.87 t ha^{-1}) and onion yield (7.7 t ha^{-1}) were recorded from treatment T_2 (FYM @10 t/ha + IPNS based N_{67} P_{36} K_{52} Mg_{10} $Zn_{1.5}$ and B1.5+ BF).

Table 17. Effect of fertilizer management on Sugarcane at RSRS, Gazipur

Treatment	Tiller ($\times10^3$ ha^{-1})	Millable cane ($\times10^3$ ha^{-1})	Yield (t ha^{-1})	Onion Yield (t ha^{-1})	Brix (%)
T_1- RFD	75.353	54.4 b	78.2 b	5.5 de	18 a
T_2- FYM @10 t/ha + IPNS based NPKS &Zn B+ BF	90.713	77.7 a	94.87 a	7.7 a	17.8 a
T_3- PM@5 t/ha + IPNS based NPKS & Zn B+ BF	73.57	52.8 b	73.1 b	6.0 cd	17.4 ab
T_4- VC @5 t/ha + IPNS based NPKS and Zn B+ BF	74.640	52.1 b	73.4 b	6.6 bc	17.1 ab
T_5- GM @20 (DM) t ha^{-1}+ IPNS based NPKS & Zn B+ BF	75.473	55.5 b	74.6 b	7.0 b	16.7 ab
T_6- MOC @500 kg ha^{-1}+ IPNS based NPKS & Zn B+ BF	71.427	55.9 b	75.9 b	5.1 e	15.9 b
LSD (0.05)	NS	19.15	11.16	0.70	1.88

RFD- RFD- Recommended Fertilizer Dose, FYM-Farm Yard Manure, IPNS-Integrated Plant Nutrition System, VC- Vermicompost, MOC-Mustard Oil Cake, BF- Biofertilizer, PGPB -Plant growth promoting bacteria.

Table 18. Initial and post-harvest soil nutrient status RSRS, Gazipur

Treatment	pH	OC%	N%	P (ppm)	K (meq%)	S (ppm)
Initial soil	6.50	0.98	0.08	15.0	0.14	24.0
Post-harvest Soil						
T_1	6.45	0.90	0.07	14.0	0.13	22.0
T_2	6.55	0.95	0.08	14.5	0.15	23.0
T_3	6.60	0.98	0.09	14.0	0.15	22.5
T_4	6.65	0.97	0.09	13.5	0.14	22.0
T_5	6.58	0.95	0.08	14.5	0.15	23.0
T_6	6.60	0.96	0.09	14.5	0.14	22.5

EFFECT OF FERTILIZER MANAGEMENT ON SWEET SORGHUM YIELD AND QUALITY

The experiment was conducted during 2023-2024 cropping season at BSRI farm (AEZ 11), Ishwardi, Pabna. The experiment was laid out in a Randomized Complete Block Design having seven treatments with three replications. The treatments of the experiment comprised of T_1 (Native soil fertility), T_2 (N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) + 2 t ha^{-1} manure), T_3 (N_{60} P_{30} K_{60} S_{10} and Zn_1 + 2 t ha^{-1} manure), T_4 (N_{90} P_{45} K_{90} S_{15} and Zn_1 + 2 t ha^{-1} manure), T_5 (N_{120} P_{60} K_{120} S_{20} and Zn_1 + 2 t ha^{-1} manure), T_6 (75% of N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) + 2 t ha^{-1} manure), T_7 (125% of N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) + 2 t ha^{-1} manure). Germination (%), height (m), girth (mm), crushable stick(10^3/ha), yield (t/ha^{-1}) and Brix (%) of sweet sorghum juice responded significantly with different fertilizer treatments. Results revealed that the highest Germination (94.3%), girth (12.1mm), crushable stick (158.6 $\times 10^3$/ha), yield (40.5 t/ha^{-1}) was obtained in treatment T_2 where N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) + 2 t ha^{-1} manure was applied. On the other hand, lowest Germination (91.1%), height (1.94m), girth (9.9mm), crushable stick (152.3 $\times 10^3$/ha), yield (26.2 t/ha^{-1}) observed in treatment T_1 where fertilizer and manure were not applied.

Table 19. Effect of fertilizer management on sweet sorghum at BSRI

Treatment	Germination (%)	Height (m)	Girth (mm)	Crushable stick (10^3/ha)	Yield (t ha^{-1})	Brix (%) of juice	Brix (%) of syrup
T_1	91.1 b	1.94 d	9.9 c	152.3 b	26.2 c	10.8 ab	71.1
T_2	94.3 a	2.49 ab	12.1 a	158.6 a	40.5 a	10.1 b	70.6
T_3	91.1 b	2.05 cd	10.4 bc	152.3 b	30.8 bc	10.8 ab	67.6
T_4	93.8 ab	2.24 bc	11.0 bc	157.6 ab	28.0 bc	12.9 a	69.3
T_5	92.3 ab	2.65 a	11.1 ab	154.6 ab	39.0 a	10.8 ab	71.5
T_6	91.5 ab	2.12 cd	10.5 bc	153.0 ab	32.3 b	11.1 ab	73
T_7	91.5 ab	2.47 ab	11.4 ab	153 ab	40.0 a	11.3 ab	68
LSD (0.05)	3.08	0.25	1.09	6.17	4.8	2.17	NS

T_1 -Native soil fertility, T_2 - N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) + 2 t ha^{-1} manure, T_3- N_{60} P_{30} K_{60} S_{10} and Zn_1 + 2 t ha^{-1} manure, T_4 -N_{90} P_{45} K_{90} S_{15} and Zn_1 + 2 t ha^{-1} manure, T_5- N_{120} P_{60} K_{120} S_{20} and Zn_1 + 2 t ha^{-1} manure, T_6- (75% of N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) + 2 t ha^{-1} manure, T_7- 125% of N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) + 2 t ha^{-1} manure.

From the above discussion it maybe concluded that T_2 (N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) + 2 t ha^{-1} manure shows better performance in case yield (40.5 t/ha^{-1}) and yield attributing characters: Germination (94.3%), girth (12.1mm), crushable stick (158.6 × 10^3/ha). Therefore, application of N_{111} P_{12} K_{19} S_5 Zn_2 and B_1 (STB) with 2 t ha^{-1} manure is recommended for sweet sorghum cultivation.

YIELD MAXIMIZATION OF SUGARCANE BY INTEGRATED NUTRIENT MANAGEMENT PRACTICES IN NOAKHALI REGION (AEZ 18)

The experiment was conducted during 2023-2024 cropping season at Subarnachar, Noakhali. The experiment was comprised of six treatments and laid out in randomized complete block design having unit plot size of 48 m^2 with three replications. The treatments were T_1- No fertilizer (control), T_2- N_{184} P_{60} K_{55} S_{15} $Zn_{2.5}$ and $B_{1.5}$ Soil Test Basis (STB), T_3- 75% of T_2, T_4- T_3 + Cowdung @ 10t/ha, T_5- T_3 + Poultry manure @ 5 t/ha, T_6- T_3 + Mustard Oil Cake @ 500Kg/ha. Urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate was used as sources of N, P, K, S and Zn, respectively. Full amount of triple super phosphate, gypsum, zinc sulphate, one third of urea and muriate of potash were applied in trenches and thoroughly mixed with soil by spade prior to sett plantation. The rest amount of urea and muriate of potash were applied in two equal splits; at tillering stage (120 DAP) and at grand growth phase (150 DAP). Two eyed budded sugarcane setts were planted. BSRI Akh 46 Sugarcane variety was used as test crop in the experiment. Necessary intercultural operations were done when required. Juice quality parameters like brix % also measured. The data were statistically analyzed by using the computer package Statistix 10 program for Windows Version. Analysis of variance and finally adjudged by least significant difference (LSD) test.

All the parameters cane responded significantly with dfferent fertilizer treatmeants. Results showed that, highest Germination 68.8%, tiller (101.4 x 10^3 ha^{-1}), millable cane (83. 2x 10^3 ha^{-1}) recorded from T_2- N_{184} P_{60} K_{55} S_{15} $Zn_{2.5}$ and $B_{1.5}$ (STV) but highest Yield (101.47 t ha^{-1}) were recorded from treatment T_3- 75% of N_{184} P_{60} K_{55} S_{15} $Zn_{2.5}$ and $B_{1.5}$ (STV).

Table 20. Effect of integrated nutrient management practices in Noakhali region (AEZ 18)

Treatment	Germination %	Number of tiller (×10^3 ha^{-1})	Number of millable canes (×10^3 ha^{-1})	Yield (t ha^{-1})	Brix (%)
T_1 -Control	62.6 ab	58.2 c	45.7 c	42.36 c	13.8 ab
T_2- Soil Test Basis (STB)	68.8 a	101.4 a	83.2 a	87.03 ab	12.6 b
T_3- 75% of T_2	57.8 b	87 ab	68. ab	101.47 a	14.9 a
T_4- T_3 + Cowdung @ 10t/ha	65.6 ab	85.6 ab	67.5 ab	85.60 ab	15 a
T_5- T_3 + Poultry manure @ 5 t/ha	68.7 a	81.1 ab	65.8 ab	82.83 ab	12.9 ab
T_6- T_3 + Mustard Oil Cake @ 500Kg/ha	66.6 ab	75.2 bc	63.3 bc	75.03 b	13.6 ab
LSD (0.05)	9.5	21.4	17.75	21.8	2.12

From the above result T_3- 75% of N_{184} P_{60} K_{55} $S_{15}Zn_{2.5}$ and $B_{1.5}$ (STB) may be recommending as it produces highest Yield (101.47 t ha^{-1}).

Table 21. Initial and post-harvest soil nutrient status Noakhali region (AEZ 18)

Treatment	pH	OC%	N%	P (ppm)	K (meq%)	S (ppm)
Initial soil	7.18	0.67	0.07	7.0	0.15	24.0
Post harvest Soil						
T_1	7.10	0.62	0.06	5.5	0.13	22.0
T_2	7.25	0.65	0.07	6.0	0.14	21.0
T_3	7.15	0.62	0.07	6.5	0.14	22.5
T_4	7.20	0.66	0.07	7.0	0.15	24.0
T_5	7.25	0.65	0.07	6.5	0.13	23.0
T_6	7.20	0.64	0.07	6.0	0.14	23.5

BIOLOGICAL N_2-FIXATION BY FREE-LIVING AND ASSOCIATIVE BACTERIA IN SUGARCANE GENOTYPES OF BANGLADESH

A field experiment was carried out during 2023-2024 cropping season at BSRI farm Ishwardi to identify/screen out suitable sugarcane genotypes favored with biological N_2-fixing system under N-stressed field condition. It was laid out in RCBD with three replications. Fourteen promising sugarcane genotypes were chosen as treatments/ observations under the study. Sugarcane variety/clones viz Isd 40, Isd 37, GT-17, BSRI Akh 46, I 71-18, BSRI Akh 45, I 49-17, I 94-16, I 56-18, I 78-17, I 141-18, I 182-18, I 75-18, I 75-17 were used as test crop in this experiment. The plot size was 5m x 5m. It was planted during November in traditional method with three-budded cutting.

Results presented in Table 22 showed that growth parameters and yield of sugarcane differed significantly due to different clones in N-stressed field condition at Ishwardi site.

Table 22. Performance of different sugarcane clones in N-stressed field condition at Ishwardi site

Variety/clone	Germination %	Tiller ($\times 10^3$ ha^{-1})	Millable Cane ($\times 10^3$ ha^{-1})	Yield of Cane (t ha^{-1})	Pol (%) cane
Isd 40	40.1 abc	50.0 ab	42.0 ab	52.9 b	10.71 e
Isd 37	40.6 abc	53.7 ab	42.9 ab	47.5 c	11.15 cde
GT-17	46.3 a	51.6 ab	39.5 ab	47.5 c	11.56 bcde
BSRI Akh 46	40.6 abc	51.2 ab	41.2 ab	46.6 c	11.43 bcde
I 71-18	41.1 abc	54.1 ab	41.6 ab	47.0 c	13.76 a
BSRI Akh 45	43.0 ab	50.4 ab	41.6 ab	50.4 bc	12.64 abcd
I 49-17	39.0 bc	53.7 ab	42.9 ab	48.3 bc	13.13 ab
I 94-16	35.9 c	55.4 ab	41.2 ab	49.1 bc	11.96 abcde
I 56-18	42.7 abc	42.7 b	39.1 b	48.3 bc	12.54 acde
I 78-17	38.0 bc	48.7 ab	42.0 ab	47.9 bc	13.01 abc
I 141-18	40.6 abc	51.6 ab	44.5 a	50.8 bc	11.79 bcde
I 182-18	42.7 abc	62.5 a	42.5 ab	59.5 a	12.84 abcd
I 75-18	43.2 ab	47.9 ab	39.5 ab	50.0 bc	12.28 abcde
I 75-17	41.6 abc	50.0 ab	39.5 ab	48.0 bc	11.06 de
LSD (0.05)	7.09	18.37	5.34	5.1	1.9

The highest number of tiller (62. 5 x 10^3 ha^{-1}), yield of cane (59.5 t ha^{-1}) were obtained in clone I 182-18 in N stressed field condition. On the other hand, highest millable cane (44.5 x 10^3 ha^{-1}) were found in I 141-18 clone.

From the above discussion it maybe concluded that growth parameters, yield of sugarcane differed significantly due to different clones in N-stressed field condition at Ishwardi site. The highest number of tiller, yield of cane were obtained in clone I 182-18 in N stressed field condition. Therefore, this clone may have biological nitrogen fixing potential and further study is needed for confirmation.

EFFECT OF DIAZOTROPHIC BACTERIAL BIO-FERTILIZER ON GROWTH AND YIELD OF SUGARCANE

A field experiment was carried out to determine the effect of diazotrophic bacteria inoculation on growth and yield of sugarcane. Two diazotrophic bacterial strains (*Kocuria rosea* and *Bacillus pumilus*) were used to conduct the experiment. Two eyed sugarcane setts of variety Isd 37 was used in this experiment. Three N doses viz., 50%, 75% and 100% of Recommended Fertilizer Dose (RFD) as per FRG 2018 were used to conduct the experiment. The experiment was conducted following RCB design with three replications. The treatment combinations of this experiment were: T_1 = No fertilizers and strains, T_2 = Recommended Dose of Fertilizer (RFD), T_3 = 75% N of RFD + *Kocuria rosea*, T_4 = 75% N of RFD + *Bacillus pumilus*, T_5 = 75% N of RFD + (*Kocuria rosea*+ *Bacillus pumilus*), T_6 = 50% N of RFD + *Kocuria rosea*, T_7 = 50% N of RFD + *Bacillus pumilus*, T_8 = 50% N of RFD + (*Kocuria rosea*+ *Bacillus pumilus*). All fertilized plots were providing with full amount of P, K, S, Mg, Zn and B as per recommendation. The plot size was 8m x 6m.

Preparation of inoculants:

The bacterial strains were grown in respective broth culture for two days. Then the broth was centrifuged at 6000 rpm for 5 minutes. After that supernatant was discarded and cell pellets washed two times with sterile water and collected in a 30 ml bottle. This solution was centrifuged by vortex mixture to homogenize the strains in sterile water. Bacterial concentration was adjusted using a spectrophotometer at 540 nm and 0.1 ml of suspension containing 10^8 cells was inoculated.

Setts soaking with inoculants:

Two eyed sugarcane sets were soaked in 40 L suspension containing 500 ml bacterial culture for 30 minutes for the bacteria to adhere to the setts.

Fertilizer application:

One third of nitrogen, one half of potassium, full amount of phosphorus, sulphur, magnesium, zinc and boron fertilizer were applied as basal dose and thoroughly mixed with the soil before planting. Remaining potassium and one third of nitrogen fertilizer were applied as top dressing at tillering stage (120-150 days). The rest amount nitrogen was top dressed after completion of tillering (about 180 days).

Inoculants application rate:

40 L bacterial suspension was prepared with 500 ml bacterial culture for inoculating 1 acre land. Inoculants were applied at the base of seedling at 120 and 180 DAP. All other recommended practices were followed in the experiment. Necessary intercultural operations were done throughout the cropping period for proper growth and development of sugarcane. Collected data were compiled and tabulated in proper form and were subjected to statistical analysis by using the computer package Statistix 10 program for Windows Version. Computation was done by the use of Microsoft Excel 2003 program.

Results presented in Table 23 shows that all the growth parameters, yield of cane and Pol

(%) cane differed significantly over control due to different treatment combinations. Highest number of tiller (124.1 × 10^3 ha^{-1}) was found in treatment T_7 (50% N of RFD + *Bacillus pumilus*) and the lowest tiller data was found from T_6 (50% N of RFD + *Kocuria rosea*). Highest number of millable cane (111.0 × 10^3 ha^{-1}) was obtained in treatment T_8 {50% N of RFD + (*Kocuria rosea*+ *Bacillus pumilus)*} and the lowest data was recorded from T_5 {75% N of RFD + (*Kocuria rosea*+ *Bacillus pumilus*)}. Germnations %, Yield and Pol percent cane do not differ significantly due to different treatment combinations.

Table 23. Effect of diazotrophic bacterial bio-fertilizer on growth and yield of sugarcane

Treatment	Germination %	Tiller (× 10^3 ha^{-1})	Millable Cane (× 10^3 ha^{-1})	Yield of Cane (t ha^{-1})	Pol (%) cane
T_1	48.3	122.6 ab	109.8 ab	116.33	13.94
T_2	46.4	123.3 ab	110.3 ab	117.17	13.41
T_3	45	123.1 ab	110.6 ab	116.83	12.9
T_4	48.7	122.8 ab	110.3 ab	117.00	14.03
T_5	45.1	120.8 ab	108.6 b	115.17	13.75
T_6	47.1	120.0 b	108.8 ab	115.17	13.02
T_7	47.5	124.1 a	110.6 ab	117.83	13.48
T_8	45.5	123.5 ab	111.0 a	117.67	13.49
LSD (0.05)	NS	4.16	2.25	NS	NS

T_1 = No fertilizers and strains, T_2 = Recommended Dose of Fertilizer (RFD), T_3 = 75% N of RFD + *Kocuria rosea*, T_4 = 75% N of RFD + *Bacillus pumilus*, T_5 = 75% N of RFD + (*Kocuria rosea*+ *Bacillus pumilus*) , T_6 = 50% N of RFD + *Kocuria rosea*, T_7 = 50% N of RFD + *Bacillus pumilus*, T_8 = 50% N of RFD + (*Kocuria rosea*+ *Bacillus pumilus*)

Table 24. Initial and post harvest soil nutrient status at BSRI

Treatment	pH	OC%	N%	P (ppm)	K (meq%)	S (ppm)
Initial soil	7.78	0.55	0.07	16	0.12	20
Post harvest Soil						
T_1	7.60	0.51	0.06	13.0	0.10	17.5
T_2	7.65	0.53	0.065	14.0	0.12	18.0
T_3	7.60	0.55	0.065	14.0	0.12	18.0
T_4	7.60	0.56	0.07	15.0	0.13	18.0
T_5	7.65	0.54	0.070	15.0	0.13	18.5
T_6	7.60	0.54	0.065	14.5	0.12	18.0
T_7	7.55	0.56	0.070	14.0	0.12	18.0
T_8	7.50	0.55	0.065	15.0	0.13	19.0

From the above results it may be concluded that at Ishwardi site (AEZ 11) the growth parameter tiller and millable cane differed significantly. Therefore, application of *Kocuria rosea*+ *Bacillus pumilus* bacterial strain with 50% N of RFD may be recommended for cultivation of sugarcane in Ishwardi location (AEZ 11).

ON FARM RESEARCH DIVISION

RESEARCH HIGHLIGHTS

- Clone I 94-16 showed superior yield across Joypurhat (95.88 t/ha), Thakurgaon (112.80 t/ha) and Chuadanga (86.63 t/ha). In Rajshahi, BSRI Akh 41 topped with 134.56 t/ha.
- BSRI Akh 48 had the highest yield (104.85 t/ha) and tiller count (147.27×10³/ha). Isd 34 had the highest millable cane and strong Brix %, performing well alongside BSRI Akh 48.
- Black Ruby led in yield (up to 196.90 t/ha in Rajshahi and Bogura (145.48 t/ha), while BSRI Akh 42 achieved the highest Benefit Cost Ratio (up to 4.72). In Gazipur and Sirajganj, BSRI Akh 42 stood out in yield and profitability.
- Simultaneous planting or planting within 30 DAS of maize allows both crops to perform well without significantly affecting sugarcane yield. Delaying cane planting to 45-60 DAS maximizes maize yield but results in a notable decline in sugarcane productivity. From an economic perspective, treatments T_1 and T_2 offer the highest gross returns, net returns and BCRs, suggesting that early intercropping ensures the best balance of income from both crops. Therefore, early cane planting (0–30 DAS of maize) is recommended to optimize total productivity and profitability in a sugarcane-maize intercropping system.
- This study demonstrated that intercropping sugarcane with garlic, onion and potato significantly improved profitability with garlic yielding the highest net return (Tk 962,960) and BCR (4.232), followed by onion (Tk 882,320; BCR 3.952) and potato (Tk 823,840; BCR 3.527). Although tomato increase the Brix (18.57%) of cane, its net return was lower (Tk 391,020) due to high input costs and market price. Lentil, pea and chickpea offered moderate returns (Tk 500,240; Tk 484,165; Tk 448,371 respectively) with low input needs, proving suitable for resource-limited farmers. Overall, intercropping improved land use and income efficiency.

ON-FARM TRIAL OF PROMISING SUGARCANE CLONES AT DIFFERENT AEZs UNDER FARMER'S FIELD

The experiment was set up in Randomized Complete Block Design with three replications at four locations viz., Joypurhat, Thakurgaon, Rajshahi and Chuadanga. The promising clones I 75-17, I 78-17, I 49-17, I 94-16 and BSRI Akh 45 were studied in the experiment. Sugarcane sett were planted with a spacing of 100 cm x 45 cm. Recommended crop management practices were followed as and when necessary to provide better field condition for proper growth and development of crop. The plant protection measures were taken as and when required. The crop was harvested during December to January 2024. Different types of parameters such as tiller, millable cane, yield and brix data of sugarcane has been presented in following table:

Table 1. Performance of some promising sugarcane clones at Joypurhat

Variety	Tiller at 150 DAP ($x10^3$ ha^{-1})	Millabe cane ($x10^3$ ha^{-1})	Yield (t ha^{-1})	Brix (%)
I 75-17	127.85 c	75.50 c	61.03 c	16.00
I 78-17	157.90 ab	105.53 ab	81.80 ab	15.58
I 49-17	144.77 bc	91.41 bc	69.07 bc	14.74
I 94-16	168.66 a	111.16 a	95.88 a	15.48
BSRI Akh 45	155.82 ab	99.86 ab	80.86 ab	15.58
LSD (0.05)	16.99	18.71	18.85	NS

The table shows that highest number of tiller was found at 150 DAP in I 94-16 (168.66x10^3 ha^{-1}) followed by I 78-17 (157.90 x10^3 ha^{-1}) which is statistically similar with BSRI Akh 45 (155.82x10^3 ha^{-1}). Lowest number of tiller was found from I 75-17 (127.85x10^3 ha^{-1}). In case of millable cane I 94-16 produced highest number of millable cane (111.16 x10^3 ha^{-1}) followed by I 78-17 (105.53 x10^3 ha^{-1}) which was statistically similar with BSRI Akh 45 (99.86 x10^3 ha^{-1}). Lowest number of millable cane was found from I 75-17 (75.50 x 10^3 ha^{-1}). The highest cane yield was obtained from clone I 94-16 (95.88 tha^{-1}) followed by I 78-17 (81.80 tha^{-1}) which was statistically similar with BSRI Akh 45 (80.86 tha^{-1}) and I 49-17 (69.07 tha^{-1}). Lowest yield was found from I 75-17 (61.03 tha^{-1}). Among the tested clones Brix (%) was highest in I 75-17 (16.00) followed by I 78-17 (15.58) and BSRI Akh 45 (15.58). Lowest brix % was found from I 49-17 (14.78) at Joypurhat location.

Table 2. Performance of some promising sugarcane clones at Thakurgaon

Variety	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Yield (t ha^{-1})	Brix (%)
I 75-17	159.81 c	88.82 c	71.80 c	22.86
I 78-17	197.37 ab	124.15 ab	96.24 ab	22.26
I 49-17	180.96 bc	107.54 bc	81.27 bc	21.06
I 94-16	210.82 a	130.77 a	112.80 a	22.06
BSRI Akh 45	194.77 ab	117.48 ab	95.13 ab	22.26
LSD (0.05)	21.248	22.01	22.18	NS

From the above table it was showed that yield and yield contributing characters differed significantly different among the treatments practiced in Thakurgaon region. The highest number of tiller was obtained from clone I 94-16 (210.82 x10^3 ha^{-1}) followed by I 78-17 (197.37x10^3 ha^{-1}) which was statistically similar with BSRI Akh 45 (194.77 x10^3 ha^{-1}). Lowest tiller production was obtained from I 75-17 (159.81 x10^3 ha^{-1}) in Thakurgaon area. Highest millable cane was found at clone I 94-16 (130.77 x10^3 ha^{-1}) which was statistically similar with I 78-17 (124.15 x10^3 ha^{-1}) and BSRI Akh 45 (117.48x10^3 ha^{-1}). Lowest number of millable cane was found from I 75-17 (88.82 x10^3 ha^{-1}). In case of yield, highest yield obtained from clone I 94-16 (112.80 tha^{-1}) which was statistically similar with I 78-17 (96.24 tha^{-1}) and BSRI AKh 45 (95.13 tha^{-1}) followed by clone I 49-17 (81.27 tha^{-1}). Lowest yield was found from clone I 75-17 (71.80 tha^{-1}) at Thakurgaon district.

Table 3. Performance of some promising sugarcane clones grown at Rajshahi

Variety	Tiller 150 DAP ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-})	Yield (t ha^{-1})	Brix (%)
Modumala	107.72 c	88.36 b	112.26 b	18.40 b
BSRI Akh 41	149.20 a	101.19 a	134.56 a	17.06 de
I 94-16	124.56 b	89.88 b	98.79 bc	18.61 a
BSRI Akh 45	148.95 a	103.01 a	87.97 cd	18.01 c
I 75-17	104.26 c	84.52 b	79.21 d	16.003 f
I 49-17	106.73 c	85.17 b	82.33 cd	17.19 d
I 78-17	101.44 c	85.98 b	83.25 cd	16.96 e
LSD (0.05)	13.806	8.45	16.509	0.198

BSRI Akh 41 produced highest number of tiller (149.20 $x10^3$ ha^{-1}) which was statistically similar with BSRI Akh 45 (148.95$x10^3$ ha^{-1}). Lowest tiller was obtained from I 78-17 (101.44$x10^3$ ha^{-1}) which was statistically similar with I 75-17 (104.26 $x10^3$ ha^{-1}), I 49-17 (106.73 $x10^3$ ha^{-1}) and Modhumala (107.72 $x10^3$ ha^{-1}). In case of millable cane BSRI Akh 45 (103.01$x10^3$ ha^{-1}) showed highest number of millable cane which was statistically similar with BSRI AKh 41 (101.19 $x10^3$ ha^{-1}). Lowest no. of millable cane was found at I 75-17 (84.52 tha^{-1}) which was statistically similar with clone I 78-17 (85.98$x10^3$ ha^{-1}), I 49-17 (85.17$x10^3$ ha^{-1}), Modhumala (88.36 $x10^3$ ha^{-1}) and I 94-16 (89.88$x10^3$ ha^{-1}) respectively in Rajshahi region. In case of yield highest yield was found from variety BSRI Akh 41 (134.56 tha^{-1}) followed by Modhumala (112.26 tha^{-1}). Lowest yield was obtained from clone I 75-17 (79.21 tha^{-1}). Brix (%) was highest in I 94-16 (18.61) and lowest Brix (%) was obtained from clone I 75-17 (16.003) at Rajshahi region.

Table 4. Performance of some promising sugarcane clones grown at Chuadanga

Variety	Tiller 150 DAP ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Yield (t ha^{-1})	Brix (%)
Modumala	121.67 c	57.92 c	63.71 de	16.410 d
BSRI Akh 41	108.72 d	67.50 b	69.06 cd	17.567 a
I 94-16	152.97 b	78.75 a	86.63 a	17.21 b
BSRI Akh 45	145.67 b	84.16 a	79.96 b	15.957 e
I 75-17	169.25 a	54.92 c	60.27 e	15.25 f
I 49-17	151.42 b	66.25 b	73.01 c	16.82 c
I 78-17	97.50 e	59.17 c	59.65 e	16.39 d
LSD (0.05)	9.58	6.33	6.38	0.328

In chuadanga, I 75-17 produced highest number of tiller (169.25 x 10^3 ha^{-1}) followed by clone I 94-16 (152.97 $x10^3$ ha^{-1}) which was statistically similar with clone I 49-17 (151.42 x 10^3 ha^{-1}) and BSRI AKh 45 (145.67 x 10^3 ha^{-1}). Lowest tiller was found at I 78-17 (97.50 x 10^3 ha^{-1}). Highest millable cane was found from BSRI Akh 45 (84.16 x 10^3 ha^{-1}) which is statistically similar with clone I 94-16 (78.75 x 10^3 ha^{-1}). Lowest millable cane was found at I 75-17 (54.92 x 10^3 ha^{-1}) which was statistically similar with I 78-17 (59.17 x 10^3 ha^{-1}) and Modhumala (57.92 x 10^3 ha^{-1}) respectively. Highest yield was found at clone I 94-16 (86.63 tha^{-1}) and lowest was obtained from clone I 78-17 (59.65 tha^{-1}). In case of Brix (%) BSRI Akh 41 (17.567) showed highest brix (%) and lowest brix (%) was found at I 75-17 (15.25) in Chuadanga region.

Out of this seven genotypes I 94-16 perform better in Joypurhat, Thakurgaon and Chuadanga district. BSRI Akh 41 perform better in Rajshahi district among these tested genotypes in these study area.

PERFORMANCE OF NEWLY RELEASED SUGARCANE VARIETIES IN CHAR LAND ECOSYSTEM

The diversified ecosystems of Bangladesh are prone to various environmental hazards. Climate change is added threat to the Bangladesh agriculture and vulnerable to ecosystem. Moreover, cultivable land of Bangladesh is decreasing by 1% in every year but population is increasing at an alarming rate. So, to feed the ever increasing population, crop production measures in unfavorable eco-systems like char land areas under the context of changing climate should be strengthened for ensuring food security. Bangladesh has about 0.83 million hectares char land of which about 0.52-0.79 million hectares are cultivable. Island chars are distributed sporadically in the main channel of the rivers and attached chars which eventually become an integral part of the mainland. Cultivated soils of chars are mostly sandy loam to silty loam with slightly acidic to slightly alkaline in reaction and deficient in plant nutrients as well as organic matter content. Generally farmers in char lands cultivate local variety of sugarcane. Moreover, they follow their own crop production techniques which are the main causes of low yield in char areas. Scientists of On-farm Research Division, BSRI are engaged in introducing modern varieties of sugarcane along with suitable management practices for improving livelihood of the poor farmers of char land areas. The experiment was set up in RCB design with four replications at Jamuna char, Sirajganj in cropping season of 2023-2024. The unit plot size was 8m x 8m. Recommended doses of fertilizers were applied and cultural practices were done as and when required. The results of the study are presented in the Table 5.

Table 5. Performance of BSRI released sugarcane varieties in Charland, Sirajganj

Variety	Height (m)	Tiller 150 DAP ($x10^3$ ha^{-1})	Millable Cane ($x10^3$ ha^{-1})	Yield (tha^{-1})	Brix
Isd 34	3.056	111.65 c	85.338 a	102.15 a	19.40 ab
BSRI Akh 44	3.073	126.81 b	75.703 b	96.20 b	18.73 b
BSRI Akh 45	3.067	124.34 b	81.59 ab	86.83 c	20.00 a
BSRI Akh 46	3.13	121.90 b	76.126 b	93.84 b	18.78 ab
BSRI Akh 48	3.19	147.27 a	80.049 ab	104.85 a	19.067 ab
LSD (0.05)	NS	6.47	5.97	4.67	1.248

The table shows that, among the treatments BSRI Akh 48 showed highest plant height comparative to other varieties.In case of tiller production the highest number of tiller (147.27 $x10^3$ ha^{-1}) was found in BSRI Akh 48 followed by BSRI Akh 44 (126.81$x10^3$ ha^{-1}) which was statistically similar with BSRI Akh 45 (124.34$x10^3$ ha^{-1}) and BSRI Akh 46 (121.90 $x10^3$ ha^{-1}). Lowest number of tiller was produced from Isd 34 (111.65$x10^3$ ha^{-1}). Variety Isd 34 produced the highest number of millable cane (85.338$x10^3$ ha^{-1}) followed by BSRI Akh 45 (81.59 $x10^3$ ha^{-1}) and BSRI Akh 48 (80.049$x10^3$ ha^{-1}). Lowest number of millable cane (75.703 $x10^3$ ha^{-1}) was found in BSRI Akh 44. In case of sugarcane yield BSRI Akh 48 produced highest cane yield (104.85 tha^{-1}) which was statistically similar with Isd 34 (102.15 tha^{-1}). Lowest yield was found from BSRI Akh 45 (86.83 tha^{-1}). Among the treatments BSRI Akh 45 produced the highest Brix % (20.00) which was statistically similar with Isd 34 (19.40), BSRI Akh 48 (19.067). BSRI Akh 44 produced the lowest Brix % (18.73).

ADAPTIVE TRIAL OF CHEWING CANE IN DIFFERENT REGION OF BANGLADESH

An experiment was conducted in different region of Bangladesh (Rajshahi, Gaibandha, Satkhira and Gazipur) to verification of agro-economic performance of chewing varieties for higher yield and economic return as well as reducing poverty, resource management and livelihood improvement of ever increasing populations. The study consists of the following treatments:

T_1 = BSRI Akh 41
T_2 = BSRI Akh 42
T_3 = Black Ruby
T_4 = Local variety

The experiment was setup in RCB design with three replications in October-November 2023 and harvested in the month of September-November 2024. The number of tiller, chewable cane, yield, Brix%, price of cane and benefit cost ratio have been presented in table 6-9.

Table 6. Performance of different chewing cane at Rajshahi

Treatment	Tiller ($x10^3 ha^{-1}$)	Chewable cane ($x10^3$ ha^{-1})	Stalk height (m)	Yield (t ha^{-1})	Brix (%)	Return ($x10^3$ Tk. ha^{-1})	Cost of prod. ($x10^3$ Tk. ha^{-1})	BCR
BSRI Akh 41	173.64 a	94.34 a	3.78 a	176.9 b	17.57 a	943.40	310.00	3.05
BSRI Akh 42	151.38 b	90.46 a	3.79 a	175.50b	16.95ab	1447.36	306.78	4.72
Black Ruby	162.73ab	90.74 a	3.088 a	196.90a	17.28 a	1451.84	340.00	4.27
Local (Turag)	145.25 b	70.30 b	3.05 b	106.89c	15.67 b	632.70	285.00	2.22
LSD (0.05)	17.649	5.10	0.112	10.92	1.598	-	-	-

BSRI Akh 41= 10 TK/Stalk, BSRI Akh 42= 16 TK/Stalk, Black Ruby = 16 TK/Stalk, Turag = 09Tk/Stalk

At Rajshahi location BSRI Akh 41 produced the highest number of tiller($173.64x10^3$ ha^{-1}), highest chewable cane was obtained from BSRI Akh 41 ($94.34x10^3$ ha^{-1}) which is statistically similar with Black Ruby (90.74 $x10^3$ ha^{-1}) and BSRI Akh 42 ($90.46x10^3$ ha^{-1}). Stalk height was highest in BSRI Akh 42 (3.79). Maximum yield was produced by Black Ruby (196.90 $x10^3$ tha^{-1}) followed by BSRI Akh 41 (176.9 tha^{-1}) which is statistically similar with BSRI Akh 42 (175.50 tha^{-1}). Lowest yield was found in local variety (Turag) (106.89 tha^{-1}). Considering the total return and BCR, Black Ruby gave the highest return ($1451.84x10^3$ $Tk.ha^{-1}$) followed by BSRI Akh 42 ($1447.36.84x10^3$ $Tk.ha^{-1}$). The lowest BCR was obtained from local variety Turag (2.22). From the above findings it may be concluded that variety BSRI Akh 42 and Black Ruby was more suitable for wide cultivation in Rajshahi district (Table 6).

Table 7. Performance of different chewing cane at Bogura

Treatment	Tiller ($x10^3$ ha^{-1})	Chewable cane ($x10^3$ ha^{-1})	Stalk height (m)	Yield (t ha^{-1})	Brix (%)	Return ($x10^3$ ha^{-1})	Cost of prod. ($x10^3$ ha^{-1})	BCR
BSRI Akh 41	179.52 a	79.90 b	2.816ab	140.28ab	15.48 b	639.20	300.00	2.13
BSRI Akh 42	127.58 c	74.28 b	2.70 b	130.28 b	16.76ab	1485.60	340.00	4.37
Black Ruby	161.22 b	80.85 b	2.50 c	145.48 a	16.48ab	1131.90	330.00	3.43
Local (Q 69)	189.47 a	112.69 a	2.85 a	123.71 c	17.35 a	788.83	295.00	2.68
LSD (0.05)	11.71	7.70	0.12	11.55	1.52	-	-	-

**BSRI Akh 41= 08 TK/Stalk, BSRI Akh 42= 15 TK/Stalk, Black Ruby= 14 TK/Stalk, Q 69 = 07Tk/Stalk

At Bogura location Local (Q 69) produced the highest number of tiller and chewable cane 189.47x10^3 ha^{-1} and 112.69 x 10^3 ha^{-1} respectively. On the other hand BSRI Akh 42 produced the lowest number of tiller 127.58x10^3 ha^{-1} and chewable cane 74.28x10^3 ha^{-1}. The highest Brix % was observed in local variety Q 69 (17.35) and the lowest was found in BSRI Akh 41 (15.48). In case of yield performance, Black Ruby gave the highest yield (145.48 t ha^{-1}) which is statistically similar to BSRI Akh 41 (140.28 t ha^{-1}). Lowest yield was found from Local (Q 69) (123.71 t ha^{-1}). Considering the total return BSRI Akh 42 gave the highest return (1485.60x10^3 Tk. ha^{-1}). The highest Benefit Cost Ratio was obtained from variety BSRI Akh 42 (4.37). The lowest BCR was obtained from BSRI Akh 41 (2.13) (Table 7). From the above findings it may be concluded that variety BSRI Akh 42 and Black Ruby was more suitable for cultivation in Bogura district.

Table 8. Performance of different chewing cane at Sirajganj

Treatments	Tiller (x10^3 ha^{-1})	Chewable cane (x10^3 ha^{-1})	Stalk Height (m)	Yield (t ha^{-1})	Brix (%)	Return (x10^3 ha^{-1})	Cost of prod. (x10^3 ha^{-1})	BCR
BSRI Akh 41	199.34 a	89.39 a	3.08 b	148.35 b	19.50 a	893.90	315.00	2.56
BSRI Akh 42	192.24 a	85.17 a	3.34 a	161.14 a	18.387 b	1192.38	340.00	3.51
Modhumala	162.30 b	85.62 a	2.97 c	142.87 b	15.767 c	770.58	310.00	2.49
Black Ruby	112.95 c	66.65 b	2.40 d	112.81 c	14.827 d	733.15	326.00	2.25
LSD (0.05)	17.34	5.93	0.064	12.08	0.68			

** BSRI Akh 41= 10 TK/Stalk, BSRI Akh 42= 14 TK/Stalk, Black Ruby= 11 TK/Stalk, Q 69 = 07Tk/Stalk, Madhumala= 09Tk/Stalk

At Sirajganj location BSRI Akh 41 produced the highest number of tiller and chewable cane 199.34 x 10^3 ha^{-1} and 89.39x 10^3 ha^{-1} respectively. On the other hand Black Ruby produced the lowest number of tiller 112.95 x 10^3 ha^{-1} and chewable cane (66.65 x 10^3 ha^{-1}). In case of yield BSRI Akh 42 gave the highest yield (161.14 tha^{-1}) and Black Ruby gave the lowest (112.81 tha^{-1}). The highest Brix % was observed in BSRI Akh 41(19.50) and the lowest was found in Black Ruby (14.83). Considering the total return BSRI Akh 42 gave the highest return (1192.38 x 10^3 Tk. ha^{-1}) and the highest Benefit Cost Ratio (3.51). The lowest BCR was obtained from Black Ruby (2.25) (Table 8). From the above findings it may be concluded that variety BSRI Akh 42 was more suitable for cultivation in Sirajganj District.

Table 9. Performance of different chewing cane at Gazipur

Treatments	Tiller (x10^3 ha^{-1})	Chewable cane (x10^3 ha^{-1})	Yield (t ha^{-1})	Brix (%)	Return (x10^3 ha^{-1})	Cost of prod. (x10^3 ha^{-1})	BCR
BSRI Akh 41	90.33 b	70.83 b	122.48 ab	19.40 a	779.13	320.00	2.44
BSRI Akh 42	90.00 b	70.50 b	134.09 a	17.967b	987.00	345.00	2.86
Modhumala	87.00 b	66.50 b	124.69 ab	17.867b	598.50	300.00	2.00
Black Ruby	85.17 b	67.67 b	106.77 bc	17.367c	812.04	320.00	2.54
Local (Q 69)	107.83 a	86.167 a	91.34 c	19.13 a	689.34	300.00	2.30
LSD (0.05)	9.56	10.90	18.325	0.358	-	-	-

**BSRI Akh 41= 11 TK/Stalk, BSRI Akh 42= 14 TK/Stalk, Modhumala =09 Tk/Stalk, Black Ruby= 12 TK/Stalk, Q 69 = 08Tk/Stalk

At Gazipur district Q-69 produced the highest number of tiller and chewable cane 107.83x10^3 ha^{-1},86.167 t ha^{-1}. Black Ruby produced the lowest number of tiller 85.17x10^3 ha^{-1}.The highest return (987.00 x 10^3 Tk ha^{-1}) given by BSRI Akh 42 variety. The highest Benefit Cost Ratio was obtained from treatment BSRI Akh 42 (2.86) and the lowest BCR was obtained from local variety Q-69 (2.30) (Table 9). Brix (%) was highest in BSRI Akh 41 (19.40). In case of yield BSRI Akh 42 produced highest yield (134.09 tha^{-1}). Lowest yield was found at Local (Q 69) 91.34 (tha^{-1}). From the above findings it may be concluded that variety BSRI Akh 42 perform better in Gazipur district.

PERFORMANCE OF MAIZE AS INTERCROP WITH SUGARCANE IN DIFFERENT PLANTING TIMES

Intercropping is a widely adopted strategy to maximize land use efficiency and increase overall productivity. Sugarcane's long duration and wide spacing make it a suitable crop for intercropping with short-duration crops like maize. However, the planting time of the intercrop significantly influences the competitive dynamics, yield performance and resource utilization. This study aims to determine the optimal planting time for maize in a sugarcane intercropping system by evaluating their agronomic interactions and productivity. The experiment was set up at BSRI Farm and Chuadanga consisted of six treatments: T_0: Sole Sugarcane (First date of Maize plantation), T_1: Maize +Sugarcane (At a time), T_2: Maize + Sugarcane (15 DAS of Maize), T_3: Maize + Sugarcane (30 DAS of Maize), T_4: Maize + Sugarcane (45 DAS of Maize), T_5: Maize + Sugarcane (60 DAS of Maize). Observations were recorded for stalk height, girth, number of tillers at 150 DAP, millable cane count, Brix percentage, cane yield and maize grain yield. Statistical analysis was conducted to identify significant differences among treatments.

Agronomic characteristics varied significantly among treatments. The tallest sugarcane stalks were found in the sole cane plot (3.44 m) followed by T_1 and T_2. The thickest cane girth was in T_2 (25.47 mm), showing a potential compensatory growth response when maize was introduced at 15 DAS. Tiller production was highest in sole cane (158.33 x10^3/ha) and decreased with delayed sugarcane planting, reaching the lowest in T_4 (61.78 x10^3/ha).

Millable cane count was not significantly different among treatments, suggesting that while growth parameters varied, final cane formation was relatively stable. Brix percentage, a key indicator of sugar content, was highest in T_3 (19.29 %) and T_5 (19.08%), indicating that later maize planting may reduce vegetative competition and improve juice quality. Cane yield was highest in the sole cane treatment (103.64 t/ha) and similar in T_1, T_2 and T_3. However, late intercropping at 45 and 60 DAS significantly reduced cane yield to 74.53 and 62.07 t/ha, respectively, likely due to increased resource competition during cane's critical growth period. Maize yield increased with delayed sugarcane planting, peaking in T_5 (12.53 t/ha), suggesting reduced shading and better maize establishment. However, this came at the cost of sugarcane yield.

Table 10. Agronomic and yield performance of sugarcane and maize in different planting times at BSRI farm

Treatments	Stalk Height (m)	Girth (mm)	Tiller 150 DAP ($x10^3$ ha^{-1})	Millable Cane ($x10^3$ ha^{-1})	Brix (%)	Cane Yield (tha^{-1})	Maize grain Yield (t/ha)
T_0	3.44 a	23.56 b	158.33 a	90.89	16.69 cd	103.64 a	0.00 c
T_1	3.23 ab	25.19 ab	89.33 b	84.889	15.49 d	99.22 a	11.19 ab
T_2	3.21 ab	25.47 a	72.11 cd	86.78	17.93 bc	101.76 a	10.53 b
T_3	3.04 bc	23.856 ab	84.44 bc	87.78	19.29 a	94.09 a	10.36 b
T_4	2.91 c	21.38 c	61.78 d	88.77	17.64 c	74.53 b	11.12 ab
T_5	2.83 c	20.79 c	73.22 cd	90.22	19.08 ab	62.07 b	12.53 a
LSD (0.05)	0.2915	1.68	14.21	NS	1.30	18.79	1.73

A partial budget analysis was conducted using average market prices to estimate the economic returns of each treatment. For sugarcane, the price was assumed to be Tk 5500 per ton and for maize, Tk 18000 per ton. Approximate cost of production was Tk 200,000/ha for sole cane and Tk 260,000/ha for intercrops due to additional seed, fertilizer and labor costs.

Table 11. Economic analysis of sugarcane-maize intercropping treatments at BSRI farm

Treatment	Gross Return (Tk/ha)	Cost of Production (Tk/ha)	Net Return (Tk/ha)	BCR
T_0	570020	200000	370020	2.85
T_1	747130	260000	487130	2.87
T_2	749220	260000	489220	2.88
T_3	703975	260000	443975	2.71
T_4	610075	260000	350075	2.35
T_5	566925	260000	306925	2.18

Intercropping maize with sugarcane is influenced strongly by the planting time of sugarcane. Simultaneous sowing or sowing within 30 DAS allows both crops to perform well without significantly affecting sugarcane yield. Delaying cane sowing to 45-60 DAS maximizes maize yield but results in a notable decline in sugarcane productivity. From an economic perspective, treatments T_1 and T_2 offer the highest gross returns, net returns and BCRs, suggesting that early intercropping ensures the best balance of income from both crops. Therefore, early cane planting (0–30 DAS of maize) is recommended to optimize total productivity and profitability in a sugarcane-maize intercropping system.

As shown in Table 12, sugarcane growth parameters were highest in the sole crop (T_0) and early intercropping treatments (T_1, T_2). Delayed planting of sugarcane (T_4 and T_5) resulted in poor establishment due to competition from well-established maize. This led to reduced stalk height, girth, millable cane count and ultimately lower cane yield.

Table 12. Agronomic and yield performance of sugarcane and maize in different planting times at Chuadanga

Treatments	Stalk Height (m)	Girth (mm)	Millable Cane ($x10^3$ ha^{-1})	Brix (%)	Cane Yield (tha^{-1})	Maize grain Yield (tha^{-1})
T_0	3.32 a	24.01ab	109.70 a	16.02 d	99.58 a	0.00 d
T_1	3.24 a	24.80 a	96.30 b	16.24 d	95.02 ab	10.05 c
T_2	3.23 a	24.78 a	95.58 b	17.8 b	98.54 a	10.54 bc
T_3	3.10 b	23.65 b	92.44 bc	18.14 b	89.97 bc	10.94 ab
T_4	2.95 c	22.28 c	86.68 cd	18.88 a	72.56 d	11.15 a
T_5	2.88 c	21.33 c	88.58 cd	18.96 a	65.77 e	11.78 a
LSD (0.05)	0.12	1.05	5.65	0.58	3.20	0.65

Conversely, maize yield increased as sugarcane planting was delayed, likely due to reduced below and above-ground competition in the early growth stages of maize. Treatments T_4 and T_5 achieved the highest maize yields but suffered from severely reduced cane productivity.

Table 13. Economic analysis of sugarcane-maize intercropping treatments at Chuadanga

Treatment	Gross Return (Tk/ha)	Cost of Production (Tk/ha)	Net Return (Tk/ha)	BCR
T_0	547690	200000	347690	2.74
T_1	707110	260000	447110	2.72
T_2	730970	260000	470970	2.81
T_3	694185	260000	434185	2.67
T_4	615580	260000	355580	2.37
T_5	582155	260000	322155	2.24

As shown in Table 13, the economic analysis revealed that intercropping with sugarcane at 15 DAS (T_2) yielded the highest gross return and net profit, along with the best benefit-cost ratio (2.81). Though maize yield peaked in T_5, the drastic decline in cane yield led to lower total returns. T_2 emerged as the most economically sustainable option.

ON-FARM TRIAL OF DIFFERENT INTERCROP WITH SUGARCANE IN LOW GANGES RIVER FLOODPLAIN SOIL

Sugarcane is a major cash crop for Bangladesh but its long maturity period leaves inter-row space underutilized. Intercropping offers a potential strategy to improve land use efficiency, diversify income and boost farm productivity. This study aims to evaluate the effects of different intercrops on sugarcane growth, yield and profitability under on-farm conditions.

The trial was laid out in a randomized complete block design with nine treatments: T_0: Sole Sugarcane (Control), T_1: Sugarcane + Onion, T_2: Sugarcane + Garlic, T_3: Sugarcane + Cauliflower, T_4: Sugarcane + Tomato, T_5: Sugarcane + Potato, T_6: Sugarcane + Lentil, T_7: Sugarcane + Pea, T_8: Sugarcane + Chick Pea. The experiment were conducted at BSRI Farm with three

replications. Standard agronomic practices were followed. Data on stalk height, girth, tiller count, millable cane, Brix % and yield were recorded. Economic analysis included cane equivalent yield (CEY), adjusted cane yield, cost of production, gross return, net return and benefit-cost ratio (BCR).

Agronomic traits showed significant variability across treatments. The tallest canes were observed in cane + cauliflower (3.89 m), while cane + pea produced the thickest stalks (26.85 mm). The highest number of tillers (54.67 $x10^3$/ha) was recorded in cane + cauliflower in early January. Millable cane was highest in cane + garlic (191.56 $x10^3$/ha)(Table 12).

Cane yield was highest in cane + onion (124.58 t/ha) followed by cane + lentil (119.40 t/ha) and cane + potato (119.20 t/ha) (Figure 1). Cane + tomato had the highest Brix (18.57%) (table 12), indicating superior sugar content and potential for high-quality juice production. These agronomic advantages reflect the suitability of certain vegetables and pulses to coexist and even support cane growth through reduced competition and possible soil health improvement.

Table 14. Agronomic traits influenced by different intercrop combination treatment

Treatments	Stalk Height (m)	Girth (mm)	Tiller (04.01.2024) ($x10^3$ ha^{-1})	Tiller (09.03.2024) ($x10^3$ ha^{-1})	Millable Cane ($x10^3$ ha^{-1})	Brix (%)	yield of intercrop (t/ha)
Sole cane	3.56 b	24.64 ab	50.22 abc	185.22 a	78.09 ab	17.647 ab	-
Cane+ onion	3.78 ab	24.40 ab	47.89 bc	164.44 b	82.40 a	15.43 cd	9.92 d
Cane+ Garlic	3.72 ab	24.13 b	50.56 abc	191.56 a	78.23 ab	14.967 d	5.16 e
Cane+ Cauliflower	3. 89 a	24.38 ab	54.67 a	166.56 b	77.40 ab	15.45 cd	21.01 b
Cane+ Tomato	3.51 b	24.57 ab	53.33 ab	76.22 e	71.60 b	18.57 a	35.46 a
Cane+Potato	3.65 ab	24.52 ab	47.78 abc	149.89 b	84.20 a	17.647 ab	16.476 c
Cane+Lentil	3.75 ab	25.43 ab	45.44 c	111.33 cd	85.10 a	17.093 ab	0.689 f
Cane+ Pea	3.52 b	26.85 a	46.52 c	117.74	78.67 ab	16.66 bc	0.73 f
Cane+ chick Pea	3.61 b	24.92 ab	49.78 abc	97.56 d	80.20 a	17.28 ab	0.74 f
LSD (0.05)	0.27	2.49	5.515	17.841	7.76	1.503	1.03
CV %	4.29	5.80	6.43	7.36	9.85	5.18	7.19

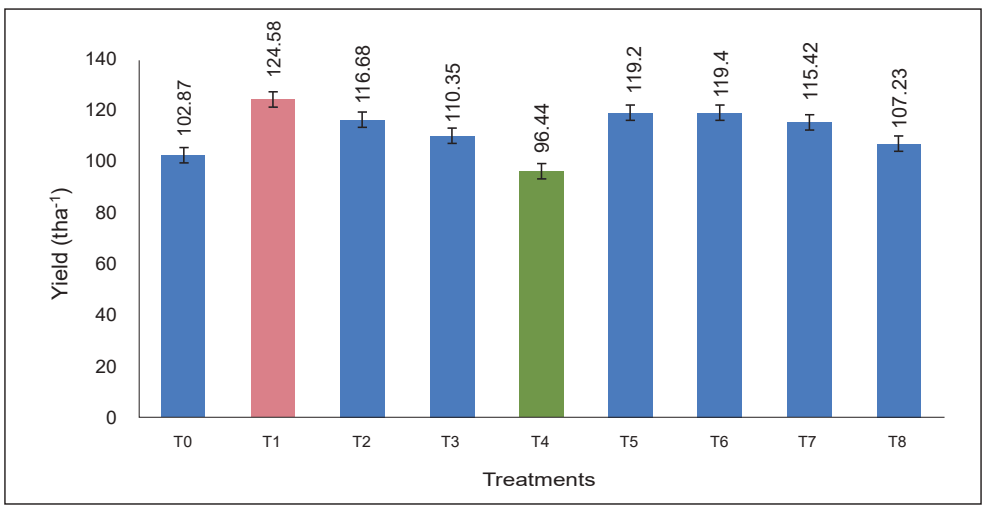


Figure 1: Yield of Sugarcane influenced by different intercrop combination treatment

Economically, cane + garlic led with the highest CEY (112.58 t/ha) followed by cane + onion (90.18 t/ha) and cane + potato (64.47 t/ha). Cane + garlic and cane + onion also yielded high net returns (Tk 962,960 and Tk 882,320 respectively) followed by cane + potato (Tk 823840) with favorable BCRs of 4.232, 3.952 and 3.527. The profitability of these intercrops stems from their market value and compatibility with sugarcane. On the other hand, sole sugarcane had the lowest CEY, net return (Tk 362,010) and BCR (2.777), indicating that the monoculture approach is less economically viable under current conditions. (Table 13).

Although lentil, pea and chickpea had low intercrop yields, their low input costs still resulted in moderately good net returns and BCRs, suggesting they may be suitable for risk-averse farmers or those with limited resources.

Table 15. Economic Analysis

Treatments	Cane equivalent yield (t/ha)	Adjusted Cane yield (t/ha)	Cost of production (TK)	Gross return(TK)	Net return (TK)	BCR
Sole cane	-	102.87	203775	565785	362010	2.777
Cane+ onion	90.1818	214.762	298870	1181190	882320	3.952
Cane+ Garlic	112.582	229.262	297980	1260940	962960	4.232
Cane+ Cauliflower	38.2	148.55	353210	817025	463815	2.313
Cane+ Tomato	64.4727	160.913	494000	885020	391020	1.792
Cane+Potato	89.8691	209.069	326040	1149880	823840	3.527
Cane+Lentil	12.5273	131.927	225360	725600	500240	3.220
Cane+ Pea	14.6	130.02	230945	715110	484165	3.096
Cane+ chick Pea	14.8	122.03	222794	671165	448371	3.012

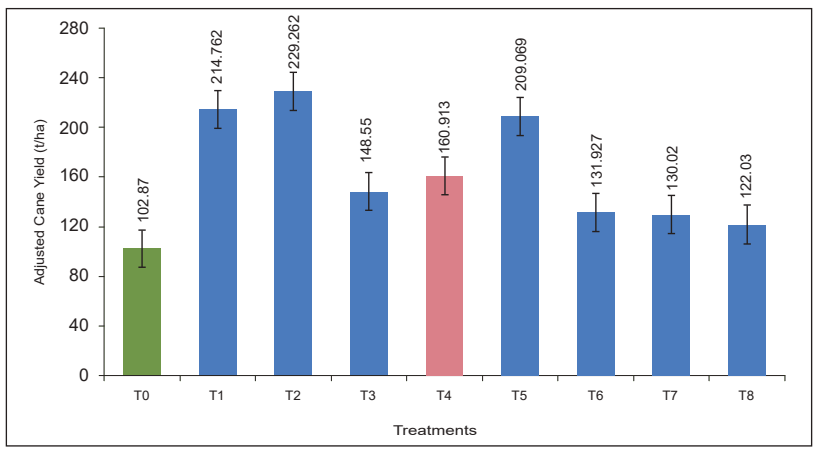


Figure 2. Adjusted Cane Yield (t/ha) of different treatment combination

Intercropping sugarcane with garlic, onion and potato significantly enhances profitability and resource use efficiency in the Low Ganges River Floodplain. Garlic provided the highest net return and benefit-cost ratio, while onion and potato also offered strong economic performance. Although tomato increase the Brix % of cane, its high input cost and low market price reduced profitability. Lentil, pea and chickpea, despite lower yields, showed moderate returns due to low production costs, making them suitable for resource-limited farmers. Overall, early-season vegetable intercrops with sugarcane are effective for increasing farm income and optimizing land use, supporting intercropping as a sustainable strategy for sugarcane-based farming systems.

AGRICULTURAL ENGINEERING DIVISION

RESEARCH HIGHLIGHTS

- Earthing Up Machine for Sugarcane is easy to operate, Field capacity and efficiency of the machine is 0.33 ha/hr. and 77% respectively. Fuel consumption-is only 1 l/hr;
- Double-acting Single-budded Sett Cutting Machine is capable to cut uniforms single sugarcane sett for planting, while minimizing manual intervention;
- Excessive tillage may be avoided without compromising cane yield or quality.

TECHNOLOGY DEVELOPED WITH SALIENT FEATURES (DURING 2023-2024).

NAME OF TECHNOLOGY: EARTHING UP MACHINE FOR SUGARCANE CULTIVATION

i. Precision Earthing-Up: Ensures accurate soil mounding around sugarcane plants for better root support, moisture retention, and weed control.

ii. Adaptable Row Spacing: Operates smoothly between sugarcane rows spaced 100 cm apart or above.

iii. High Field Capacity: Covers 0.33 hectares per hour per man, productivity and time depend on farms size and operator's performance.

iv. Fuel Efficiency: Consumes only 1 liter of fuel per hour, reducing both operational costs and environmental impact.

v. User-Friendly Design: Easy to operate, making it practical for farmers to use with minimal training.

Fig 1 (a & b) shows Pictorial view of Earthing-Up Machine and field operation respectively.

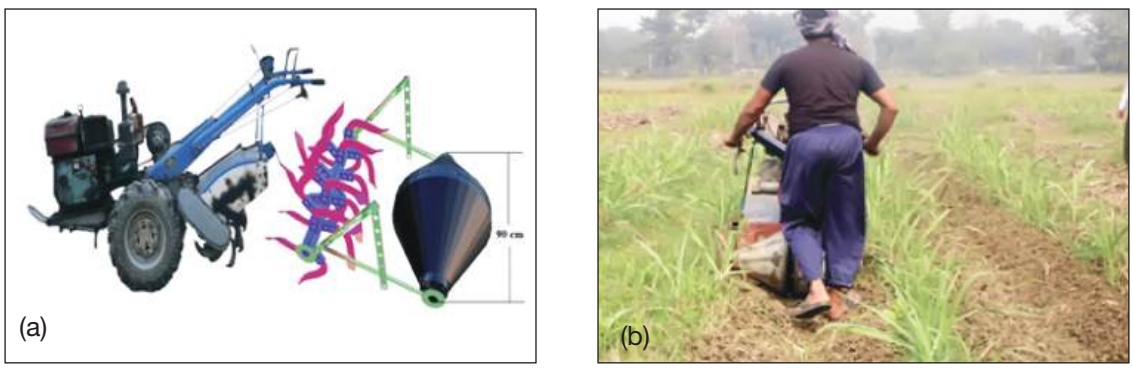


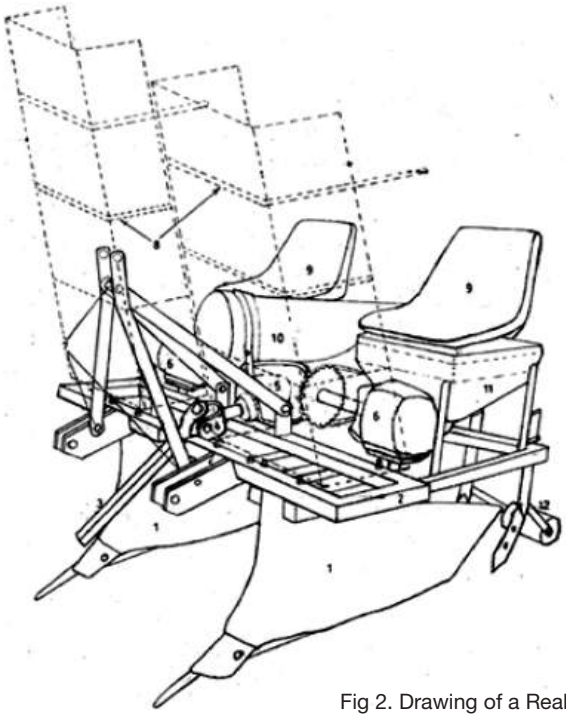
Fig1. Pictorial view of (a) Earthing Up Machineand (b) field operation

REPORT OF EXPERIMENT

DESIGN AND DEVELOPMENT OF A REAL CUT SUGARCANE PLANTER

Sugarcane planting is not only expensive but also requires a great deal of manual labour and is an extremely labor-intensive task. In comparison to traditional ways, planting sugarcane using machinery is less expensive. Additionally, it lessens the laboriousness associated with sugarcane planting unit activities. In terms of crop development and yield, planting is often of utmost importance. The designing and

development of a prototype for a sugarcane planter is essential for profitable sugarcane farming through low cost and timeliness operation of sugarcane planting. In the meantime design of planter completed and its drawing is as below. To develop a prototype as per design, purchasing of required materials are in progress.



1: Furrow opener
2: Maim frame
3: Propeller shaft
4: Universal joint
5: Gear box
6: Bevel gear box
7: 3 point linkage
8: Seed cane tray
9: PVC seat
10: Insecticide solution Tank
11: Fertilizer box
12: Soil covering shovel & roller

Fig 2. Drawing of a Real Cut Sugarcane Planter

DESIGN AND DEVELOPMENT OF A FOOD DRYER AND STORAGE SYSTEM WITH AIR DEHUMIDIFICATION

A Food Dryer and Storage System has already been designed, fabricated and tested to produce quality dry food products and storage of semi-solid jaggery. Flow chat of draying systemis given below (Fig 3).

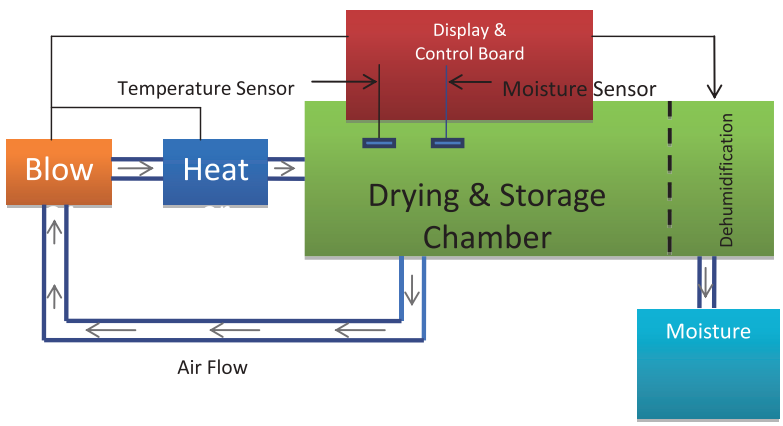


Fig 3.Flow chart of designed drying system

Some problems have identified and from test. The current food dryer with a dehumidifier have encountered issues where the dehumidification process becomes less effective as the temperature rises. To address this challenge, a cooling system will be integrated into the dryer in the upcoming research phase. This addition is expected to stabilize the temperature, thereby enhancing the performance of the dehumidifier and ensuring consistent drying efficiency even under varying thermal conditions.

DESIGN AND DEVELOPMENT OF DOUBLE-ACTING SINGLE- BUDDED SET CUTTING MACHINE

A double-acting single-budded sett cutting machine has been designed and developed that is scheduled for testing next year. Flow chart diagram (Fig 4) and Pictorial view (Fig 5) of developed Double-acting Single-budded Sett Cutting Machine are given below. The machine was built to efficiently cut single sugarcane sett for planting, ensuring uniformity and reducing manual labor. During this testing phase, data will be collected to evaluate its performance and efficiency. Based on the results, further improvements will be made if necessary to enhance its functionality and effectiveness.

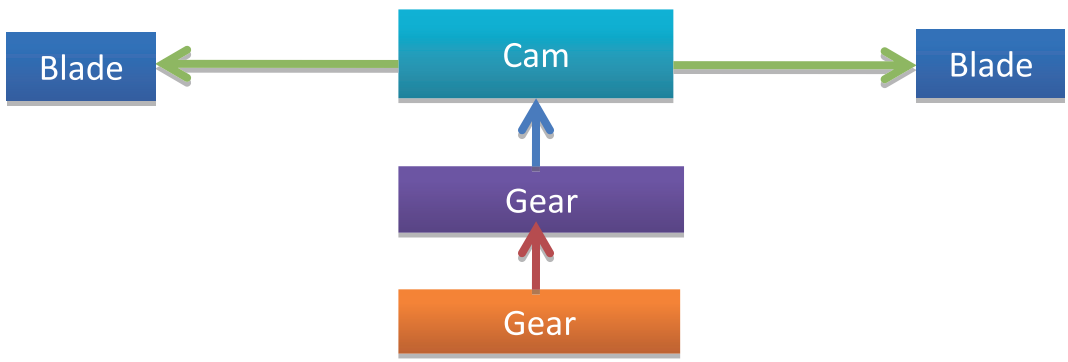


Fig 4. Flow chart diagram of double-acting single-budded sett cutting machine

Fig 5. Pictorial view of developed Double-acting Single-budded Sett Cutting Machine

PERFORMANCE EVALUATION OF DIFFERENT TILLAGE AND RESIDUE MANAGEMENT FOR SUSTAINABLE SUGARCANE CULTIVATION

Sugarcane is animportant commercial food crop in Bangladesh that plays a significant role in the agricultural economy of many countries, including Bangladesh. Despite its importance, the productivity of sugarcane at the farm level in Bangladesh has remained stagnant at approximately 45 tons per hectare (tha^{-1}). This yield is significantly lower than the potential yield of the cultivated varieties, which can be reached up to 100 tha^{-1} under optimal conditions.

The discrepancy between farm-level productivity and the potential yield, known as the "yield gap," is a major concern in the sugarcane industry. Several factors contribute to this gap, including the low productivity of sugarcane farmland, which is often due to poor soil health, inadequate nutrient management, and suboptimal farming practices. One of the key challenges is the lack of resource-conserving agricultural practices that could enhance soil fertility, reduce environmental degradation, and improve crop productivity.

In particular, ratooning—the practice of allowing the sugarcane plant to regenerate after the first harvest-offers significant potential to increase yield without the need for additional land preparation or seed material. However, poor ratoon management often leads to suboptimal yields. To address this, one of the primary objectives of this study was to explore ways to improve sugarcane yield, especially ratoon yield, and reduce the yield gap.

To achieve this, a field experiment was conducted that evaluated the effects of different tillage systems and trash management practices. The experiment aimed to identify the most effective combination of tillage and residue management techniques to enhance both the overall cane yield and the ratoon crop yield. By integrating modern agricultural practices that conserve resources and promote soil health, the study sought to develop strategies that could help bridge the yield gap, improve farm-level productivity, and promote sustainable sugarcane cultivation in Bangladesh.

Materials and Methods

A field experiment was designed using a Randomized Complete Block Design (RCBD) to evaluate the effects of different tillage systems and trash management practices on sugarcane yield and quality. The experiment included four treatment combinations of tillage and residue mulch, as follows:

Strip Tillage (ST)
Strip Tillage (ST) + Residue Mulch (trash mulching)
Conventional Tillage (Four passes of power tiller + Manual trenching)
Conventional Tillage + Residue Mulch

Each treatment was replicated four times to ensure statistical reliability. Single-budded seedlings were planted on March 1, 2023, with a 1-meter row spacing and 50 cm plant-to-plant spacing. The crop was harvested on December 6, 2023. Immediate after harvesting ratoon shaving done and mulching practices was followed according to designed treatment.

Data on the number of tillers, millable canes, total yield, and brix percentage (indicating the sugar content) were collected from each plot. The statistical analysis of the data was conducted using Statistics 10, and the means of the different treatments were compared using Tukey's Honestly Significant Difference (HSD) test to determine if there were any significant differences between the treatments.

Results

The results of the study revealed that there were no significant impacts of the different tillage and residue mulch treatment

combinations on sugarcane yield and quality during the ratoon cane phase (Table 1). Although, different treatment combinations have significant impact on tillering but was insignificant in case of millable cane (Table 1). This suggests that variations in tillage methods and the addition of residue mulch did not lead to any noticeable changes in the key yield-contributing characteristics or overall cane quality during the first ratooning.

Table 1. Effect of different tillage and residue management on ratoon sugarcane yield contributing characteristics, yield and cane quality

Treatments	Tiller ($x10^3$ ha^{-1})	Millable Cane ($x10^3$ ha^{-1})	Yield(t/ha)	Brix (%)
Strip Tillage(ST)	196.67 a	118.00	75.33	20.2
ST+Residue Mulch	176.00 ab	96.00	79.67	19.5
Conventional Tillage(CT)	189.33 ab	99.00	74.00	19.5
CT + Residue Mulch	158.00 b	98.67	78.67	19.8
HSD %	34.68	NS	NS	NS
CV %	6.81	9.81	9.18	5.34

Explanation of Table:

- **Tiller (1000/ha):** The number of tillers per hectare reflects the potential for millable cane. In this study, the number of tillers ranged from 158.00 to 196.67 thousand per hectares (Table 1). Where strip tillage without residue mulch had significantly higher tiller per hectares (196.67 thousand per hectares) and Conventional Tillage with residue mulch had lowest (158.00 thousand per hectares).
- **Millable Cane (1000/ha):** Millable cane is the number of cane stalks that are of sufficient size to be harvested. The values were between 96.00 and 118.00 thousand per hectares (Table 1). Although different tillage and residue mulch treatments have significant impact on tillering but there is not significant differences between the tillage and residue mulch treatments for millable cane.
- **Yield (t/ha):** The actual sugarcane yield per hectare. The yield ranged from 74.00 t/ha to 79.67 t/ha across all treatments, with no significant differences observed (Table 1).
- **Brix (%):** Brix (%) is the total soluble solid content of the cane juice, represented as a percentage. The brix values ranged from 19.5% to 20.2%, indicating that there was no significant difference in the quality of the cane between the treatments (Table 1).

Discussion of Results: The results suggest that the different tillage systems, whether strip tillage or conventional tillage, and the addition of residue mulch did not showing the significantly effect the sugarcane yield or quality during the first ratoon although initially number of tiller per hectare was reduced due to residue mulch. These findings imply that excessive tillage can potentially be avoided without negatively impacting the cane's growth or quality. Furthermore, residue mulching, while a beneficial practice for soil conservation and moisture retention, may require more time to show measurable benefits. The study suggests that trash mulching may take few years to fully decompose and provide its full benefits to soil health and sugarcane productivity.

ENTOMOLOGY DIVISION

RESEARCH HIGHLIGHTS

- **In ZYT III**

  At BSRI, four clones (I 94-16, I 49-17, I 75-17, I 78-17) and one standard variety (BSRI Akh 45) were used as planting material inZYT III. ESB infestation was very low and ranged from 1.36 to 2.73%. Black beetle infestation ranged from 4.01 to 9.35%. Due to top shoot borer, infestation ranged from 3.71 to 5.41%. The lowest (3.71%) infestation was found in I 49-17 with the highest (5.41%) in I 75-17. Stem borer (stalk basis) infestation ranged from 6.94 to 9.14 % and the lowest (6.94%) infestation was found in I 75-17, while, the highest (9.14%) infestation was found in I 94-16. Stem borer (internode basis), the lowest (15.28%) infestation was found in I 75-17, with the highest (23.61%) in I 94-16. Rootstock borer infestation ranged from 25.09 to 37.15%, the lowest (25.09%) rootstock borer infestation was observed in I 94-16 with the highest (37.15%) in I 75-17. Mealy bug infestation ranged from 3.31 to 5.09%, the lowest (3.31%) infestation was found in I 94-16. In case of scale insect, the lowest (1.15%) infestation was observed in I 94-16.

  At RSRS, Thakurgaon, four clones (I 94-16, I 49-17, I 75-17, I 78-17) and one standard variety (BSRI Akh 45) were also used in this experiment. Early shoot borer infestation ranged from 13.63 to 15.58% in all the test clones/varieties. The lowest (13.63%) infestation was observed in I 75-17. Black beetle infestation ranged from 21.00 to 27.27% with the lowest (21.00%) infestation was recorded in I 78-17 and the highest (27.27%) infestation was observed in I 94-16. Stem borer (stalk basis) infestation ranged from 29.22 to 52.42% with the lowest (29.22%) infestation was found in (BSRI Akh 45). In case of stem borer (internode basis), the lowest (20.93%) infestation was found in I 49-17 with the highest (32.03%) in I 78-17. Rootstock borer infestation was high which ranging from 85.10 to 96.67%. The lowest (85.10%) rootstock borer infestation was observed in I 78-17 followed by I 94-16 (87.83%) with the highest (96.67%) in in (BSRI Akh 45). Mealy bug infestation among the test clones/varieties ranged from 58.31 to 76.46%, the lowest (58.31%) infestation was found in I 78-17. White grub infestation ranged from 2.00 to 4.33, the lowest (2.00%) infestation was observed in I 78-17.

- **Mass Rearing of Bio-control agents**

  In Entomology Divisional Laboratory, *Trichogramma chilonis* and its alternative host *Corcyra cephalonica* and another bio-agent *Bracon hebetor* and its alternative host *Galleria mellonela* were reared continuously. The highest *C. cephalonica* eggs (47.13 g) were collected from 25025 moths in the month of August 2024. The lowest *C. cephalonica* eggs (8.43 g) were collected from 5400 moths in the month of January 2024. The total (365.28 g) *C. cephalonica* eggs were collected from 176775 moths. Total 51.68 g eggs were used for parasitisation from January to December 2024. Another remaining eggs of *C. cephalonica* were used for recycling of Rice meal moth. Another alternate host larvae of *Galleria mellonella* was reared in artificial diet which made from a combination of wax, milk, sugar, wheat bran, maize bran and yeast in recommended proportion. The emerged larvae were used to parasitize by the *Bracon hebetor*. About 100 wax moth larvae and 30 pair of male & female B. hebetor adult was kept in a single boyyam for parasitization. After 10-14 days, about 1000-1200 B. hebetor adult was emerged

and ready for field release in sugarbeet. Some adult of *B. hebetor* were used for recycled. This process was repeated for *B. hebetor* and its alternate host rearing. The highest *G. mellonela* larvae (400) were produced in June and september 2024. The lowest *G. mellonela* larvae (190) were produced in March 2024. The total 3430 *G. mellonela* larvae were produced and also a total of 141 wax ball produced. A total of 1271 larvae were used for parasitization in the month of January to December'24. Rest of *G. mellonela* larvae were used for recycling of wax moth.

- **Screening insecticides against termites of sugarcane**

  Saheeplus 505EC, Imituff 20SL, Event 3GR, Chabuk 80WDG, Gharda action 3GR, U-gent 3GR, Enfuran 3GR, Envoy 50SC and Regeant 3GR gave the efficacy 81.62%, 81.62%, 80.42%, 80.74%, 80.74%, 80.85%, 80.31%, 80.63 and 81.73% against termites at Akondobaria Farm, Carew & Co. At Bhabanipur, NBSM insecticides Saheeplus 505EC, Imituff 20SL, Event 3GR, Chabuk 80WDG, Gharda action 3GR, U-gent 3GR, Enfuran 3GR, Envoy 50SC and Regeant 3GR gave the expected efficacy 80.64%, 80.33%, 80.79%, 80.64%, 81.09%, 80.64%, 81.24%, 80.48 and 80.18% respectively against termite.

- **Screening insecticides against top shoot borer of sugarcane**

  Vaygo Super 6GR, Vistara 4GR, Vendora 0.4G, Ballot 4GR, Katrina 0.4 GR and Ferrtera 0.4% GR gave the efficacy (80% and above) against top shoot borer at BSRI experimental farm, Ishwardi and RSRS farm, Thakurgaon.

- **Screening insecticides against stem borer of sugarcane**

  Arotap Plus 50WP, Tulip 50SP, Goal 95SP, Lotus 40WG, Zombi 40WDG, Thioprole 40WDG and Virtako 40WG gave the efficacy (80% and above) against stem shoot borer at BSRI experimental farm, Ishwardi and RSRS farm, Thakurgaon.

- **Screening insecticides against white grub of sugarcane**

  KT Plus 55 WDG, Chamdo 4GR, Spider 5GR, Vendora 0.4G, Oncol 5G and Goolee 3GR showed the efficacy (80% and above 80.00%) against white grubs at RSRS farm, Thakurgaon and Habibpur farm, TSM, Thakurgaon.

- **Screening Bio-Intensive Pest Management (BIPM) Components against Stem Borer**

  The treatment combination of T_5 (Removal of Primary infested cane of stem borer (May-September)+ Detrashing once a month from July to October+ Release of *Trichogramma chilonis* @ 10000 /ha /week from July to October) showed 55.30% effectiveness over control, where T_6 treatment with insecticides Virtako 40 WG @ 300 g ha^{-1} applied in June + July + August gave the satisfactory reduction (80.93%) of stem borer infestation over control.

- **Screening insecticides against mealy bug of sugarcane**

  At BSRI farm, Ishwardi, Pabna the treatments, T_7 (Nitro 505EC @ 4.5 litre ha^{-1} ((July + August + September)) gave highest efficacy of 57.33% over control followed by T_6 (Virtako 40WG @ 300.0 ha^{-1} (July + August + September) which gave 55.30% control of mealy bug infestation. RSRS farm, Thakurgaon, the treatment T_7 showed the highest efficacy of 58.42% over control, followed by T_6 (Virtako 40WG @ 300.0 g ha^{-1} (July + August + September) which gave 54.96% control of mealy bug infestation. At Faridpur Sugar Mill (FSM) farm, the treatments, T_7 Nitro 505EC @ 4.5 litre ha^{-1} (July + August + September) gave highest efficacy of 56.81% over control followed by T_6 (Virtako 40WG @ 300.0 g ha^{-1} (July +

August + September) which gave 53.37% control of mealy bug infestation.

- **Management of varroa mite in honey bee colonies**

  The results revealed that, among the two treatments (application of sugar dust and mite stripes), the highest dead mite population of 51 & 12 and the lowest dead *Apis mellifera* population of 19 & 11 was found in mite stript and sugar dust treated boxes after 15 days of 1st and 2nd application, respectively.

- **Performance of sugar substitutes for honeybee colonies at low cost during offseason and monitoring of its effectiveness**

  The findings indicate that the number of brood cell development varied after the feeding of several types of food substitutes. It was observed that bee colonies that received pumpkin syrup showed a significant increase of 88.90% in the number of brood cells. Colony growth was observed as brood cells developed, with a notable increase of 29.03% in colonies fed with banana syrup. Conversely, colonies fed with rice syrup showed a slight loss of 0.53% in brood cells, while those fed with maize syrup had a more significant decrease of 47.02%. The sugar syrup exhibited the lowest number of brood cells, with a drop of 66.59% compared to other conditions

- **Evaluation of Different Management Approaches against Red Palm Weevil**

  A total of four integrated pest management (IPM) packages, such as (package 1) only pheromone trapping in the garden (March, May, July, September); (package 2) plantation of repellent plant + netting around the garden (February-August) + pheromone trapping (March, May, July, September); (package 3) plantation of repellent plant + netting around the garden (February-August) + pheromone trapping (March, May, July, September) + application of Fipronil (Regent 3GR) in soil; and (package 4) plantation of repellent plant + netting around the garden (February-August) + pheromone trapping (March, May, July, September) + spraying chloropyriphos (Dursban 20 EC) (April and October) were applied in date palm gardens in controlling red palm weevil at four locations in Bangladesh, viz., (i) BSRI farm, Ishwardi, Pabna; (ii) RSRS farm, Gazipur; (iii) Pirozali, Gazipur; and (iv) Goaspur, Pabna. Among the four IPM packages, the significantly lowest population of 7.33, 9.33, 8.00, and 5.33 adults garden^{-1} was found in the gardens treated with package 4 in both locations in September 2024.

SCREENING OF SELECTED SUGARCANE CLONES IN ZTY-I, ZYT-II & ZYT-II FOR RESISTANCE AGAINST SOME MAJOR INSECT PEST IN THE FIELD

Screening of advanced sugarcane clones against major insect pests is a regular work of Entomology division. For this purpose, different clones were planted in the field and recorded the incidence of natural insect pests' for consecutive three years, which is the requirement of the National Seed Board (NSB) as pre-requisite to release a new variety. Our desire is low infestation of all major insect pests against sugarcane which was screened out in natural field condition. Under the natural pest reaction programme, three experiments (ZYT-I, ZYT-II and ZYT-III) were conducted at each locations: i. BSRI farm, Ishwardi and ii. RSRS farm, Thakurgaon during the cropping season 2023-2024. The experiments were conducted with RCB design with 3 replications. The plot size was maintained 5m x 6m. All the test materials were

subjected to natural infestation by Early shoot borer (ESB), Black beetle (BB), Top shoot borer (TSB), Stem borer (SB), Rootstock borer (RSB), Mealy bug (MB), White grub (WG) and Scale insect (SI) etc.

ZYT-I: At BSRI farm, Ishwardi, among eight clones (I 70-19, I 71-19, I 92-19, I 138-19, I 149-19, I 182-19, I 185-19 and I 190-19 and one standard variety (BSRI Akh 46) were used in this experiments. Early shoot borer (ESB) infestation ranged from 1.11 to 7.11%. The highest ESB infestation of 7.11% was found in I 138-19 clone and the lowest of 1.11% in I 190-19 clone. Black beetle (BB) infestation ranged from 6.16 to 19.66%, where the lowest (6.16%) infestation was found in I 182-19 clone followed by I 71-19 (6.99%). Due to top shoot borer, infestation ranged from 4.23 to 8.79%, while the lowest (4.23%) infestation was found in I 182-19 followed by I 138-19 (4.31%) with the highest (8.79%) in I 185-19. Stem borer (stalk basis) infestation ranged from 4.31 to 8.79%, where the lowest (4.31%) infestation was found in I 138-19 followed by I 182-19 (4.23%) with the highest (8.79%) in I 185-19. In case of stem borer internodes basis, infestation ranged from 16.63-30.26% having the lowest (16.63%) infestation in I 138-19 followed by I 185-19 (17.01%) with the highest (30.26%) infestation was found in BSRI Akh 46. Rootstock borer infestation ranged from 20.92-46.02% where, the lowest (20.92%) infestation was found in I 92-19 followed by I 182-19 (24.29%) with the highest (46.02%) infestation was recorded in I 138-19. Mealy bug infestation ranged from 3.73-10.43%. The lowest (3.73%) mealy bug infestation was recorded in I 70-19. Scale insect infestation ranged from 3.14-17.90%, where, the lowest (3.14%) infestation was recorded in I 70-19. Early shoot borer, Top shoot borer and stem borer infestation were not statistically significantly difference among the tested clones (Table 1).

At RSRS Thakurgaon, eight clones (I 70-19, I 71-19, I 92-19, I 138-19, I 149-19, I 182-19, I 185-19 and I 190-19 and one standard variety (BSRI Akh 46) as same as BSRI farm were also used in this experiment. In this location, early shoot borer infestation ranged from 6.94-20.57% in all the test varieties/clones. The lowest (6.54%) infestation was observed in I 92-19. Black beetle infestation was ranged from 16.02-31.92% with the lowest (16.02%) infestation was recorded in I 92-19 and the highest (31.92%) infestation was observed in BSRI Akh 46. No top shoot borer infestation was found only in all tested clones/variety. Stem borer (stalk basis) infestation ranged from 21.48-56.65%, where, the lowest (21.48%) infestation was found in I 149-19 with the highest (56.65%) infestation in I 92-19. In case of stem borer (internode basis), the lowest (13.92%) infestation was found in I 149-19 followed by I 182-19 (14.72%) with the highest (32.47%) in I 190-19. Rootstock borer infestation ranged from 69.91- 100%. The lowest (69.91%) rootstock borer infestation was observed in I 192-19 with the highest (100%) in I 70-19. Mealy bug (MB) infestation ranged from 61.64-87.70%. The lowest (61.64%) MB infestation was found in I 70-19 where as the highest (87.70%) infestation was recorded in I 92-19. The lowest (2.46%) scale insect infestation was observed in I 92-19. White grub (WG) infestation ranged from 0.67-1.67%. The lowest (0.67%) WG infestation was found in I 70-19 where as the highest (1.67%) infestation was recorded in I 185-19 and there was no significant difference among the tested clones/variety (Table 2).

ZYT II: At BSRI, Ishurdi, five clones (I 56-18, I 71-18, I 75-18, I 141-18 and I 182-18) and one standard variety (BSRI Akh 46) were used in this experiment. Early shoot borer infestation ranged from 0.00 to 3.96% in all the test clones/varieties where, no infestation was found in I 182-18. Black

beetle infestation ranged from 4.50-15.39%. The lowest (4.50%) infestation was found in I 75-18 followed by I 182-18 (6.22%) with the highest (15.39%) in I 141-18. Top shoot borer infestation ranged from 1.76 to 5.72%. The lowest (1.76%) infestation was found in BSRI AKh 46 followed by I 71-18 (2.43%) with the highest (5.72%) in I 182-18. Stem borer (stalk basis) infestation ranged from 5.75 to 14.37%, where the lowest infestation (5.75%) was found in I 141-18. Due to stem borer (internode basis), infestation ranged from 14.38 to 22.50% having the lowest (14.38%) infestation was found in I 75-18 with the highest (22.50%) was recorded in BSRI Akh 46. Rootstock borer infestation ranged from 23.88 to 28.23%, where the lowest infestation (23.88%) was found in I 71-18. Mealy bug infestation ranged from 2.74 to 7.22%. Scale insect infestation ranged from 1.52 to 7.47% and the lowest infestation (1.52%) was found in I 56-18 (Table 3).

At RSRS,Thakurgaon, four clones (I 56-18, I 71-18, I 75-18, I 141-18 and I 182-18) and one standard variety (BSRI Akh 46) were also used in this experiment. Early shoot borer infestation ranged from 7.02 to 12.30 % and no statistically difference was found among the clones/varieties. The lowest (7.02%) infestation was observed in I 57-18. Black beetle infestation ranged from 18.59 to 28.74%. The lowest (18.59%) infestation was found in I 57-18. Top shoot borer infestation ranged from 0.0 to 0.94%. The highest (0.94%) infestation was recorded in I 57-18. Stem borer (stalk basis) infestation ranged from 36.73 to 60.41%, the lowest (36.73%) infestation was found in I 141-18 with the highest (60.41%) in BSRI Akh 46. Stem borer (internode basis) infestation ranged from 22.66 to 36.11% and the lowest infestation (22.66) was found in I 141-18. Rootstock borer infestation ranged 90.61 to 97.22%, the lowest (90.61%) rootstock borer infestation was observed in I 141-18, with the highest (97.22%) in I 182-18. Mealy bug infestation ranged from 64.00 to 93.565%, the lowest (64.00%) infestation was found in I 75-18. The lowest (5.68%) scale insect infestation was observed in BSRI Akh 46. White grub infestation ranged from 2.00 to 3.67%, while the lowest infestation (2.00%)was found in I 141-18 (Table 4).

ZYT III: At BSRI, four clones (I 94-16, I 49-17, I 75-17, I 78-17) and one standard variety (BSRI Akh 45) were used in this experiment. ESB infestation was very low and ranged from 1.36 to 2.73%. Black beetle infestation ranged from 4.01 to 9.35%. Due to top shoot borer, infestation ranged from 3.71 to 5.41%. The lowest (3.71%) infestation was found in I 49-17 with the highest (5.41%) in I 75-17. Stem borer (stalk basis) infestation ranged from 6.94 to 9.14 % with the lowest (6.94%) infestation was found in I 75-17, while, the highest (9.14%) infestation was found in I 94-16. Stem borer (internode basis), the lowest (15.28%) infestation was found in I 75-17, with the highest (23.61%) in I 94-16. Rootstock borer infestation ranged from 25.09 to 37.15%, the lowest (25.09%) rootstock borer infestation was observed in I 94-16 with the highest (37.15%) in I 75-17. Mealy bug infestation ranged from 3.31 to 5.09%, the lowest (3.31%) infestation was found in I 94-16. In case of scale insect, the lowest (1.15%) infestation was observed in I 94-16 (Table 5).

At RSRS, Thakurgaon, four clones (I 94-16, I 49-17, I 75-17, I 78-17) and one standard variety (BSRI Akh 45) were also used in this experiment. Early shoot borer infestation ranged from 13.63 to 15.58% in all the test clones/varieties. The lowest (13.63%) infestation was observed in I 75-17. Black beetle infestation ranged from 21.00 to 27.27% with the lowest (21.00%) infestation was recorded in I 78-17 and the highest (27.27%) infestation was observed in I 94-16. Stem borer (stalk basis) infestation

ranged from 29.22 to 52.42% with the lowest (29.22%) infestation was found in (BSRI Akh 45). In case of stem borer (internode basis), the lowest (20.93%) infestation was found in I 49-17 with the highest (32.03%) in I 78-17. Rootstock borer infestation was high which ranging from 85.10 to 96.67%. The lowest (85.10%) rootstock borer infestation was observed in I 78-17 followed by I 94-16 (87.83%) with the highest (96.67%) in in (BSRI Akh 45). Mealy. bug infestation among the test clones/varieties ranged from 58.31 to 76.46%, the lowest (58.31%) infestation was found in I 78-17. White grub infestation ranged from 2.00 to 4.33, the lowest (2.00%) infestation was observed in I 78-17 (Table 6).

Table 1. Infestation levels of major insect pests to promising sugarcane clones (ZYT-I), BSRI farm, Ishwardi, Pabna, 2023-2024

Clones/ Variety	Percent infestation (Mean)							
	ESB	BB	TSB	SB (stalk)	SB (inter-node)	MB	SI	RSB
I 70-19	2.65 ab	11.50 ab	6.55	6.55	17.45	3.73 b	3.14 c	40.83 abc
I 71-19	1.17 b	6.99 b	5.56	5.56	22.37	5.41 b	5.67 bc	31.19 abc
I 92-19	1.74 b	7.18 b	6.22	6.22	23.64	4.31 b	4.34 c	20.92 c
I 138-19	7.11 a	19.66 a	4.31	4.31	16.63	8.01 ab	17.9 a	46.02 a
I 149-19	3.56 ab	9.73 b	4.79	4.79	17.07	6.68 ab	8.18 abc	31.11 abc
I 182-19	1.56 b	6.16 b	4.23	4.23	26.28	3.98 b	3.66 c	24.29 bc
I 185-19	2.13 ab	7.33 b	8.79	8.79	17.01	10.43 a	4.52 c	38.46 abc
I 190-19	1.11 b	7.20 b	8.40	8.40	22.91	4.37 b	3.44 c	31.02 abc
BSRI Akh 46	2.74 ab	14.80 ab	5.08	5.08	30.26	5.40 b	15.85 ab	41.96 ab
LSD (0.05)	9.29	4.67	NS	NS	NS	4.58	11.14	20.35

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect, WG=White grub. Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 2. Infestation levels of some major insect pests to promising sugarcane clones (ZYT-I), RSRS, Thakurgaon, 2023-2024

Clones/ Variety	Percent infestation (Mean)								
	ESB	BB	TSB	SB (stalk)	SB (inter-node)	MB	SI	RSB	WG
I 70-19	11.43 bcd	29.08 ab	0	43.96 ab	24.01 abc	61.64 cd	35.93 ab	100 a	0.67 a
I 71-19	8.51 cd	29.97 ab	0	34.96 ab	21.62 bcd	68.92 bc	10.58 cd	93.94 a	0.67 a
I 92-19	6.94 d	16.02 c	0	56.65 a	24.32 abc	87.70 a	2.46 d	69.91 b	0.67 a
I 138-19	15.62 abc	26.78 ab	0	38.72 ab	28.24 ab	67.31 bc	33.26 b	95.83 a	1.67 a
I 149-19	16. 48 ab	27.05 ab	0	21.48 b	13.92 d	69.36 bc	21.42 bc	100 a	1.00 a
I 182-19	6.95 d	19.85 bc	0	43.21 ab	14.72 d	79.91 ab	7.10 cd	95.83 a	0.67 a
I 185-19	8.87 cd	20.16 bc	0	41.05 ab	18.72 cd	80.88 ab	14.40 cd	92.96 a	1.67 a
I 190-19	15.55 a	29.61 ab	0	34.41 ab	32.47 a	49.49 d	5.20 d	96.3 a	1.33 a
BSRI Akh 46	20.57 a	31.15 a	0.00	50.06 a	30.28 a	67.31 bc	49.25 a	95.83 a	1.67 a
LSD (0.05)	7.16	10.37	NS	NS	27.15	17.38	15.43	17.83	NS

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect. Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 3. Infestation levels of some major insect pests to promising sugarcane clones (ZYT-II), BSRI farm, Ishwardi, Pabna, 2023-2024

Clones/ Variety	Percent infestation (Mean)							
	ESB	BB	TSB	SB (stalk)	SB (inter-node)	MB	SI	RSB
I 56-18	2.79 ab	9.59 ab	4.87 ab	6.60 ab	18.01	2.74 c	1.52 b	28.23
I 71-18	1.34 bc	9.86 ab	2.43 bc	10.48 ab	20.76	3.46 bc	2.85 b	23.883
I 75-18	0.98 bc	4.50 b	2.80 bc	6.09 b	14.38	3.58 bc	2.27 b	27.84
I 141-18	3.96 a	15.39 a	4.78 ab	5.75 b	18.36	4.90 b	2.14 b	27.54
I 182-18	0.00 c	6.22 b	5.72 a	14.37 a	20.48	7.22 a	7.47 a	24.25
BSRI Akh 46	0.97 bc	8.31 b	1.76 c	7.55 ab	22.50	3.46 bc	2.57 b	25.71
LSD (0.05)	2.03	7.08	2.47	7.94	NS	1.93	2.51	NS

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect, WG=White grub. Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 4. Infestation levels of some major insect pests to promising sugarcane clones (ZYT-II), RSRS, Thakurgaon, 2023-2024

Clones/ Variety	Percent infestation (Mean)								
	ESB	BB	TSB	SB (stalk)	SB (inter-node)	MB	SI	RSB	WG
I 56-18	7.02	18.59	0.94	38.92 b	29.07 ab	73.66 ab	56.25 a	92.31	2.67 ab
I 71-18	11.86	28.74	0	46.73 ab	36.11 a	79.12 ab	57.28 a	91.11	2.67 ab
I 75-18	12.30	23.40	0	48.91 ab	26.82 ab	64.00 b	59.08 a	91.11	3.67 a
I 141-18	11.00	25.73	0	36.73 b	22.66 b	76.58 ab	52.24 a	90.61	2.00 b
I 182-18	9.74	23.22	0	56.72 ab	30.57 ab	93.56 a	11.62 b	97.22	2.33 ab
BSRI Akh 46	7.06	20.45	0	60.41 a	33.59 ab	88.21 a	5.68 b	91.67	2.33 ab
LSD (0.05)	NS	NS	NS	20.34	12.54	22.60	21.23	16.46	1.47

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect, WG=White grub. Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 5. Infestation levels of some major insect pests to promising sugarcane clones (ZYT-III), BSRI farm, Ishwardi, Pabna, 2023-2024

Clones/ Variety	Percent infestation (Mean)							
	ESB	BB	TSB	SB (stalk)	SB (inter-node)	MB	SI	RSB
I 94-16	1.48	8.93	4.08	9.14	23.61	3.31 c	1.15	25.097
I 49-17	1.84	4.01	3.71	7.06	16.77	5.09 a	2.82	33.537
I 75-17	2.73	5.08	5.41	6.94	15.28	4.91 ab	2.32	37.157
I 78-17	1.36	8.97	4.21	7.98	17.53	3.40 c	2.44	28.123
BSRI Akh 45	4.11	9.35	3.81	7.73	17.08	3.58 bc	2.33	28.377
LSD (0.05)	NS	NS	NS	NS	NS	1.39	NS	NS

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect. Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 6. Infestation levels of some major insect pests to promising sugarcane clones (ZYT-III), RSRS, Thakurgaon, 2023-2024

Clones/ Variety	Percent infestation (Mean)								
	ESB	BB	TSB	SB (stalk)	SB (inter-node)	MB	SI	RSB	WG
I 94-16	15.58	27.27	0.00 b	37.16 ab	30.23	70.59	4.43 b	87.83 ab	4.33 a
I 49-17	14.46	23.05	0.43 b	38.82 ab	20.93	76.46	18.92 ab	94.45 ab	3.33 ab
I 75-17	13.63	26.47	0.00 b	52.42 a	26.72	71.86	36.95 a	94.19 ab	3.00 ab
I 78-17	15.02	21.00	2.62 a	43.40 ab	32.03	58.31	11.05 ab	85.10 b	2.00 b
BSRI Akh 45	15.12	26.14	0.00 b	29.22 b	24.07	69.83	7.05 b	96.67 a	3.00 ab
LSD (0.05)	NS	NS	2.14	18.49	NS	NS	26.55	10.42	2.23

ESB= Early shoot borer, BB= Black beetle, TSB= Top shoot borer, SB= Stem borer, RSB= Rootstock borer, MB = Mealy bug, SI= Scale insect, WG=White grub. Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

ASSESMENT OF SOME SELECTED BIO-AGENTS AGAINST MAJOR INSECT PEST OF SUGARCROP

In Entomology Divisional Laboratory, *Trichogramma chilonis* and its alternative host *Corcyra cephalonica* and another bio-agent *Bracon hebetor* and its alternative host *Galleria mellonela* were reared continuously. The laboratory have 3 separate rooms, one for *T. chilonis*, one for *C. cephalonica* larvae and *C. cephalonica* moth and another one used as rearing for *Bracon hebetor* & its alternative host *Galleria mellonela. C. cephalonica* reared on ground wheat in plastic trays, eggs of which collected for rearing *T. chilonis.* adults (moths) of rice meal moth would be captured every morning in the emergence room and poured in glass boyams where they mate and lay eggs. These eggs were collected, cleaned and fixed with paper strips (daughter strip). Daughter strips are inserted in a test tube containing a mother strip from which *T. chilonis* parasitoids emerge. New strips were (eggs) parasitized by adult parasitoids and become mother strips within a week. Thus the process was repeated and continued for generations by generations. The excess eggs of *C. cephalonica* are used for recycling of it. The eggs were spread on ground wheat contained in plastic trays. The eggs hatched and larvae feed on ground wheat, they feed and pupates and finally *C. cephalonica* moths emerge and they were collected by test tube.

The highest *C. cephalonica* eggs (47.13 g) were collected from 25025 moths in the month of August 2024. The lowest *C. cephalonica* eggs (8.43 g) were collected from 5400 moths in the month of January 2024. The total (365.28 g) *C. cephalonica* eggs were collected from 176775 moths. Total 51.68 g eggs were used for parasitisation from January to December 2024. Another remaining eggs of *C. cephalonica* were used for recycling of Rice meal moth (Table 7).

Another alternate host larvae of *Galleria mellonella* was reared in artificial diet which made from a combination of wax, milk, sugar, wheat bran, maize bran and yeast in recommended proportion. The emerged larvae were used to parasitize by the *Bracon hebetor*. The 4/5 instars emerged wax moth larvae were kept in plastic boyyams with corrugated paper. About 100 wax moth larvae and 30 pair of male & female *B. hebetor* adult was kept in a single boyyam for parasitization. After 10-14 days, about 1000-1200 *B. hebetor* adult was emerged and ready for field release in sugarbeet. Some adult of *B. hebetor* were used for recycled. This process was repeated for *B. hebetor* and its alternate host rearing.

The highest *G. mellonela* larvae (400) were produced in June and september 2024. The lowest *G. mellonela* larvae (190) were produced in March 2024. The total 3430 *G. mellonela* larvae were produced and also a total of 141 wax ball produced. A total of 1271 larvae were used for parasitization in the month of January to December'24. Rest of *G. mellonela* larvae were used for recycling of wax moth (Table 8).

Table 7. Laboratory activities of *Corcyra cephalonica* rearing at Entomology Division, BSRI, 2024

Months	No. of *Corcyra* moths	*Corcyra* Egg (g)	Amount of eggs (g) for Parasitisation
January'24	5400	8.43	3.00
February'24	9880	24.98	2.86
March'24	21075	33.30	3.33
April'24	14845	28.95	4.18
May'24	8660	21.14	4.40
June'24	6815	22.76	5.20
July'24	20855	40.46	4.40
August'24	25025	47.13	4.73
September'24	18935	45.96	5.50
October'24	16850	36.78	5.50
November'24	16975	31.48	5.17
December'24	11460	23.91	3.41
Total	1,76,775	365.28	51.68

Table 8. Laboratory activities of *Galleria mellonela* rearing at Entomology Division, BSRI, 2024

Months	No. of wax ball produced	No. of larvae produced	No. of larvae for Parasitisation
January'24	10	200	110
February'24	9	250	120
March'24	11	190	99
April'24	10	200	105
May'24	13	350	110
June'24	14	400	120
July'24	15	350	150
August'24	20	370	100
September'24	10	400	90
October'24	11	250	85
November'24	10	240	90
December'24	8	230	92
Total	141	3430	1271

EVALUATION OF NEW MOLECULES FOR THE MANAGEMENT OF SOME MAJOR INSECT PESTS OF SUGARCANE

Evaluation of different insecticides in controlling Termites of sugarcane

The experiments were conducted at Akondobaria farm, Carew & Co. and Bhabanipur farm, Noth Bengal Sugarmill (NBSM). The experiments were laid out in RCB design with 3 replications. The plot size was 6m x 6m in both locations. Insecticides were applied in the trenches at planting + March + April as per treatments during the cropping season 2023-2024. Sugarcane variety Isd 37 was used as planting materials at both locations. A total of 16 insecticides were used as treatments including one control. All the intercultural operations were done as per schedule. Fertilizer was applied according to the Fertilizer Recommendation Guide (FRG)-2018. Irrigation was applied according to the requirement of the experiment. Data on termite population were collected (2 times) in whole cropping season.

Results presented in Table 9 showed that among the insecticides, Saheeplus 505EC, Imituff 20SL, Event 3GR, Chabuk 80WDG, Gharda action 3GR, U-gent 3GR, Enfuran 3GR, Envoy 50SC and Regeant 3GR gave the expected efficacy 81.62%, 81.62%, 80.42%, 80.74%, 80.74%, 80.85%, 80.31%, 80.63 and 81.73% against termites at Akondobaria Farm, Carew & Co. during 2023-2024, where Regeant 3GR was used as standard treatment (Table 9).

Similarly at Bhabanipur, Noth Bengal Sugarmill (NBSM) during 2023-2024, insecticides Saheeplus 505EC, Imituff 20SL, Event 3GR, Chabuk 80WDG, Gharda action 3GR, U-gent 3GR, Enfuran 3GR, Envoy 50SC and Regeant 3GR gave the expected efficacy 80.64%, 80.33%, 80.79%, 80.64%, 81.09%, 80.64%, 81.24%, 80.48 and 80.18% respectively against termite, where Regent 3GR was used as standard and showed the efficacy at 80.18% (Table 10).

Evaluation of different insecticides in controlling sugarcane top shoot borer

This experiment was conducted at two locations, one at BSRI experimental farm, Ishwardi and another at RSRS farm, Thakurgaon during the cropping season 2023-2024. Variety BSRI Akh 45 was used as planting material in both locations. The

experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. There were seventeen (17) treatments including one control. The plot size was 6mx6m in both locations. Chemicals were applied as per schedule in March and May. All the intercultural operations were done timely. Fertilizers were applied as per FRG-2018. Level of infestation in treated and untreated plots was compared and percent efficacy was computed. Data on yield were taken at harvest. Result presented in Table 11 and 12 showed that among the insecticides, Vaygo Super 6GR, Vistara 4GR, Vendora 0.4G, Ballot 4GR, Katrina 0.4 GR and Ferrtera 0.4% GR gave the expected efficacy (80% and above) against top shoot borer at both locations.

Evaluation of different insecticides in controlling sugarcane stem borer

This experiment was conducted at two locations, one at BSRI experimental farm, Ishwardi and another at RSRS farm, Thakurgaon during the cropping season 2023-2024. Variety BSRI Akh 45 was used as planting material in both locations. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. There were seventeen (17) treatments including one control. The plot size was 6m x 6m in both locations. Chemicals were applied as per schedule in June, July and august. All the intercultural operations were done timely. Fertilizers were applied as per FRG-2018. Level of infestation in treated and untreated plots was compared and percent efficacy was computed. Data on yield were taken at harvest. Result presented in Table 13 and 14 showed that among the insecticides, Arotap Plus 50WP, Tulip 50SP, Goal 95SP, Lotus 40WG, Zombi 40WDG, Thioprole 40WDG and Virtako 40WG gave the expected efficacy (80% and above) against stem shoot borer at both locations, where Virtako 40WG was used as standard (Table 13 and 14)

Evaluation of different insecticides in controlling white grub of sugarcane

This experiment was conducted at two locations, one at RSRS farm, Thakurgaon and another at Habibpur farm, TSM, Thakurgaon during the cropping season 2023-2024. Variety Isd 37 was used as planting material in both locations. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. There were eight (8) treatments including one control. The plot size was 6m x 6m in both locations. Chemicals were applied as per schedule in March and April. All the intercultural operations were done timely. Fertilizers were applied as per FRG-2018. Level of infestation in treated and untreated plots was compared and percent efficacy was computed.

Results presented in Table 15 and 16 showed that among the tested insecticides, KT Plus 55 WDG, Chamdo 4GR, Spider 5GR, Vendora 0.4G, Oncol 5G and Goolee 3GR showed the expected efficacy (80% and above 80.00%) against white grubs in both locations, where Goolee 3GR was used as standard (Table 15 and 16).

Table 9. Effects of different insecticides in controlling Termites of sugarcane at Akondobaria farm, Carew & Co., 2023-2024

Treatments	TM Population (Mean)			
	1st data	2nd data	Pooled data	% increase over control
T_1 - Saheeplus 505EC@2.25L a.i/ha at Planting March + April	30.33 b	25.67 b	28.00	81.62
T_2 - Imituff 20SL @ 200mL a.i/ha in Planting + March + April	31 b	25 b	28.00	81.62
T_3 - Halaku 50EDG @ 250g a.i/ha in Planting + March + April	36.33 b	29.33 b	32.83	78.45
T_4 - Event 3GR @ 50g a.i/ha in Planting + March + April	30.67 b	29 b	29.83	80.42
T_5 - Pogotin 5SG @ 100gL a.i/ha in Planting + March + April	44 b	37.33 b	40.67	73.30
T_6 - Chabuk 80WDG @ 200g a.i/ha in Planting + March + April	29.67 b	29 b	29.33	80.74
T_7 - Tasin 60WPC @ 800g a.i/ha in Planting + March + April	45 b	41.33 b	43.17	71.66
T_8 - Gharda action 3GR @ 50g a.i/ha in Planting + March + April	30 b	28.67 b	29.33	80.74
T_9 - Amphan 80WG @ 160g a.i/ha in Planting + March + April	48 b	41.67 b	44.83	70.57
T_{10} - Leader 2.5E @ 10ml a.i/ha in Planting + March + April	43.67 b	45 b	44.33	70.90
T_{11} - Pentap 50SP @ 150g a.i/ha in Planting + March + April	49.33 b	37.33 b	43.33	71.55
T_{12} - U-gent 3GR @ 50g a.i/ha in Planting + March + April	30 b	28.33 b	29.17	80.85
T_{13} - Enfuran 3GR @ 50g a.i/ha in Planting + March + April	30.67 b	29.33 b	30.00	80.31
T_{14} - Agrimeetin 5WSG @ 100g a.i/ha in Planting + March + April	47 b	34.67 b	40.83	73.19
T_{15} - Envoy 50SC @ 1L a.i/ha in Planting + March + April	31 b	28 b	29.50	80.63
T_{16} -Regeant 3GR @ 50g a.i/ha in Planting + March + April (Standard)	29.33 b	26.33 b	27.83	81.73
T_0 - Control (untreated)	157.33 a	147.33 a	152.33	0.00
LSD (0.05)	24.98	23.30	-	-

Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 10. Effects of different insecticides in controlling Termites of sugarcane at Bhabanipur farm, NBSM 2023-2024

Treatments	TM Population (Mean)			
	1st data	2nd data	Pooled data	% increase over control
T_1 - Saheeplus 505EC@2.25L a.i/ha at Planting March + April	26.33 b	16.33 bc	21.33	80.64
T_2 - Imituff 20SL @ 200mL a.i/ha in Planting + March + April	26.67 b	16.67 bc	21.67	80.33
T_3 - Halaku 50EDG @ 250g a.i/ha in Planting + March + April	34.33 b	25 bc	29.67	73.07
T_4 - Event 3GR @ 50g a.i/ha in Planting + March + April	25.33 b	17 bc	21.17	80.79
T_5 - Pogotin 5SG @ 100gL a.i/ha in Planting + March + April	35 b	24 bc	29.50	73.22
T_6 - Chabuk 80WDG @ 200g a.i/ha in Planting + March + April	26.33 b	16.33 bc	21.33	80.64
T_7 - Tasin 60WPC @ 800g a.i/ha in Planting + March + April	35 b	28.33 bc	31.67	71.26
T_8 - Gharda action 3GR @ 50g a.i/ha in Planting + March + April	26 b	15.67 c	20.83	81.09
T_9 - Amphan 80WG @ 160g a.i/ha in Planting + March + April	35 b	28 bc	31.50	71.41
T_{10} - Leader 2.5E @ 10ml a.i/ha in Planting + March + April	34 b	19.33 bc	26.67	75.79
T_{11} - Pentap 50SP @ 150g a.i/ha in Planting + March + April	40.33 b	31 b	35.67	67.62
T_{12} - U-gent 3GR @ 50g a.i/ha in Planting + March + April	25.67 b	17 bc	21.33	80.64
T_{13} - Enfuran 3GR @ 50g a.i/ha in Planting + March + April	25.33 b	16 c	20.67	81.24
T_{14} - Agrimeetin 5WSG @ 100g a.i/ha in Planting + March + April	32.67 b	22.33 bc	27.50	75.04
T_{15} - Envoy 50SC @ 1L a.i/ha in Planting + March + April	26.33 b	16.67 bc	21.50	80.48
T_{16} - Regeant 3GR @ 50g a.i/ha in Planting + March + April (Standard)	26.67 b	17 bc	21.83	80.18
T_0 - Control (untreated)	133.67 a	86.67 a	110.17	0.00
LSD (0.05)	24.14	14.94	-	-

Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 11. Effects of different insecticides in controlling top shoot borer (TSB) of sugarcane at BSRI farm 2023-2024

Treatments (Insecticides)	TSB infestation		Mean infestation	% effectiveness over control
	1st data	2nd data		
T_1 - Vaygo Super 6GR @ 80 g a.i/ha (2nd Year)	8.34 de	6.56 c	7.45	83.24
T_2 - KT Plus 55 WDG @ 1.25kg a.i/ha at March + May (2nd Year)	13.07 bc	9.80 bc	11.43	74.29
T_3 - Camdo 4GR @80g a.i/ha at March + May (2nd Year)	11.59 cde	10.60 bc	11.09	75.05
T_4 - Protirodh 5 GR @ 800g a.i/ha at March + May (2nd year)	11.48 cde	10.39 bc	10.94	75.41
T_5 - Purdacloprid 70WA @300 g a.i/ha May (2nd year)	12.61 bcde	11.60 bc	12.11	72.77
T_6 - M-Furan 5GR @ 1.40kg a.i/ha at March + May (1st Year)	11.71 cde	11.25 bc	11.48	74.19
T_7 - Vistara 4GR @ 80g a.i/ha at March + May (1st Year)	7.93 e	8.37 bc	8.15	81.68
T_8- Vendora 0.4G @ 80g a.i/ha at March + May (1st Year)	8.20 e	7.43 c	7.81	82.43
T_9 - Imagine 10SC @ 100ml a.i/ha at March + May (1st Year)	12.94 bcd	11.58 bc	12.26	72.43
T_{10} - Monotaf 50WDG @3g/L a.i/ha at March + May (1st Year)	12.27 cde	12.69 bc	12.48	71.94
T_{11} - Ballot 4GR @ 80g a.i/ha at March + May (1st Year)	8.08 e	6.93 c	7.51	83.12
T_{12} - Spider 5GR @ 1.4kg a.i/ha at March + May (1st Year)	13.71 bc	15.00 b	14.36	67.71
T_{13} - Tecorel 18.5SC@ 700 ml a.i/ha at March + May (1st Year)	17.12 b	11.36 bc	14.24	67.99
T_{14} - Zia M 5 GR @ 1.4kg a.i/ha at March + May (1st Year)	13.27 bc	10.66 bc	11.97	73.09
T_{15} - Power XL 18.5 SL @ 80g a.i/ha at March+ May (1st Year)	13.36 bc	11.02 bc	12.19	72.59
T_{16} - Katrina 0.4 GR @ 80 g a.i/ha at March+ May (1st Year)	8.32 de	7.61 c	7.96	82.09
T_{17} - Ferrtera 0.4% GR @ 80 g a.i/ha at March + May (Std.)	8.28 de	9.02 bc	8.65	80.54
T_0 - Control	41.74 a	47.20 a	44.47	0.00
LSD (0.05)	4.71	6.76	-	-

Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 12. Effects of different insecticides in controlling top shoot borer (TSB) of sugarcane at RSRS Thakurgaon during 2023-2024

Treatments (Insecticides)	TSB infestation		Mean infestation	%effectiveness over control
	1st data	2nd data		
T_1 - Vaygo Super 6GR @ 80g a.i/ha (2 nd Year)	6.01 cde	6.317 cde	6.16	80.92
T_2 - KT Plus 55 WDG @ 1.25kg a.i/ha at March + May (2nd Year)	10.98 bcd	11.047 b	11.01	65.90
T_3 - Camdo 4GR @80g a.i/ha at March + May (2nd Year)	12.61 b	9.667 bc	11.14	65.51
T_4 - Protirodh 5 GR @ 800g a.i/ha at March + May (2nd year)	9.82 bcde	9.443 bcd	9.63	70.17
T_5 - Purdacloprid 70WA @300g a.i/ha May (2nd year)	12.38 b	10.59 b	11.48	64.44
T_6 - M-Furan 5GR @ 1.40kg a.i/ha at March + May (1st Year)	10.47 bcde	9.717 b	10.09	68.75
T_7 - Vistara 4GR @ 80g a.i/ha at March + May (1st Year)	5.66 de	6.24 de	5.95	81.58
T_8 - Vendora 0.4G @ 80g a.i/ha at March + May (1st Year)	6.04 cde	6.18 de	6.11	81.08
T_9- Imagine 10SC @ 100ml a.i/ha at March + May (1st Year)	11.50 bc	10.92 b	11.21	65.29
T_{10} - Monotaf 50WDG @3g/L a.i/ha at March + May (1st Year)	11.00 bcd	10.247 b	10.63	67.10
T_{11} - Ballot 4GR @ 80g a.i/ha at March + May (1st Year)	4.89 bcde	6.06 e	5.48	83.05
T_{12} - Spider 5GR @ 1.4kg a.i/ha at March + May (1st Year)	12.14 b	12.363 b	12.25	62.07
T_{13} - Tecorel 18.5SC@ 700 ml a.i/ha at March + May (1st Year)	11.99 b	11.757 b	11.87	63.23
T_{14} - Zia M 5 GR @ 1.4kg a.i/ha at March + May (1st Year)	11.07 bcd	11.243 b	11.16	65.46
T_{15} - Power XL 18.5 SL @ 80g a.i/ha at March+ May (1st Year)	9.65 bcde	9 bcde	9.33	71.13
T_{16} - Katrina 0.4 GR @ 80g a.i/ha at March+ May (1st Year)	5.79 de	6.253 de	6.02	81.36
T_{17} - Ferrtera 0.4% GR @ 80g a.i/ha at March + May (Std.)	5.85 de	6.337 cde	6.09	81.13
T_0 - Control	31.96 a	32.627 a	32.30	0.00
LSD (0.05)	5.65	3.38	-	-

Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 13. Effects of different insecticides in controlling stem borer of sugarcane at BSRI farm 2023-2024

Treatments	% SB Infestation		Mean population	%Effectiveness over control
	1st data	2nd data		
T_1: Genodam 10GR @ 2.5kg a.i/ha at June +July + August	6.52 bc	6.55 cde	6.53	62.47
T_2: Arotap Plus 50WP @ 500g a.i/ha at June +July + August	2.26 d	4.37 de	3.31	80.97
T_3: Tulip 50SP @ 500g a.i/ha at June +July + August (1st year)	2.27 d	4.38 de	3.33	80.90
T_4: Proper 80WDG @ 240g a.i/ha at June +July + August	7.97 bc	8.53 bc	8.25	52.62
T_5 Hasudin 10GR @ 2.5kg a.i/ha at June +July + August (1st year)	7.55 bc	7.01 bcd	7.28	58.18
T_6: World sudin 10GR @ 2.5kg a.i/ha at June +July + August	7.94 bc	8.07 bc	8.00	54.03
T_7: JN-sudin 10GR @2.5kg a.i/ha at June +July + August	6.81 bc	7.71 bc	7.26	58.29
T_8: Samasudin 10GR @ 2.5kg a.i/ha at June +July + August	7.13 bc	9.45 b	8.29	52.36
T_9: Goal 95SP @ 760 a.i/ha at June +July + August (1st year)	2.28 d	4.32 de	3.30	81.04
T_{10}: X-furan 5GR @ 1.4kg a.i/ha	5.92 bc	8.22 bc	7.07	59.40
T_{11}: Oncol 5G @ 600g a.i /ha	8.35 b	7.41 bc	7.88	54.73
T_{12}: Dhumketu 5GR @ 1.4kg a.i /ha	8.13 bc	7.54 bc	7.83	55.00
T_{13}: Haliyar 5GR@ 1.4kg a.i /ha	5.70 c	5.97 cde	5.84	66.47
T_{14}: Lotus 40WG@ 120g a.i /ha	2.29 d	4.36 de	3.33	80.90
T_{15}: Zombi 40WDG@ 120g a.i /ha	1.82 d	4.25 de	3.04	82.56
T_{16}: Thioprole 40WDG @ 120g a.i /ha	1.65 d	4.13 e	2.89	83.40
T_{17}: Virtako 40WG @ 120g/ha (June +July + August) (Standard)	1.25 d	4.40 de	2.83	83.77
T_0: Control	12.70 a	22.12 a	17.41	0.00
LSD (0.05)	2.57	2.87	-	-

Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 14. Effects of different insecticides in controlling Stem borer of sugarcane at Thakugaon farm 2023-2024

Treatments	% SB Infestation		Mean population	%Effectiveness over control
	1st data	2nd data		
T_1: Genodam 10GR @ 2.5kg a.i/ha at June +July + August	17.85 b	54.017 b	35.93	45.93
T_2: Arotap Plus 50WP @ 500g a.i/ha at June +July + August	7.44 d	18.327 c	12.89	80.61
T_3: Tulip 50SP @ 500g a.i/ha at June +July + August (1st year)	7.47 d	18.377 c	12.93	80.55
T_4: Proper 80WDG @ 240g a.i/ha at June +July + August	18.72 b	56.227 b	37.47	43.61
T_5: Hasudin 10GR @ 2.5kg a.i/ha at June +July + August (1st year)	15.49 bc	57.53 b	36.51	45.07
T_6: World sudin 10GR @ 2.5kg a.i/ha at June +July + August	16.75 bc	62.237 b	39.49	40.58
T_7: JN-sudin 10GR @2.5kg a.i/ha at June +July + August	18.95 b	56.07 b	37.51	43.56
T_8: Samasudin 10GR @ 2.5kg a.i/ha at June +July + August	16.02 bc	59.217 b	37.62	43.40
T_9: Goal 95SP @ 760 a.i/ha at June +July + August (1st year)	7.25d	16.967 c	12.11	81.78
T_{10}: X-furan 5GR @ 1.4kg a.i/ha	12.99 c	62.71 b	37.85	43.05
T_{11}: Oncol 5G @ 600g a.i /ha	17.21 bc	56.477 b	36.84	44.56
T_{12}: Dhumketu 5GR @ 1.4kg a.i /ha	18.04b b	49.92 b	33.98	48.87
T_{13}: Haliyar 5GR@ 1.4kg a.i /ha	14.89 bc	51.397 b	33.15	50.13
T_{14}: Lotus 40WG@ 120g a.i /ha	7.33 d	17.24 c	12.29	81.51
T_{15}: Zombi 40WDG@ 120g a.i /ha	6.46 d	18.167 c	12.31	81.47
T_{16}: Thioprole 40WDG @ 120g a.i /ha	6.73 d	18.593 c	12.66	80.95
T_{17}: Virtako 40WG @ 120g/ha (June +July + August) (Standard)	7.15d	18.86 c	13.01	80.43
T_0: Control	38.26 a	94.663 a	66.46	0.00
LSD (0.05)	4.80	16.92	-	-

Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 15. Effects of different insecticides in controlling White grubs of sugarcane In RSRS, Thakurgaon, 2023-2024

Treatments	% White grubs population (Mean)			
	1st data	2nd data	Pooled data	% increase over control
T_1- KT Plus 55 WDG @ 1.25kg a.i/ha at March+April	2.67 c	4.33 bc	3.50	83.33
T_2- Chamdo 4GR @ 600g a.i/ha at March+April	2.33 c	4.00 c	3.17	84.92
T_3- Chothin 50WDG @ 1.5kg a.i/ha at March+April	5.00 b	8.00 b	6.50	69.05
T_4- Spider 5GR @ 1.4kg a.i/ha at March+April	2.33 c	4.33 bc	3.33	84.13
T_5- Vendora 0.4G @ 40g a.i/ha at March+April	3.33 c	3.67 c	3.50	83.33
T_6- Oncol 5G @ 600g a.i/ha at March+April	3.33 c	4.33 bc	3.83	81.75
T_7- Goolee 3GR @ 50g a.i/ha at March+April	2.33 c	3.00 c	2.67	87.30
T_0 – Control (untreated)	15.67 a	26.33 a	21.00	0.00
LSD (0.05)	1.46	3.70	-	-

Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 16. Effects of different insecticides in controlling White grubs of sugarcane at Habibpur Farm, Thakurgaon, 2023-2024

Treatments	% White grubs population (Mean)			
	1st data	2nd data	Pooled data	% increase over control
T_1 - KT Plus 55 WDG @ 1.25kg a.i/ha at March + April	3.33 bc	3.67 c	3.56	82.79
T_2 - Chamdo 4GR @ 600g a.i/ha at March+April	2.00 c	4.00 c	3.00	85.25
T_3 - Chothin 50WDG @ 1.5kg a.i/ha at March+April	5.00 b	8.00 b	6.50	68.03
T_4 - Spider 5GR @ 1.4kg a.i/ha at March+April	2.33 c	3.33 c	2.83	86.07
T_5 - Vendora 0.4G @ 40g a.i/ha at March+April	3.00 bc	3.00 c	3.00	85.25
T_6 - Oncol 5G @ 600g a.i/ha at March+April	2.00 c	3.33 c	2.67	86.89
T_7 - Goolee 3GR @ 50g a.i/ha at March+April	2.33 c	3.67 c	3.00	85.25
T_0 - Control (untreated)	17.67 a	23.00 a	20.33	0.00
LSD (0.05)	2.04	3.26	-	-

Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

INTEGRATION OF BIO-INTENSIVE PEST MANAGEMENT (BIPM) COMPONENTS AGAINST SUGARCANE STEM BORER

The experiment was carried out at BSRI experimental farm, Ishwardi, Pabna during the cropping season 2023-2024. The plot size was 6m x 6m. Plot to plot distance was 1m and block to block distance was 2m. All the treatments were applied as per schedule. All types of intercultural operations were done timely. Data on stem borer infestation were taken in the month of July to October.

Results presented in Table 17 showed that the treatment combination of T_5 showed 55.30% effectiveness over control, where T_6 treatment with insecticides Virtako 40 WG @ 300 g ha^{-1} applied in June + July + August gave the satisfactory reduction (80.93%) of stem borer infestation over control among all the treatments (Table 17).

Table 17. Efficacy of different BIPM techniques against sugarcane stem borer, BSRI farm, Ishwardi, Pabna during 2023-2024

Treatments	% SB Infestation		Mean population	% Effectiveness over control
	1st data	2nd data		
T_1: Removal of Primary infested cane of stem borer (May-September)	24.58 b	18.42 b	21.50	27.60
T_2: T_1 + Detrashing once a month from July to October	24.08 b	16.42 bc	20.25	31.81
T_3: Release of *Trichogramma chilonis* @ 10000 /ha/week from July to October	17.65 c	15.22 bcd	16.44	44.65
T_4: T_2 +T_3	16.72cd	14.08 cd	15.40	48.13
T_5: T_2 +T_3 + T_4	14.07 d	12.47 d	13.27	55.30
T_6: Virtako Plus 40 WG @ 300g/ha (June +July + August)	6.25 e	5.07 e	5.66	80.93
T_0: Control	31.70 a	27.69 a	29.70	0.00
LSD (0.05)	3.34	3.43	-	-

BIO-EFFICACY OF INSECTICIDES AGAINST THE INCIDENCE OF SUGARCANE MEALY BUG

The experiment was carried out at three locations i) BSRI experimental farm, Ishwardi, Pabna and ii) RSRS farm, Thakurgaon and Faridpur Sugar Mill (FSM) farm during the cropping season 2023-2024. The plot size was 6m x 6m. Plot to plot distance was 1m and block to block distance was 2m. There were eight (8) treatments including one control. All the treatments were applied as per schedule. All types of intercultural operations were done timely. Data on stem borer infestation were taken in the month of July to September.

At BSRI farm, Ishwardi, Pabna result showed that among the treatments, T_7 (Nitro 505EC @ 4.5 litre ha^{-1} (July + August + September) gave highest efficacy of 57.33% over control followed by T_6 (Virtako 40WG @ 300.0 gm ha^{-1} (July + August + September)) which gave 55.30% control of mealy bug infestation (Table 18).

RSRS farm, Thakurgaon, the result presented that the treatment T_7 showed highest efficacy of 58.42% effectiveness over control, followed by T_6 (Virtako 40WG @ 300.0 g ha^{-1} (July + August + September)) which gave 54.96% control of mealy bug infestation (Table 19).

At Faridpur Sugar Mill (FSM) farm, result showed that among the treatments, T_7 (Nitro 505EC @ 4.5 litre ha^{-1} (July + August + September) gave highest efficacy of 56.81% over control followed by T_6 (Virtako 40WG @ 300.0 g ha^{-1} (July + August + September)) which gave 53.37 % control of mealy bug infestation (Table 20).

Table 18. Effects of different insecticides in controlling Mealybug (MB) of sugarcane at BSRI farm 2023-2024

Treatments (Insecticides)	MB in festation		Mean infestation	% effectiveness over control
	1st data	2nd data		
T_1 : Plantation with Mealybug insect free setts	11.80 b	18.90 b	15.35	25.01
T_2 : Sett dipping in Chlorantraniliprole 18.5 SC for 30 minutes before plantation	10.35 bc	16.25 b	13.30	35.03
T_3 : Emamectin benzoate (Proclaim 5 SG) @ 1.0 g/ 1 litre of water (July + August + September)	8.48 cd	13.05 c	10.77	47.41
T_4 : Spinosad 45 SC (Tracer) @ 0.50 ml/LW ((July + August + September)	7.85 d	12.55 c	10.20	50.17
T_5 : Regent 3GR (Fipronil) @ 16.66kg ha^{-1} (July + August + September)	7.55 d	11.98 c	9.77	52.30
T_6 : Virtako 40WG @ 300.0 g ha^{-1} (July + August + September)	7.15 d	11.15 c	9.15	55.30
T_7 : Nitro 505EC @ 4.5 litre ha^{-1} ((July + August + September)	6.95 d	10.52 c	8.74	57.33
T_0 : Control (untreated)	15.60 a	25.34 a	20.47	0.00
LSD (0.05)	2.35	2.84	-	-

Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 19. Effects of different insecticides in controlling Mealybug (MB) of sugarcane at Thakurgaon farm 2023-2024

Treatments (Insecticides)	MB infestation		Mean infestation	% effectiveness over control
	1st data	2nd data		
T_1 : Plantation with Mealybug insect free setts	22.52 b	60.19 b	41.36	24.71
T_2 : Sett dipping in Chlorantraniliprole 18.5 SC for 30 minutes before plantation	19.65 b	51.98 c	35.82	34.79
T_3 : Emamectin benzoate (Proclaim 5 SG) @ 1.0 g/ 1 litre of water (July + August + September)	16.12 c	41.52 d	28.82	47.53
T_4 : Spinosad 45 SC (Tracer) @ 0.50 ml/LW ((July + August + September)	15.11 cd	39.57 de	27.34	50.22
T_5 : Regent 3GR (Fipronil) @ 16.66kg ha^{-1} (July + August + September)	14.41 cd	37.93 ef	26.17	52.35
T_6 : Virtako 40WG @ 300.0 g ha^{-1} (July + August + September)	13.52 cd	35.96 fc	24.74	54.96
T_7 : Nitro 505EC @ 4.5 litre ha^{-1} ((July + August + September)	12.56 d	33.12 c	22.84	58.42
T_0 : Control (untreated)	29.49 a	80.36 a	54.93	0.00
LSD (0.05)	3.45	3.46	-	-

Means within the same column followed by the same letter (s) are not significantly different at 5% level according to LSD test.

Table 20. Effects of different insecticides in controlling Mealybug (MB) of sugarcane at FSM farm 2023-2024

Treatments (Insecticides)	MB infestation		Mean infestation	% effectiveness over control
	1st data	2nd data		
T_1 : Plantation with Mealybug insect free setts	34.28 b	34.98 b	34.63	23.60
T_2 : Sett dipping in Chlorantraniliprole 18.5 SC for 30 minutes before plantation	29.97 b	30.23 bc	30.10	33.20
T_3 : Emamectin benzoate (Proclaim 5 SG) @ 1.0 g/ 1 litre of water (July + August + September)	24.12 c	24.12 cd	24.12	46.24
T_4 : Spinosad 45 SC (Tracer) @ 0.50 ml/LW ((July + August + September)	22.98 c	23.32 cd	23.15	48.78
T_5 : Regent 3GR (Fipronil) @ 16.66kg ha^{-1} (July + August + September)	21.74 c	22.32 d	22.03	51.55
T_6 : Virtako 40WG @ 300.0 g ha^{-1} (July + August + September)	20.92 c	20.78 d	20.85	53.37
T_7 : Nitro 505EC @ 4.5 litre ha^{-1} ((July + August + September)	19.38 c	19.36 d	19.37	56.81
T_0 : Control (untreated)	44.87 a	47.03 a	45.95	0.00
LSD (0.05)	5.59	7.81	-	-

MANAGEMENT OF VARROA MITE IN HONEY BEE, *Apis mellifera* COLONIES

The experiment was conducted in Bio-control Lab., Entomology Division, BSRI, Ishwardi, Pabna and honey grower's apiary, Pabna from December, 2023 to January, 2024. Two treatments were applied to manage *Varroa* mite. Each treatment applied after 15 days interval. Each honeybee rearing box was treated with different treatment and the number of dead/fallen mites on the thick white paper sheet at bottom of the hives were used to determine the mite mortality.

The tested treatments were applied and dead mite data was collected next day. Among the tested treatments, the highest dead mite (51) numbers in the bottom brood applied at Mite Strips compared to sugar dust (46). In case of dead *Apis*, the highest 185 numbers dead *Apis mellifera* in mite strips compared to sugar dust only 19 number in the honey bee colony from 1st application data. During 2nd application data, the highest dead mite (8) numbers in the bottom brood applied at sugar dust compared to Mite Strips (4). In case of dead *A. mellifera*, the highest 156 numbers dead *A. mellifera* in mite strips compared to sugar dust only 11 number in the honey bee colony. Another infested colony was selected and dead mite data was collected. In that case 31 number of dead mite was found in 1st application data compared to 78 numbers was found in 2nd data. Morality rate of *A. mellifera* was 24 in 1st data and 41 in 2nd data (Table 21).

Table 21. Effects of different treatments in controlling *Varroa* mite at BSRI Apiary, Ishwardi during 2023-2024

Treatments	Dead Mite in Bottom brood		Difference between Application	Dead *Apis mellifera*		Percent Increase/ decrease over time
	1st Application	2nd Application		1st Application	2nd Application	
Sugar Dust	46	8	17.39	19	11	57.89
Mite Strips	51	12	23.53	185	156	84.32
Control (Untreated)	31	78	251.61	24	41	170.83

CONTROLLING SMALL HIVE BEETLE IN HONEYBEE, *Apis mellifera* COLONIES

The field experiment was conducted in Bio-control Lab., Entomology Division, BSRI, Ishwardi, Pabna and honey grower's apiary, Pabna. *Apis mellifera* species was reared whole the cropping season. Data was collected for 4 time a month from 15 July, 2024 to 15 August, 2024. Five different treatments (T_1: Manually clean Bee box once a week; T_2: Tobacco Dust @ 10 g/box; T_3: Sulphur @ 5g/box; T_4: CD cover trap @ 1/box; T_5: Top bar trap; T_6: Combination of T_1+ T_2+T_3+T_4+T_5) were applied to manage small hive beetle. Each treatment was repeated after seven days interval. After treatment application the adult small hive beetle was counted from each hive.

The tested treatment was applied and the data was collected once a week up to 1 month. Dead adult small hive beetle (SHB) was collected after treatment application. From the 1st and 2nd week data it shows that combination of T_1+ T_2+T_3+T_4+T_5 treatment difference is 37.50% which means this treatment is most effective to control adult of small hive beetle. After four week this difference was 4.17% which defines T_6 treatment can manage adult SHB. T_4 and T_5 treatments are two traps to collect adult SHB. From the 1st and 2nd week data it shows that T_4 treatment difference is 75% and T_5 treatment difference is 125% which means T_4 treatment can manage very minimum to catch SHB and T_5 treatments can't manage adult SHB. It catches more SHB than 1st week. After 4th week this difference was 87.50% and 58.33% respectively in T_4 and T_5 treatment. Use of tobacco dust and sulphur also effective in respect of managing adult SHB. 1st and 2nd week data shows that difference was T_2 (55.56%) and T_3 (42.86%). After 4th week data this difference was minimum that is 16.67% and 14.29% respectively. Lastly only Manually cleaning the box was effective to manage adult SHB. 1st and 2nd week data shows that difference was 82.35% and after 4th week data the difference was more that is 94.12% (Table 22).

Table 22. Effects of different management practices in controlling small hive beetle of BSRI Apiary, Ishwardi, 2023-2024

Treatments	Dead adult small hive beetle						
	1st week	2nd week	Difference % between Week	3rd Week	Difference% between 1st and 3rd Week	4th Week	Difference % between 1st and 4th Week
T_1: Manually clean Bee box once a week	17	14	82.35	19	111.76	16	94.12
T_2: Tobacco Dust @ 10 g/box	18	10	55.56	8	44.44	3	16.67
T_3: Sulphur @ 5g/box	21	9	42.86	6	28.57	3	14.29
T_4: CD cover trap @ 1/box	8	6	75.00	9	112.50	7	87.50
T_5: Top bar trap	12	15	125.00	8	66.67	7	58.33
T_6: Combination of T_1+ T_2+T_3+T_4+T_5	24	9	37.50	2	8.33	1	4.17

PERFORMANCE OF SUGAR SUBSTITUTES FOR HONEYBEE COLONIES AT LOW COST DURING OFFSEASON AND MONITORING OF ITS EFFECTIVENESS

The experimental study was conducted at the apiary laboratory of Bangladesh Sugarcrop Research Institute (BSRI), located in Ishwardi, Pabna, Bangladesh, during the dearth period of July to September 2023–2024. The climate of the experimental site was a hot, dry, and humid climate, where there is heavy rainfall during the rainy season from July to September. The average rainfall is 18.95 mm (avg.), and the temperature is 33.45°C (avg.). Bangladesh boasts a rich variety of local flora, including thriving forests, mangrove swamps, and extensive wetlands. However, during the dearth period from July to September, honeybees in Bangladesh encounter considerable difficulties due to food shortages. This period aligns with the monsoon season, characterized by a decrease in floral resources caused by heavy rainfall. In order to tackle these challenges, beekeepers might have to consider providing supplementary food. A total of five supplementary food were given including Sugar syrup (Sugar + Water), Banana syrup (Banana + Sugar + Honey + Water), Pumpkin syrup (Pumpkin + Sugar + Honey + Water), Maize syrup (Maize flour + Sugar + Honey + Water), Rice syrup (Rice flour + Sugar + Honey + Water)

The experiment was conducted on the honeybee species *Apis mellifera*. The experimental design chosen was a randomized complete block design (RCBD) with five replicates for each treatment, where sugar syrup was used as a control treatment. The honeybees of *A. mellifera* colonies were taken for treatment from the BSRI apiary, Ishwardi, Pabna

The total quantity of food consumed by honeybees was quantified to determine the preferred food supplements for honeybees. The remaining supplies were counted the day after providing the food (24h later). Food consumption was determined by subtracting the initial food supply from the remaining food. Three boxes for each treatment containing bee colonies were put together, each equipped with queens of similar levels. Each of these three treatment colonies was allocated to a specific feeding treatment using the same feeder. Every box contained 300 ml of food substitutes. Data collection involved extracting two sides of a single

frame from each box. The first data were collected before the feeding material was provided. Additional data were obtained every second day to evaluate the influence of honeybee colonies on these food sources during a week. Pictures of bee frames were captured, and the number of brood, honey, and pollen cells was determined by counting the images with the naked eye.

Statistical analysis of various treatments was conducted using the 'R' Studio. Analysis of variance (ANOVA) tests were used to detect significant differences (at a significance level of $\alpha = 0.05$) within treatments. The means were compared using the least significant difference (LSD) test at a significance threshold of 5%. Cost analysis involves calculating the expenses associated with acquiring various food supplements, comparing the result benefits in terms of productivity, and identifying the most economical option.

SUPPLEMENTARY FOODS CONSUMPTION ON HONEYBEE COLONIES

Table 23 shows the comparative assessment of daily artificial food consumption in honeybee colonies during the dearth period. Honeybees consumed the entire amount of sugar syrup (100%), with banana being consumed at a rate of 96.32%, followed by pumpkin at 85.48%, maize flour at 82.55%, and rice flour at 76.13% (Table 21). According to Table 22, honeybees exhibit a preference for banana, pumpkin, maize flour, and rice flour syrup, in that order. Fermentation of rice flour and maize flour syrup occurred 24 hours after feeding, while fermentation of banana and pumpkin syrup started 48 hours after feeding.

Table 23. Comparative analysis of artificial food consumption per day in honeybee colonies during a dearth period

Treatments	Food consumed (%)			Total	Utilized Mean (%)
	R_1	R_2	R_3		
T_1: Sugar syrup	100.00	100.00	100.00	300.00	100.00 a
T_2: Banana syrup	95.5	97.12	96.33	281.87	96.32 ab
T_3: Pumpkin syrup	90.22	85.89	80.33	264.89	85.48 abc
T_4: Maize flour syrup	85.81	79.51	82.33	255.22	82.55 bc
T_5: Rice flour syrup	75.00	72.50	80.87	235.22	76.13 c
LSD (0.05)	-	-	-	-	5.95

IMPACT OF SUPPLEMENTARY FEEDING ON THE BROOD CELL DEVELOPMENT

The study investigates the variation in the number of brood cell development in honeybee colonies when provided with different food substitutes during a dearth period (Table 24). The findings indicate that the number of brood cell development varied after the feeding of several types of food substitutes. It was observed that bee colonies that received pumpkin syrup showed a significant increase of 88.90 % in the number of brood cells. Colony growth was observed as brood cells developed, with a notable increase of 29.03 % in colonies fed with banana syrup. Conversely, colonies fed with rice syrup showed a slight loss of 0.53% in brood cells, while those fed with maize syrup had a more significant decrease of 47.02 %. The sugar syrup exhibited the lowest number of brood cells, with a drop of 66.59 % compared to other conditions, as seen in Table 24.

Table 24. The number of brood cells on honeybee colonies in the dearth period for providing different artificial food substitutes

Treatment	Brood cells (beginning)	Brood cells (end)	Increased/decreased (%)
T_1: Sugar syrup	217.18 d	72.55 d	-66.59%
T_2: Banana syrup	494.83 bc	638.46 b	29.03%
T_3: Pumpkin syrup	507.92 b	959.48 a	88.90%
T_4: Maize flour syrup	858.96 a	455.08 c	-47.02%
T_5: Rice flour syrup	476.79 c	474.24 c	-0.53%
LSD (0.05)	20.16	25.02	-

IMPACT OF SUPPLEMENTARY FEEDINGS ON THE HONEY CELL DEVELOPMENT

Supplementary feeding of banana, pumpkin, maize flour, and rice flour syrup during the dearth period has a significant impact on honey cell development in honeybee colonies. Table 25 shows the development of honey cells in honeybee colonies when provided with different supplementary feeding alternatives during the dearth periods. The honey cell numbers exhibited a somewhat uniform appearance at the start of the experiment. The honey cell number varied after providing various types of food substitutes. Upon concluding the experiment, it was noted that the bee colonies that were given pumpkin syrup displayed the highest number of honey cells, showing a significant increase of 128.84 %. Next, colonies were given sugar syrup as supplementary food, resulting in 16.61 % increase. Conversely, colonies fed with banana syrup showed a slight increase 2.27 % in honey cells, while those fed with maize syrup showed a decrease of 10.24 %. The lowest number of honey cells was found in colonies fed with rice syrup, with a decline of 43.47 %, as shown in Table 25.

Table 25. The development of honey cells in honeybee colonies fed with various artificial food substitutes during periods of dearth

Treatment	Honey cells (beginning)	Honey cells (end)	Increased/ decreased (%)
T_1: Sugar syrup	202.28 c	238.18 c	16.61
T_2: Banana syrup	172.13 d	153.26 e	2.27
T_3: Pumpkin syrup	165.18 d	375.51 a	128.84
T_4: Maize flour syrup	343.80 a	309.83 b	-10.24
T_5: Rice flour syrup	310.54 b	175.20 d	-43.47
LSD (0.05)	14.64	16.01	-

IMPACT OF SUPPLEMENTARY FEEDINGS ON THE POLLEN CELL DEVELOPMENT

The number of pollen cell development in honeybee colonies during the dearth period was measured while providing various supplementary feedings, as shown in Table 26. According to the findings, the number of cells covered with pollen after each treatment decreased, except for the pumpkin syrup. The colony was provided with pumpkin syrup, resulting in a significant increase in the number of pollen cells (55.47 %). On the other hand, the consumption of sugar syrup resulted in a decline of 23.98 % in pollen cells. In the same way, the consumption of maize syrup led to a 56.20 % reduction in pollen cells, whereas rice syrup caused an even more significant decrease of 70.91 %. The colony which consumed banana syrup exhibited the most significant decrease (81.98%) in pollen cells.

Table 26. The number of pollen cells on honeybee colonies during the dearth period for feeding of the different food supplements

Treatment	Pollen cells (beginning)	Pollen cells (end)	Increased/ decreased (%)
T_1: Sugar syrup	8.05 e	6.12 d	-23.98
T_2: Banana syrup	108.29 a	19.97 b	-81.56
T_3: Pumpkin syrup	17.45 c	27.13 a	55.47
T_4: Maize flour syrup	26.62 b	11.66 c	-56.20
T_5: Rice flour syrup	12.48 d	3.63 e	-70.91
LSD (0.05)	2.71	1.93	-

COMPARATIVE ANALYSIS OF POLLEN, HONEY AND BROOD CELL DEVELOPMENT DURING THE DEARTH PERIOD

The development of the brood cells number is increased only for the banana and pumpkin syrup, on the other hand, brood cells number are decreased for other three syrup. Honeybees that were given pumpkin syrup experienced a greater rise in brood and bee population compared to those who were given banana, maize, or rice flour syrup. The results reveal that pumpkin supplemental diets increased the population density in comparison to all supplemented diets. Honey cells and pollen cells also increased significantly in those bee colonies which feed on supplemental diets of pumpkin syrup. The figures also underline that all supplemental diets tests here were not equally effective in stimulating the various biological activities of honeybee colonies. Figure 1 shows the comparative percentage figure of pollen, honey and brood cell numbers after taking the supplementary food materials in the dearth period. Here, Figure underlines brood, honey and pollen cells percentages are increased only for the pumpkin syrup and brood, honey cells percentages are increased for the banana syrup. It can be noted that wherever the feeding supplementary diet's contain low carbohydrates and high sugar the honeybee most likely prefers to consume those supplementary diets in the dearth period resulting in an increase in the development of brood, honey and pollen cells in arid or semi-arid hot climate environment during dearth period

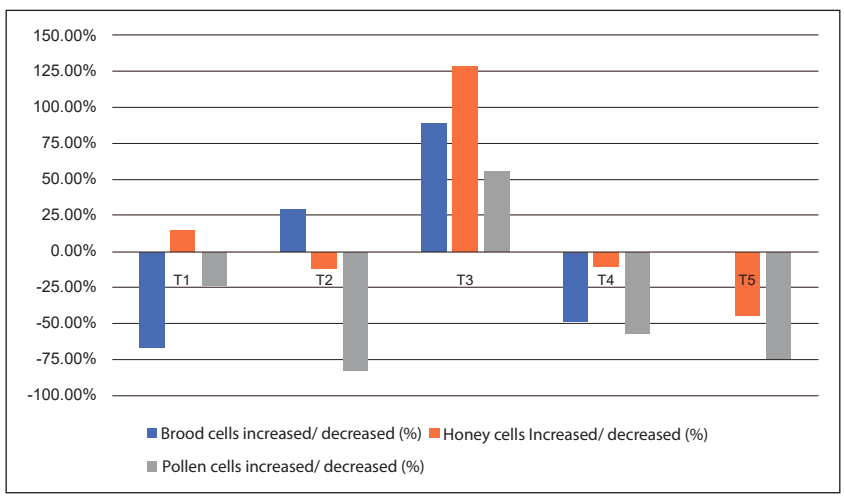


Figure 1: Comparative analysis of pollen, honey, and brood cell development during the dearth period

COST ANALYSIS OF SUPPLEMENTAL FEEDING SUPPLIED DURING THE DEARTH PERIOD

The comparative cost analysis of various supplementary feeding materials can be seen in Table 27. The costs of various food substitutes utilized for feeding the bee colonies vary. The highest-cost food substitute was found to be sugar syrup. To feed every colony, 900ml food supplement was given. It cost 150/- taka to prepare 900ml sugar syrup, followed by banana syrup 51/-taka, pumpkin syrup 48/- taka, maize syrup 32/- taka, rice syrup 31/- taka respectively. The cost of sugar feeding during dearth period of honey bee can be reduced 50% by feeding pumpkin syrup.

Table 27. Cost Analysis of supplements feeding food supplied during the dearth period

S.N.	Food substitutes	Requierd item	Cost/Kg (tk/Kg)	Cost of requied amount to prepare 900ml food substitutes (tk)	Total cost of required amount (tk)
1	Sugar syrup	Sugar+Water	150/-	150/-	150/-
2	Banana Syrup	Banana+Sugar+Honey+Water	Banana: 56 Sugar: 150 Honey: 400	28/- banana+15/- sugar+8/- honey	51/-
3	Pumpkin Syrup	Pumpkin+Sugar+Honey+Water	Pumpkin: 50 Sugar: 150 Honey: 400	25/- pumpkin+15/- sugar+8/- honey	48/-
4	Maize Syrup	Maize flour+Sugar+Honey+Water	Maize flour : 60 Sugar: 150 Honey: 400	9/- Maize flour+15/- sugar+8/- honey	32/-
5	Rice Syrup	Rice flour+Sugar+Honey+Water	Rice flour : 55 Sugar: 150 Honey: 400	8/- flour+15/- sugar+8/- honey	31/-

EFFECTS OF DIFFERENT MANAGEMENT APPROACHES IN CONTROLLING RED PALM WEEVIL ON DATE PALM

The experiment was conducted at four locations in Bangladesh, viz., (i) BSRI farm, Ishwardi, Pabna; (ii) RSRS farm, Gazipur; (iii) Pirozali, Gazipur; and (iv) Goaspur, Pabna. A total of four integrated pest management (IPM) packages, such as (package 1) only pheromone trapping in the garden (March, May, July, September); (package 2) plantation of repellent plant + netting around the garden (February-August) + pheromone trapping (March, May, July, September); (package 3) plantation of repellent plant + netting around the garden (February-August) + pheromone trapping (March, May, July, September) + application of Fipronil (Regent 3GR) in soil; and (package 4) plantation of repellent plant + netting around the garden (February-August) + pheromone trapping (March, May, July, September) + spraying chloropyriphos (Dursban 20 EC) (April and October) were applied in date palm gardens.

Field trials were conducted following a randomized complete block design (RCBD) with four treatments (as four packages) and three replicates of each treatment. The population number of adult RPW captured by pheromone trapping was collected and counted daily from the bucket with pheromone. The collected data of adult RPW were analyzed by the analysis of variance (ANOVA) and the means were compared by

the least significant difference (LSD) test at 5% significance level using Statistix 10 software (Tallahassee, FL 32312, USA).

EFFECT OF THE IPM PACKAGES AGAINST RPW IN DATE PALM GARDEN

The effect of IPM packages against RPW in date palm gardens located in different places in Bangladesh, as shown by the data presented in Figures 1-4, showed that the IPM packages had a significant effect on the management of RPW, where different effects were found among the packages at different times and at different locations. The incidence of RPW, *Rhynchophorus ferrugineus* throughout the experimental period is presented in the Figures. The population densities per garden were recorded in every month. This study revealed that the population was fluctuated during this duration and different population densities were found among the gardens treated with different packages.

EFFECT AT BSRI LOCATION

At the BSRI location in 2023, the data presented in Figure 2 showed that after the application of the IPM packages, the lowest population of 1 beetle garden^{-1} was found in package 4 treated gardens, and a maximum population of 5.00 beetle garden^{-1} was observed in package 1 treated gardens in March (Figure 1). In the peak period of infestation in September 2023, the lowest population (7.33 adults garden^{-1}) was found in the garden treated with IPM package 4, compared to a population of 20.33 adults garden^{-1}, 29.33 beetle garden^{-1}, and 39.66 adults garden^{-1} found in package 3, package 2, and package 1-treated gardens, respectively (Figure 2).

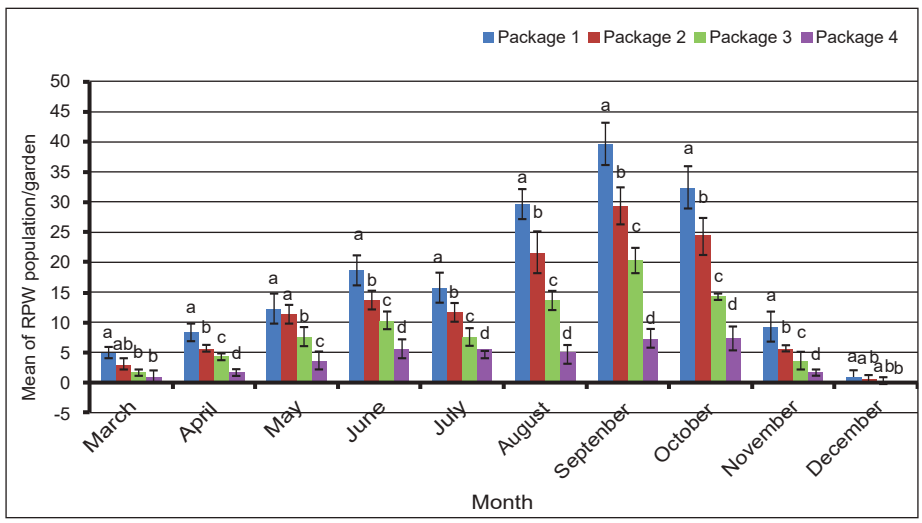


Figure 2. Polpulation of RPW per garden after treated with different IPM packages recorded at different time (every month) intervals at BSRI 2024. Different letters indicate significant differences ($P \leq 0.05$) among the packages. Columns represent the mean ± SD (n = 3). SD= standard deviation. Package 1=Only Pheromone trapping in the garden (March, May, July, September). Package 2=Plantation of repellent plant + netting around the date palm garden (February-August) + Pheromone trapping (March, May, July, September). Package 3= Plantation of repellent plant + netting around the date palm garden (February -August) + Pheromone trapping (March, May, July, September) + application of Regent 3GR in soil. Package 4= Plantation of repellent plant + netting around the date palm garden (February-August) + Pheromone trapping (March, May, July, September) + Spraying Dursban 20 EC (April and October).

EFFECT AT RSRS FARM, GAZIPUR LOCATION

The data presented in Figure 3 showed the application effects of the IPM packages at the RSRS farm, Gazipur location in 2024. The highest population ranged from 9.33 to 40.64 adults garden^{-1}; this was also found in September, where package 4 treated gardens showed the lowest population of 9.33 beetle garden^{-1} (Figure 3).

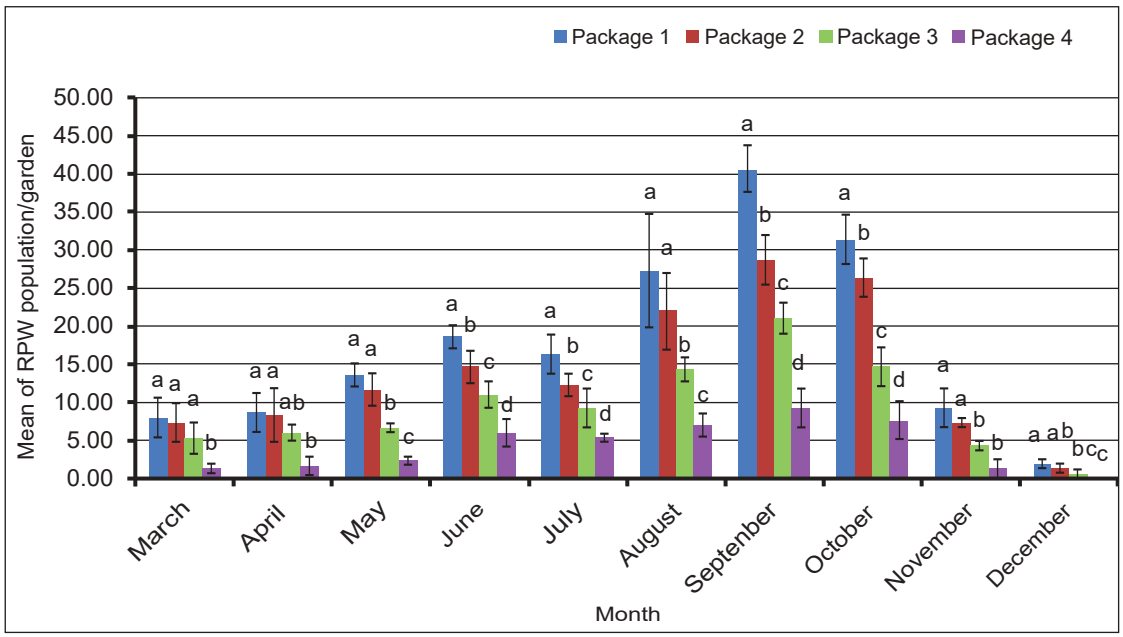


Figure 3. Polpulation of RPW per garden after treated with different IPM packages recorded at different time (every month) intervals at RSRS Gazipur 2023. Different letters indicate significant differences ($P \leq 0.05$) among the packages. Columns represent the mean ± SD (n = 3). SD= standard deviation. Package 1=Only Pheromone trapping in the garden (March, May, July, September). Package 2=Plantation of repellent plant + netting around the date palm garden (February-August) + Pheromone trapping (March, May, July, September). Package 3= Plantation of repellent plant + netting around the date palm garden (February -August) + Pheromone trapping (March, May, July, September) + application of Regent 3GR in soil. Package 4= Plantation of repellent plant + netting around the date palm garden (February -August) + Pheromone trapping (March, May, July, September) + Spraying Dursban 20 EC (April and October).

EFFECT AT PIROJALI, GAZIPUR LOCATION

The *R. ferrugineus* population observed at Pirojali, Gazipur location from March to December 2023 after the application of the IPM packages is presented in Figure 4. The highest population range from 8.00 to 37.33 adults garden^{-1}; this was also observed in September, when package 4 treated gardens had the lowest population of 8.00 beetle garden^{-1} (Figure 4).

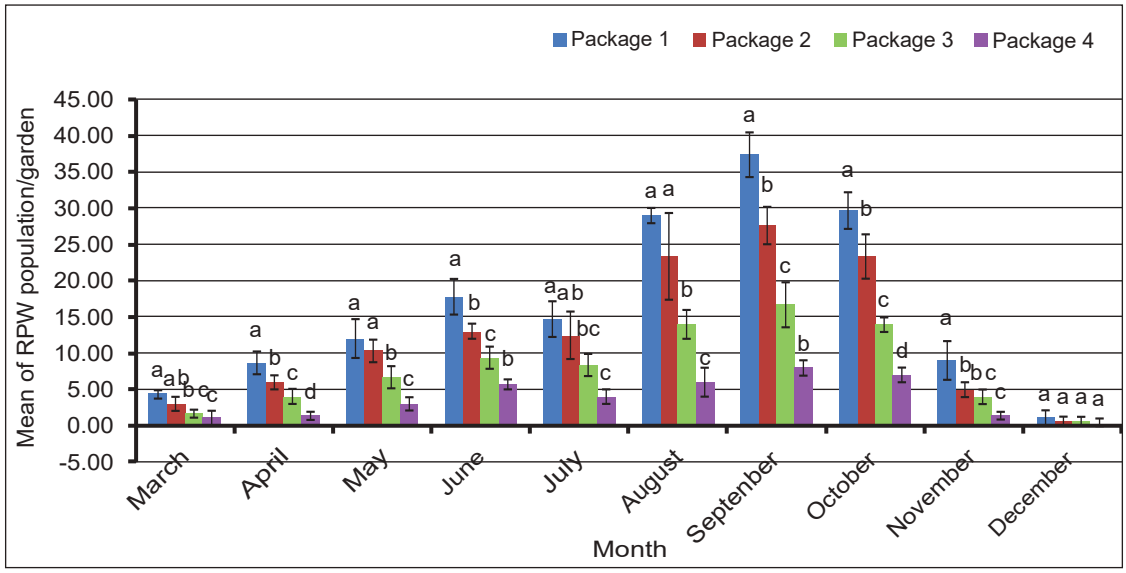


Figure 4. Polpulation of RPW per garden after treated with different IPM packages recorded at different time (every month) intervals at Pirojali, Gazipur 2024. Different letters indicate significant differences (P ≤ 0.05) among the packages. Columns represent the mean ± SD (n = 3). SD= standard deviation. Package 1=Only Pheromone trapping in the garden (March, May, July, September). Package 2=Plantation of repellent plant + netting around the date palm garden (February-August) + Pheromone trapping (March, May, July, September). Package 3= Plantation of repellent plant + netting around the date palm garden (February -August) + Pheromone trapping (March, May, July, September) + application of Regent 3GR in soil. Package 4= Plantation of repellent plant + netting around the date palm garden (February -August) + Pheromone trapping (March, May, July, September) + Spraying Dursban 20 EC (April and October).

EFFECT AT GOASPUR, PABNA LOCATION

Figure 4 depicts statistically analyzed data on the population of R. ferrugineus collected from March to December 2024 in Goaspur, Pabna Location, following the application of the IPM packages. During the peak period of infestation in September 2023 (F=91.60; p<0.001), a population of 5.33 to 33.33 adults garden^{-1} was found in the treated gardens, while the lowest population was found in package 4 treated garden compared to a population of the gardens treated with other packages (Figure 5).

Thus, package 4 was found to be the best among all the packages, showing a reduction in the population of *R. ferrugineus* in the date palm gardens in all the locations.

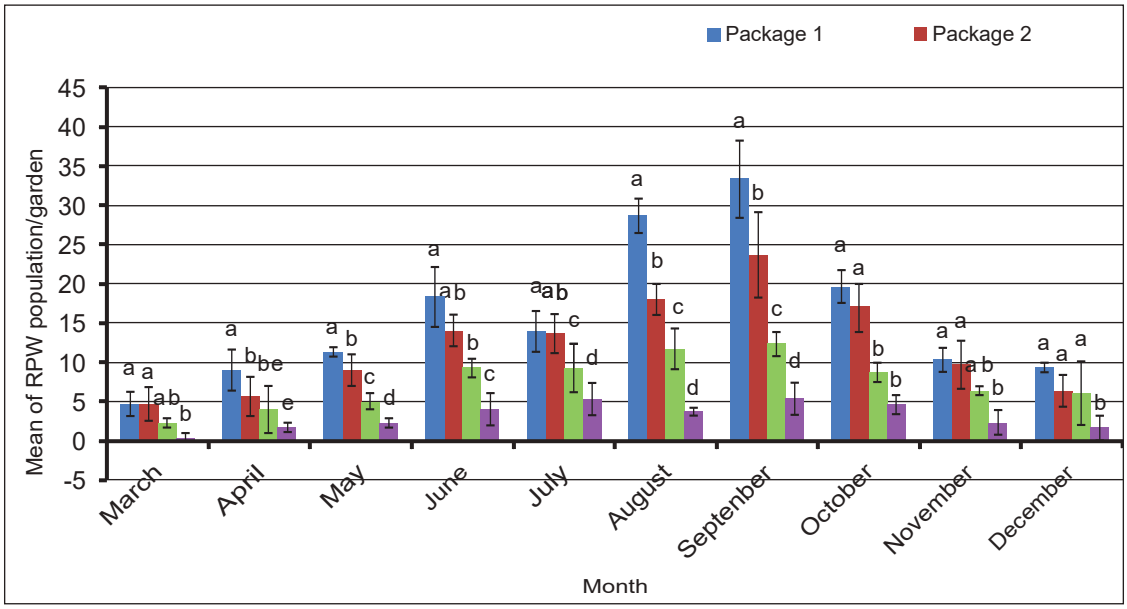


Figure 5. Polpulation of RPW per garden after treated with different IPM packages recorded at different time (every month) intervals at Goaspur 2023. Different letters indicate significant differences ($P \leq 0.05$) among the packages. Columns represent the mean ± SD ($n = 3$). SD= standard deviation. Package 1=Only Pheromone trapping in the garden (March, May, July, September). Package 2=Plantation of repellent plant + netting around the date palm garden (February-August) + Pheromone trapping (March, May, July, September). Package 3= Plantation of repellent plant + netting around the date palm garden (February-August) + Pheromone trapping (March, May, July, September) + application of Regent 3GR in soil. Package 4= Plantation of repellent plant + netting around the date palm garden (February-August) + Pheromone trapping (March, May, July, September) + Spraying Dursban 20 EC (April and October).

PATHOLOGY DIVISION

RESEARCH HIGHLIGHTS

- Total 98 sugarcane genotypes comprising commercial varieties, clones under PVT, ZYT-III, ZYT-II, ZYT-I, AYT and PYT were tested against a mixed 46 different isolates of red rot (*Colletotrichum falcatum* Went.) pathogen. Out of 21 commercial varieties, 5 were found moderately resistant (MR), 11 were moderately susceptible (MS), 3 were susceptible (S) and remaining 2 were highly susceptible (HS) to red rot. Four clones under ZYT-III were tested. Among them 2 were moderately susceptible (MS) and remaining 2 were found susceptible (S) to red rot. Among 5 clones under ZYT-II, 1 was moderately resistant (MR), 2 were moderately susceptible (MS) and remaining 2 were found as susceptible (S) against red rot. Out of 8 clones under ZYT-I, 2 were found as moderately resistant (MR), 4 were moderately susceptible (MS) & remaining 2 were susceptible (S) against red rot. Under AYT, total 15 clones were tested where 3 were resistant (R), 3 were moderately resistant (MR), 2 were moderately susceptible (MS), 6 were susceptible and remaining 1 was highly susceptible (S) to red rot. Among 43 clones under PYT, 6 were resistant (R), 17 were moderately resistant (MR), 11 were moderately susceptible (MS), 5 were susceptible (S) and remaining 4 were highly susceptible (HS) against red rot disease.
- Forty (40) sugarcane genotypes including commercial varieties, clones under PVT, ZYT III, ZYT II and ZYT I were tested against mixed isolate (mixture of four isolates from 4 different locations) of *Fusarium sacchari* (C.O. of wilt disease). Among the tested 21 commercial varieties, 1 was found resistant (R), 6 were found as moderately resistant (MR), 9 were moderately susceptible (MS), 4 were susceptible (S) and 1 was highly susceptible (HS). Under ZYT-III, out of 4 clones, 2 were found as resistant (R) reaction, 1 was moderately resistant (MR) and rest one was susceptible (S) to wilt disease. Out of 5 clones under ZYT-II, 3 were moderately resistant (MR), 1 was moderately susceptible (MS) and remaining 1 was found as susceptible (S) against wilt disease. Under ZYT-I, 8 clones were tested where 5 were found moderately resistant (MR) and remaining 3 were found as moderately susceptible (MS) to wilt disease.
- Thirty four (34) sugarcane genotypes including commercial varieties, clones under ZYT III, II, I and AYT were tested against smut (*Ustilago scitaminea*) disease. Among the tested genotypes, 23 were found as resistant (R), 4 were moderately resistant (MR), 6 were moderately susceptible (MS), 5 were susceptible (S) and remaining 1 was highly susceptible (HS) against smut disease.
- Twenty three (23) sugarcane genotypes consisting commercial varieties, clones under ZYT III, II and I were tested against pineapple disease (*Ceratocystis paradoxa*). Among them, 4 were found as resistant (R), 1 was moderately resistant (MR), 6 were moderately susceptible (MS), 5 were susceptible (S) and the remaining 7 clones were found as highly susceptible (HS) against pineapple disease.
- The effectiveness of some sett treating fungicides against pineapple disease on germination of cane was evaluated. There was significant difference between control and other tested fungicides. Among the two years results of the tested fungicides, Rhinotop 75 WP, Corner 50 WDG and Pantrobin Top 25 SC showed more than 80% efficacy in both cropping seasons (2022-2023 and 2023-2024).

- The experiment was set up to find out the suitable soaking time of sugarcane setts for chemical treatment. Among 6 treatments, sett dipping in 0.1% solution of Knowin 50 WP for 30 minutes (T_2) showed the highest germination percentage (92.67%).
- The comparative efficacy of different fungicides and bio-control agents against red rot was evaluated using BSRI Akh 42 with 10 treatments. Sett treatment with T_7 showed better result (Resistant- R reaction) in controlling red rot disease.
- Causal organism of leaf spot (*Pestalotiopsis palmarum*), graphiola leaf spot (Graphiola phoenicis) of date palm and rust of stevia was morphologically identified.
- Total 12 acres of land was cultivated to produce foundation seeds of 21 commercial sugarcane varieties. Total 258.00 tons of foundation seeds were produced.

SCREENING OF SUGARCANE GENOTYPES UNDER ZYT-III, ZYT-II, ZYT-I, AYT, PYT AND TISSUE CULTURE DERIVED CLONES TO RED ROT

This experiment was conducted in cropping season 2023-24 at two locations i) BSRI farm and ii) RSRS, Thakurgaon farm. Total 98 sugarcane genotypes comprising commercial varieties and clones under ZYT-III, ZYT-II, ZYT-I, AYT and PYT were tested against a mixed isolates of 46 different isolates of red rot (*Colletotrichum falcatum* Went.) pathogen at BSRI farm, Ishurdi, Pabna. Same genotypes except PYT clones were also tested at RSRS, Thakurgaon farm against same isolates. Among 21 commercial varieties, 5 were moderately resistant (MR), 11 were moderately susceptible (MS), 3 were found as susceptible (S) and remaining 2 were highly susceptible (HS) to red rot disease in the field under prevailing weather condition (Table 1).

Under PVT, 2 clones were found highly susceptible (HS) to red rot disease.

Under ZYT-III, 2 clones were moderately susceptible (MS) and remaining 2 were found susceptible (S) to red rot disease.

Under ZYT-II, 5 clones were inoculated. Among them, 1 was found as moderately resistant (MR), 2 clones were moderately susceptible (MS) and remaining 2 were found as susceptible (S).

Out of 8 clones under ZYT-I, 2 clones were found as moderately resistant (MR), 4 clones were moderately susceptible (MS) and remaining 2 clones were found as susceptible (S) (Table 1). Under AYT, total 15 clones were tested of which 3 were resistant (R), 3 were moderately resistant (MR), 2 were moderately susceptible (MS), 6 were susceptible (S) and remaining 1 was highly susceptible (HS) to red rot disease (Table 1).

Under PYT, 43 clones were tested to red rot pathogen where 6 clones were found as resistant (R), 17 were moderately resistant (MR), 11 were moderately susceptible (MS), 5 were susceptible (S) and remaining 4 were highly susceptible (HS) (Table 1).

Table 1. Reaction of sugarcane genotypes against *Colletotrichum falcatum* Went. at BSRI farm and RSRS, Thakurgaon (2023-24)

Disease reaction (Average of 2 locations)	Name of varieties/clones (98)
Commercial Varieties (21 varieties)	
MR	Isd 34, Isd 37, Isd 38, Isd 39, BSRI Akh 45
MS	Isd 2/54, Isd 19, Isd 28, Isd 32, Isd 36, Isd 40, BSRI Akh 41, BSRI Akh 43, BSRI Akh 44, BSRI Akh 46, BSRI Akh 48
S	Isd 16, Isd 20, Isd 33
HS	Isd 18, BSRI Akh 42
PVT (2 Clones)	
HS	Black rubi, Madhumala
ZYT-III (4 Clones)	
MS	I 94-16, I 78-17
S	I 49-17, I 75-17
ZYT-II (5 Clones)	
MR	I 182-18
MS	I 56-18, I 141-18
S	I 71-18, I 75-18
ZYT-I (8 Clones)	
MR	I 185-19 & I 190-19
MS	I 70-19, I 138-19, I 149-19, I 182-19
S	I 71-19 & I 92-19
AYT (15 Clones)	
R	I 05-20, I 98-20, I 131-20,
MR	I 31-20, I 93-20, I 118-20
MS	I 39-20, I 100-20
S	I 08-20, I 23-20, I 27-20, I 103-20, I 137-20, I 138-20
HS	I 122-20
PYT (43 Clones)	
R	I 02-21, I 14-21, I 28-21, I 44-21, I 59-21, I 112-21
MR	I 16-21, I 33-21, I 36-21, I 38-21, I 56-21, I 60-21, I 72-21, I 76-21, I 88-21, I 99-21, I 100-21, I 142-21, I 150-21, I 153-21, I 164-21, I 167-21, I 177-21
MS	I 08-21, I 25-21, I 26-21, I 65-21, I 69-21, I 82-21, I 104-21, I 110-21, I 130-21, I 137-21, I 146-21
S	I 46-21, I 57-21, I 114-21, I 138-21, I 163-21
HS	I 108-21, I 145-21, I 155-21, I 162-21

R-Resistant, MR-Moderately resistant, MS-Moderately susceptible, S-Susceptible and HS-Highly susceptible.

Fig: Field view of screening of sugarcane genotypes against red rot

SCREENING OF SUGARCANE GENOTYPES TO WILT DISEASE

This experiment was conducted in cropping season 2023-24 at BSRI farm. Forty (40) sugarcane genotypes including commercial varieties, clones under PVT, ZYT III, ZYT II, ZYT I were tested against mixed isolate (mixture of four isolates from 4 different locations) of *Fusarium sacchari* causal organism of wilt disease following hypodermis syringe method at BSRI farm.

Among 21 commercial varieties, 1 was found resistant (R), 6 were found moderately resistant (MR), 9 were found moderately susceptible (MS), 4 were susceptible (S) and remaining 1 was highly susceptible (HS) to wilt disease in the field under prevailing weather condition (Table 2). Under PVT, 2 were inoculated, of which, both showed highly susceptible (HS) reaction to wilt disease. Under ZYT-III, 4 were inoculated, among them, 1 showed moderately resistant (MR) reaction, 2 showed resistant (R) reaction and remaining 1 was susceptible (S) to wilt disease. Out of 5 clones under ZYT-II, 3 were found as moderately resistant (MR), 1 was moderately susceptible (MS) and rest 1 showed susceptible (S) reaction against wilt disease. Out of 8 clones under ZYT-I, 5 were found as moderately resistant (MR), 2 showed moderately resistant (MR) and remaining 3 were moderately susceptible (MS) to wilt disease in the field under prevailing weather condition (Table 2).

Table 2. Reaction of sugarcane genotypes against wilt disease at BSRI farm (2023-24)

Disease reaction	Name of varieties/clones (40)
Commercial varieties (21)	
R	Isd 28
MR	Isd 2/54, Isd 34, Isd 39, BSRI Akh 43, BSRI Akh 45, BSRI Akh 46
MS	Isd 16, Isd 18, Isd 20, Isd 32, Isd 36, Isd 37, Isd 38, Isd 40, BSRI Akh 48
S	Isd 19, Isd 33, BSRI Akh 41 & BSRI Akh 44
HS	BSRI Akh 42
PVT (2 Clones)	
HS	Black rubi, Madhumala
ZYT-III (4 Clones)	
R	I 94-16, I 78-17
MR	I 75-17
S	I 49-17
ZYT-II (5 Clones)	
MR	I 75-18, I 141-18, I 182-18
MS	I 71-18
S	I 56-18
ZYT-I (8 Clones)	
MR	I 92-19, I 138-19, I 182-19, I 185-19, I 190-19
MS	I 70-19, I 71-19, I 149-19

R-Resistant, MR-Moderately resistant, MS-Moderately susceptible, S-Susceptible and HS-Highly susceptible

Fig: Field view of screening of sugarcane genotypes against wilt

SCREENING OF SUGARCANE GENOTYPES UNDER ZYT-III, II, I AND AYT TO SMUT DISEASE

This experiment was conducted in cropping season 2023-24 at BSRI farm. Thirty nine (39) sugarcane genotypes comprising commercial varieties and clones under ZYT III, II, I and AYT were tested against smut (*Ustilago scitaminea*) disease following spore suspension method. The variety Isd 39 was taken as resistant (R) and Isd 37 as

susceptible standard. Among 8 commercial varieties 1 was found as resistant (R), 2 were moderately resistant (MR), 1 was moderately susceptible (MS) and remaining 4 was susceptible (S) against smut disease. Under ZYT-III, among 4 tested clones, 2 were found as resistant (R), 1 was moderately resistant (MR) and remaining 1 was moderately susceptible (MS) to smut disease. Under ZYT-II, there were 5 clones where 2 were found as resistant (R), 1 was moderately susceptible (MS), 1 was susceptible (S) and remaining 1 was highly susceptible (HS). Under ZYT-I, among 8 clones 7 were found as resistant (R) and remaining 1 was found as moderately susceptible (MS) against smut disease. Under AYT, among 14 clones, 11 were found resistant (R), 1 was moderately resistant (MR) and remaining 2 were moderately susceptible (MS) against smut disease (Table 3).

Table 3. Reaction of sugarcane genotypes against smut disease at BSRI farm (2023-24)

Disease reaction	Name of varieties/clones (34)
Commercial Varieties (8)	
R	BSRI Akh 48
MR	Isd 39, BSRI Akh 45
MS	Isd 16
S	Isd 37, BSRI Akh 43, BSRI Akh 44, BSRI Akh 46
ZYT-III (4 Clones)	
R	I 94-16, I 49-17,
MR	I 78-17
MS	I 75-17
ZYT-II (5 Clones)	
R	I 71-18 & I 141-18
MS	I 182-18
S	I 75-18
HS	I 56-18
ZYT-I (8 Clones)	
R	I 70-19, I 71-19, I 92-19, I 149-19, I 182-19, I 185-19 & I 190-19
MS	I 138-19
AYT (14 Clones)	
R	I 8-20, I 23-20, I 27-20, I 39-20, I 93-20, I 98-20, I 100-20, I 103-20, I 118-20, I 122-20 & I 131-20
MR	I 5-20
MS	I 31-20, I 137-20

R-Resistant, MR-Moderately resistant, MS-Moderately susceptible, S-Susceptible and HS-Highly susceptible

Fig: Field view of screening of sugarcane genotypes against smut

SCREENING OF SUGARCANE GENOTYPES TO PINEAPPLE DISEASE

This experiment was conducted in cropping season 2023-24 at BSRI farm. Twenty three (23) sugarcane genotypes consisting commercial varieties and clones under ZYT III, ZYT II and ZYT I were tested against pineapple (*Ceratocystis paradoxa*) disease following spore suspension method. Among 6 tested commercial varieties, 3 were moderately susceptible (MS) and 4 were found highly susceptible (S) to pineapple disease (Table 4). Under ZYT-III, among 4 tested clones, 3 were susceptible (S) and remaining 1 showed highly susceptible (S) reaction against pineapple disease. Under ZYT-II, there were 5 clones where 2 were found as resistant (R), 1 was moderately susceptible (MS), 1 was susceptible (S) and remaining 1 was highly susceptible (HS) against pineapple disease. Under ZYT-I, among 8 clones, 2 were resistant (R), 1 was moderately resistant (MR), 2 were moderately susceptible (MS), 1 was susceptible (S) and remaining 2 were found as highly susceptible (HS) against pineapple disease (Table 4).

Table 4. Reaction of sugarcane genotypes against pineapple disease at BSRI farm (2023-24)

Disease reaction	Name of varieties/clones (23)
Commercial varieties (6)	
MS	Isd 38, BSRI Akh 43 & BSRI Akh 45
HS	BSRI Akh 44, BSRI Akh 46 & BSRI Akh 48
ZYT-III (4 Clones)	
S	I 94-16, I 49-17 & I 75-17
HS	I 78-17
ZYT-II (5 Clones)	
R	I 75-18 & I 182-18
MS	I 71-18
S	I 141-18
HS	I 56-18
ZYT-I (8 Clones)	
R	I 70-19 & I 71-19
MR	I 92-19
MS	I 138-19 & I 190-19
S	I 182-19
HS	I 149-19 & I 185-19

R-Resistant, MR-Moderately resistant, MS-Moderately susceptible, S-Susceptible and HS-Highly susceptible

Fig: Field view of screening of sugarcane genotypes against pineapple disease

PERFORMANCE OF DIFFERENT SETT TREATING CHEMICALS IN CONTROLLING SETT ROT DISEASE OF SUGARCANE

An experiment was conducted at BSRI farm, Ishwardi during cropping season 2022-23 and 2023-24 with a view to evaluate the effectiveness of some sett treating fungicides namely Ricoipro 52.5 WP, Ragib 28 SC, Tenstrain 75 WDG, Iprozim 50 WP, Rhinotop 75 WP, Corner 50 WDG, Pantrobin Top 25 SC, Blastacin 80 WP, Radistin 50 WP, Funzim 25 WP, Bioderma, M- Hitter Plus 50 WP, Bendazin 50 WP, ANTI Blast 38 EC, Horti 80 WDG, Maduri 72 WP, Photo

Seed Care 35 FS, Fyzi 50 WDG, Rjim 50 WDG, Anin 56 SC, Pento Zeb 80 WP, Zyka 50 DF, Azony Top 35% SC and Autostine 50 WP was used as standard. The trial was laid out in RCBD with 3 replications using the variety lsd 38. Two budded setts of sugarcane were treated by dipping in prescribed dose of the fungicides. The duration of soaking was 30 minutes for all fungicides. Sett dipping in clean water served as control. Data on germination of setts were recorded and presented in Table 5. Data shows that there were significant differences among control and other tested fungicides. Among the two years results of the tested fungicides, Rhinotop 75 WP, Corner 50 WDG and Pantrobin Top 25 SC showed more than 80% efficacy in both cropping seasons (2022-2023 and 2023-2024) (Table 5). On the other hand, in case of one year tested results of the fungicides, the following chemicals gave more than 80 % efficacy. However, the efficacy testing of these chemicals will be repeated in the next year in order to get confirmation. The chemicals are: ANTI Blast 38 EC, Horti 80 WDG, Maduri 72 WP, Zyka 50 DF & Azony Top 35 % SC.

Table 5. Performance of different fungicides on germination (2023-24)

Treatments	Germination %	Germination over control
T_0: Control	55.67 j	-
T_1: Autostine 50 WP	83.67 a-d	50.29
T_2: Ricoipro 52.5 WP	72.50 e-i	16.83
T_3: Ragib 28 SC	81.00 a-d	45.50
T_4: Tenstrain 75 WDG	80.00 a-d	43.70
T_5: Iprozim 50 WP	77.33 c-h	38.90
T_6: Rhinotop 75 WP	83.67 a-d	50.29
T_7: Corner 50 WDG	88.50 a	58.97
T_8: Pantrobin Top 25 SC	82.67 a-d	46.70
T_9: Blastacin 80 WP	80.33 b-f	44.29
T_{10}: Radistin 50 WP	78.50 c-g	41.00
T_{11}: Funzim 25 WP	76.50 d-h	37.41
T_{12}: Bioderma	72.50 f-i	30.23
T_{13}: M- Hitter Plus 50 WP	86.83 c-h	55.97
T_{14}: Bendazin 50 WP	80.00 a-d	43.70
T_{15}: ANTI Blast 38 EC	80.16 b-e	44.60
T_{16}: Horti 80 WDG	84.85 a-c	52.23
T_{17}: Maduri 72 WP	80.50 a-d	43.83
T_{18}: Photo Seed Care 35 FS	78.83 c-g	41.45
T_{19}: Fyzi 50 WDG	77.00 c-h	38.18
T_{20}: Rjim 50 WDG	71.00 g-i	27.44
T_{21}: Anin 56 SC	72.17 f-i	29.54
T_{22}: Pento Zeb 80 WP	70.00 h-i	25.65
T_{23}: Zyka 50 DF	82.83 a-d	48.61
T_{24}: Azony Top 35% SC	87.67 ab	57.28
T_{25}: Without any soaking treatment	76.83 c-h	37.87
LSD (0.05)	**7.91**	
CV %	**6.23**	

Fig: Field view of sett treating chemicals in controlling sett rot of sugarcane

EXPLORING THE SUITABLE SOAKING TIME OF SUGARCANE SETTS FOR CHEMICAL TREATMENT

An experiment was conducted during the cropping season 2023-24 at BSRI farm in an RCB design with 3 replications and 6 treatments in order to identify a suitable soaking time of sugarcane setts for chemical treatment. Here, germination percentage has been presented in Table 6. Data shows that the highest germination percentage (92.67%) was recorded from the treatment T_2 and the lowest was recorded in T_0 (62.67%).

Table 6. Performance of different soaking time on germination (2023-24)

Treatments	Germination Percentage (%)
T_0 : Control (without any sett treatment)	62.67 c
T_1 : Sett dipping in 0.1% solution of Knowin 50 WP for 30 minutes	85.67 ab
T_2 : Sett dipping in 0.1% solution of Autostin 50 WDG for 30 minutes	92.67 a
T_3 : Sett dipping in 0.1% solution of Autostin 50 WDG for 6 hours	80.00 ab
T_4 : Sett dipping in 0.1% solution of Autostin 50 WDG for 9 hours	83.67 ab
T_5: Sett dipping in 0.1% solution of Autostin 50 WDG for 12 hours	78.00 b
LSD (0.05)	13.98
CV %	9.55

Fig: Field view of suitable soaking time of sugarcane setts for chemical treatment

MANAGEMENT OF RED ROT OF SUGARCANE THROUGH CHEMICAL AND BIOLOGICAL MEANS

An experiment was set up in BSRI Akh 42 with 10 treatments namely control (no treatment), sett treatment & soil drenching with *Trichoderma harzianum* @ 106 C.F.U/mL (30 days interval upto 240 DAP), sett treatment with Sunphanate 70 WP (Thiophanate methyl) @2g/L for 30 minutes, sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & spraying with Sunphanate 70 WP (Thiophanate methyl) @ 2g/L (30 days interval upto 240 DAP), sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & soil drenching with Sunphanate 70 WP (Thiophanate methyl) @ 2g/L (30 days interval upto 240 DAP), sett treatment with FZester 32.5 SC (Azoxystrobin + Difenoconazole) @ 2mL/L for 30 minutes, sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & spraying with FZester 32.5 SC (Azoxystrobin + Difenoconazole) @ 2mL/L (30 days interval upto 240 DAP), sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & soil drenching with FZester 32.5 SC (Azoxystrobin + Difenoconazole) @ 2mL/L (30 days interval upto 240 DAP), sett treatment & soil drenching with Tricost 1% WP (*Trichoderma* spp.) @ 5g/L (30 days interval upto 240 DAP), sett treatment & soil drenching with Bioderma powder (*Trichoderma* spp.) @ 5g/L (30 days interval upto 240 DAP). Morphological parameters, red rot disease index and reaction was recorded and categorized as resistant (R), moderately resistant (MR), moderately susceptible (MS), susceptible (S) and highly susceptible (HS). Table 7. showed different treatments' performance in controlling red rot disease in terms of morphological parameters and disease reaction. Sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & Spraying with Sunphanate 70 WP (Thiophanate methyl) @ 2g/L (T_3) and sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & Soil drenching with FZester 32.5 SC (Azoxystrobin + Difenoconazole) @ 2mL/L(T7) showed better result (Resistant-R reaction) in controlling red rot disease. Sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & Spraying with FZester 32.5 SC (Azoxystrobin + Difenoconazole) @ 2mL/L (T_6) showed moderately resistant- MR reaction against red rot disease whereas other treatments showed moderately susceptible to susceptible reaction.

Table 7. Different treatments' performance in controlling red rot disease in terms of morphological parameters and disease reaction (2023-24)

Treatment	Chewable cane/Pit	Dyed cane/Pit	Weight (kg)	Brix%	Protection%	Disease Reaction
0	11 bc	3.67 abcd	7.48 cd	19.17 abc	0f	S
1	10.67 c	4.67 abc	8.35 abcd	18.25 c	35.93 d	S
2	13.33 a	4.67 abc	10.20 a	19.92 abc	38.63 d	S
3	11.33 abc	0.67 d	8.82 abcd	18.67 bc	90.57 a	R
4	13 ab	6.33 a	9.65 ab	19.17 abc	34.95 d	S
5	11 bc	5 ab	8.17 bcd	18.28 c	13.79 e	S
6	13 ab	2 bcd	9.77 ab	20.08 abc	89.93 a	MR
7	10.33 c	1 cd	9.29 abc	20.94 a	95.68 a	R
8	11.33 abc	3.67 abcd	8.603 abcd	19.92 abc	56.06 c	MS
9	11.33 abc	3.33 abcd	7.073 d	20.42 ab	40.93 d	MS

Fig: T_0 (Control)

Fig: T_3 (Spraying with Sunphanate 70 WP)

Fig: T_6 (Spraying with FZester 32.5 SC)

Fig: T_7 (Soil drenching with FZester 32.5 SC)

IDENTIFICATION AND DOCUMENTATION OF DATE PALM, PALMYRA PALM AND STEVIA DISEASES IN BANGLADESH

Survey was conducted in different locations and diseased sample was collected. Pathogen was isolated, cultured and pathogenicity test was done. Causal organism of the diseases was morphologically identified. Identification of causal organism of leaf spot (*Pestalotiopsis palmarum*), graphiola leaf spot (*Graphiola phoenicis*) of date palm and rust of stevia was done. Molecular analysis will be done for further confirmation.

Fig: Collected diseased sample of date palm

Fig: Pure culture of suspected pathogen of date palm

Fig: Microscopic view of *Pestalotiopsis palmarum* of leaf spot of date palm

Fig: Collected diseased sample of date palm

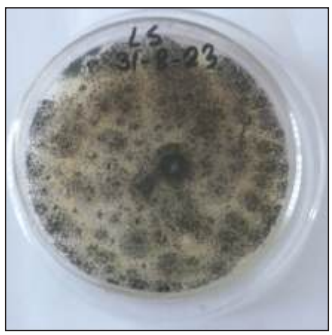


Fig: Pure culture of suspected pathogen of date palm

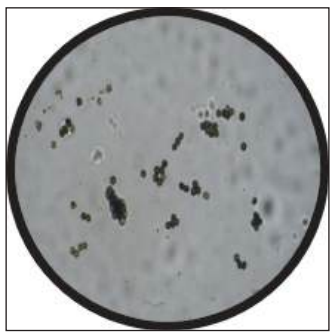


Fig: Microscopic view of *Graphiola phoenicis* of grapiola leaf spot of date palm

Fig: Collected diseased sample of stevia

Fig: Pure culture of suspected pathogen of stevia

Fig: Microscopic view of causal organism of rust of stevia

PRODUCTION, QUALITY CONTROL AND DISTRIBUTION OF DISEASE FREE CLEAN SEED OF SUGARCANE

Total 12 acres of land was cultivated to produce foundation seeds of 21 sugarcane varieties/clones (Table 8). Total 258.00 tons of foundation seeds were produced. The seeds were supplied to Farm Division of BSRI and different sugar mills for certified seed production. Moreover, the produced seeds were also supplied to different divisions to set up experiments and growers and the remaining were supplied to sugar mills for crushing.

Table 8. Production of foundation seed cane through clean seed programme (2023-24)

No. of Variety/ Clone	Area (acre)	Total Seed Production (ton)
Total Varieties: 21	12.00	258.00

Fig: Field view of disease free clean seed plot of sugarcane

TRAINING & TECHNOLOGY TRANSFER DIVISION

RESEARCH HIGHLIGHTS

- Training and Technology Transfer Division is responsible for organizing training programs for extension officers and staff of BSFIC and DAE. It also provides training to progressive sugarcane farmers from both mill and non-mill zones on the latest sugarcrop production technologies. The division establishes demonstration plots showcasing newly developed sugarcane varieties and production techniques, conducts extension and communication research, and arranges seminars and workshops.
- The division organized workshops on various topics during this period, including the Research Extension Workshop and the Internal Annual Research Program Review Workshop. Participants included scientists, professors, executives, extension specialists from various organizations, and progressive farmers from both mill and non-mill zones.
- A total of 420 farmers received training on Modern Technologies for the Production of Sugarcane and Other Sugar Crops in the current year.

Pictorial view of some executed training programme

TRAINING:

The training courses organized during 2023-2024are presented in Table 1. A total number of 420 participants attended in different training courses.

Table 1. Executed training program in 2023-2024

Sl.No.	Name of the Course	Venue	Date/Duration	No. of Participants
1	Modern Technologies of sugarcane and other sugar crops production	NTSM	06/04/2024	Farmers(30)
2	Modern Technologies of sugarcane and other sugar crops production	Natore	06/04/2024	Farmers(30)
3	Modern Technologies of sugarcane and other sugar crops production	Shatkhira	08/04/2024	Farmers(30)
4	Modern Technologies of sugarcane and other sugar crops production	Shatkhira	08/04/2024	Farmers(30)
5	Modern Technologies of sugarcane and other sugar crops production	Madaripur	10/05/2024	Farmers(30)
6	Modern Technologies of sugarcane and other sugar crops production	Madaripur	11/05/2024	Farmers(30)
7	Modern Technologies of sugarcane and other sugar crops production	BSRI	19/05/2024	Farmers(30)
8	Modern Technologies of sugarcane and other sugar crops production	BSRI	19/05/2024	Farmers(30)
9	Modern Technologies of sugarcane and other sugar crops production	NBSM	21/05/2023	Farmers(30)
10	Modern Technologies of sugarcane and other sugar crops production	NBSM	01/06/2024	Farmers(30)
11	Modern Technologies of sugarcane and other sugar crops production	Gopalpur	01/06/2024	Farmers(30)
12	Modern Technologies of sugarcane and other sugar crops production	Tangail	03/06/2024	Farmers(30)
13	Modern Technologies of sugarcane and other sugar crops production	Manikganj	05/06/2024	Farmers(30)
14	Modern Technologies of sugarcane and other sugar crops production	Naogaon	20/06/2024	Farmers(30)

DEMONSTRATION:

Demonstration serves as a medium for disseminating technology. Around 142 plot was demonstrated in cropping season 2023-2024. As part of its regular activities, the division implemented a program to establish demonstration plots showcasing the latest sugarcane varieties developed by BSRI in the technology village within the mill zone at Ishwardi, Pabna. The demonstration featured a range of BSRI-bred sugarcane varieties, including Isd 34, Isd 35, Isd 36, Isd 37, Isd 38, Isd 39, Isd 40, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, and BSRI Akh 46.

WORKSHOPS:

Workshops like the Research Extension Workshop and the Internal Annual Research Program Review Workshop were held. Around 285 delegates such as Scientists, Professors, Executives, Extension specialists from different organizations and some progressive farmers of mills and non-mill zone participated in each of the workshop.

AGRICULTURAL ECONOMICS DIVISION

RESEARCH HIGHLIGHTS

- Most sugarcane farmer's (87.08%) used BSRI-released varieties compared to local varieties for producing sugarcane *gur*. BSRI Akh 41 was the most prevalent BSRI-released sugarcane variety, accounting for 40.22% of the land in the study area.
- BSRI-released variety produced more *gur* output (8345 kg/ha) than the local variety (7198 kg/ha). Additionally, ratoon cane with intercrop yielded 7260 kg/ha of *gur*, approximately 44% higher than sole ratoon cane (4063 kg/ha).
- BSRI-released sugarcane variety demonstrated a higher benefit-cost ratio (2.79) for *gur* production than the local variety (2.24). Similarly, ratoon with intercrops had a higher benefit-cost ratio (2.55) than sole ratoon cultivars (2.07).
- The availability of nipa palm trees, the salinity of the water, the sharing of work among household members, and the price of *gur* are the main influences on farmers' perceptions toward nipa palm *gur* production.
- The optimal period for juice and *gur* production extended from December to mid-March, with peak juice extraction occurring in mid-March. Each season, 8700 liters of juice extracted from 200 nipa palm stalks yielded 1087 kg of *gur*.
- Fuel and labor costs comprised about 88% of the total production costs for nipa palm *gur*. The benefit-cost ratio of 200 nipa palm stalks for *gur* production was 3.03 in the study areas.
- Educational level, farm size, work sharing members, training, and extension contact were the significant determinants of farmers' adoption of nipa palm *gur* production.
- High fuel prices, lack of extension support and training facilities, and insufficient flow of water salinity were the major constraints for *gur* preparation in the study areas.
- Cumilla region experienced the highest growth in sugarcane area at 5.69% between 1981-82 and 1990-91, while the Khulna region faced a significant decline in sugarcane production, with a negative growth rate of 28.09% from 2001-02 to 2010-11. Additionally, the Khulna region had a positive growth in sugarcane yield at 4.32% during the period I (1981-82 to 1990-91).

FINANCIAL PROFITABILITY OF SUGARCANE *GUR* PRODUCTION IN NON-MILL ZONE AREAS OF BANGLADESH

The study was conducted during 2023-24 cropping season to estimate the financial profitability of sugarcane *gur* production in non-mill zone areas of Bangladesh. The required data was conducted from Chapainawabganj district. The district was selected as the study area due to abundance of sugarcane *gur* production. The primary data were collected from a total of 200 farmers using a structured questionnaire through direct interviews following a random sampling technique. A combination of descriptive, mathematical and statistical techniques was used to analyze the data to get meaningful results. The study depicts that most of the respondents (45%) had a medium size family (5 to 6 members) in the study areas. The age structure of the sample farmers was examined by classifying them into three age groups: (below 30), (30-65) and (above 65). It was found that most of the respondents (90%) belong to the (30-65) age group. Only 10 percent were found in those below 30 and above 65. The respondents

were classified into four categories based on education, as shown in Table 1. It was revealed that the highest portion of the respondents (41%) had no education. 33% of the respondents have achieved primary level education, and a negligible portion (6%) of respondents had above secondary level education. To be efficient, farmers must have experience in sugarcane *gur* production. The majority (61%) of the sample farmers had 21 to 40 years of experience producing *gur*. It is found that, on average, 83% of farmers were engaged in agriculture, followed by others (17%). Extension support and training are crucial inputs for the farmers for quick transfer of technology and a way to improve their agriculture and socioeconomic condition. However, the study found that, on average, 51% and 65% of respondents had received extension facilities and training in sugarcane farming in the study areas. About 80% of the farmers had land ownership status.

Table 1. Socio-demographic characteristics of the respondents

Particulars	Percentage (%) of respondent	Particulars	Percentage (%) of respondent
Family size (members)		Age distribution (years)	
Up to 4	29	Below 30	6
5 to 6	45	(30-65)	90
More than 6	26	Above 65	4
Educational level		Experience status	
Illiterate	41	Below 20	32
Primary	35	20-40	61
Secondary	18	Above 41	7
Above Secondary	6	Occupational status	
Access to extension support		Agriculture	83
Received	51	Others	17
Non-received	49	Access to training	
Landownership		Received	65
Own	80	Non-received	35
Rented	20		

The area coverage of the surveyed study locations by the various sugarcane varieties and farming practices of sugarcane is shown in Table 2. The findings showed that most sugarcane farmer's (87.08%) preferred BSRI-released varieties for producing *gur*. On the contrary, only 12.92% of farmers used local varieties in the study areas. It is apparent that BSRI Akh 41 was the most prevalent BSRI-released sugarcane variety, accounting for 40.22% of the land, followed by Isd 29 (28.20%), Isd 29 (20.13%) and BSRI Akh 45 (8.22%). Maximum numbers of farmers (70.97%) practicing sugarcane in the first year, and after harvesting cane, about 29.03 percent of the farmers keep ratoon cane for the following year. It is pointed out that most farmers (64.52%) prefer cultivating garlic as an intercrop with sugarcane, while 29.03% practice sugarcane intercropping with onion.

Table 2. Varietal status and farming practices of sugarcane

Particulars		% of area coverage
Mode of variety	BSRI-released	87.08
	Local	12.92
BSRI-released variety	BSRI Akh 41	40.22
	Isd 29	28.20
	Isd 32	20.13
	BSRI Akh 45	8.22
	BSRI Akh 46	3.23
Farming practice	Sugarcane	70.97
	Ratoon cane	29.03
Intercrop practice	Garlic	64.52
	Onion	29.03
	Others	6.45
	Direct sell	48.39

Table 3 depicts the major agronomic practices in sugarcane cultivation, focusing on four specific areas: land topography, soil physiology, planting and harvesting times, ploughing, and irrigation frequency in the study areas. It is seen that most of the farmers (41.94%) cultivated sugarcane on medium type of land, followed by low (35.48%) and high (22.58%) land. Regarding soil physiology, the majority of farmers (54.26%) planted their sugarcane setts in clay loamy soil, subsequently followed by loamy (37.44%) and sandy loamy (22.58%) soil conditions. The findings revealed that most farmers planted sugarcane in December (50.97%), followed by January (22.25%). They harvested their cane in February (48.71%), followed by January (22.68%) in the study areas. Most sugarcane farmers (80.64%) reported ploughing their fields 3-4 times. Since sugarcane is a water-intensive crop, timely irrigation ensures consistent growth. The findings show that the majority of farmers irrigate their fields 3-4 times (67.74%).

Table 3. Major agronomic practices of sugarcane cultivation by the farmers

Particulars	Percentage (%) of respondent	Particulars	Percentage (%) of respondent
Land topography		Soil physiology	
High	22.58	Sandy loamy	9.30
Medium	41.94	Loamy	37.44
Low	35.48	Clay loamy	54.26
Sugarcane setts planting time (Month)		Sugarcane harvesting time (Month)	
November	6.45	November	6.13
December	50.97	December	9.69
January	22.25	January	22.68
February	16.13	February	48.71
March	4.20	March	12.79
Ploughing (Number)		Irrigation (Number)	
Below 3	12.91	Below 3	25.80
3-4	80.64	3-4	67.74
Above 4	6.45	Above 4	6.46

The inputs used in sugarcane cultivation with intercrop by BSRI-released and local variety farmer's in the study areas are depicted in Table 4. The result shows that the per hectare human labor requirement of the BSRI-released variety was slightly higher (467 person-days/ha) than that of the local variety (464 person-days/ha). It is seen that farmers used a relatively higher amount of local variety setts (37155 pieces/ha) compared to BSRI-released variety (34833 pieces/ha). The per hectare seed rate of intercrop (Garlic) was 440 kg for both varieties. Similarly, farmers applied more fertilizer and insecticide in the BSRI-released varieties (998 kg/ha) than local varieties (812 kg/ha) of sugarcane.

Table 4. Input use pattern of sugarcane cultivation with intercrop

Input item	BSRI-released variety	Local variety
Human labor (person-days/ha)	467	464
Family	136	116
Hired	331	348
Seed		
Sugarcane setts (piece/ha)	34833	37155
Intercrop (Garlic) (kg/ha)	440	440
Fertilizer and insecticide (kg/ha)		
Urea	227	290
DAP	454	348
MoP	227	145
Gypsum	45	-
Furandan	45	29
Total	998	812

Table 5 depicts the cost and return of BSRI-released and local varieties for sugarcane *gur* production. The results showed that per hectare production cost for the BSRI-released variety was Tk.424142. Where human labor cost was Tk.140149 and Tk.45356 for land rental charge. On the other hand, the total production cost for the local variety was Tk.378704, whereas human labor and land rental costs were Tk.139332 and Tk. 43541 respectively. That means the total production cost of BSRI-released varieties was about 3.63% lower than for the cultivation of local varieties for producing sugarcane *gur*. The yield of *gur* from the BSRI-released variety (8345 kg/ha) was approximately 22% greater than that of the local variety (6824kg/ha) per hectare. Additionally, the per hectare yield of intercrop with BSRI-released variety (3991kg/ha) was also about 14% higher than that of the local variety (3483 kg/ha). The results, as shown in Table 5, found that BSRI-released variety farmer's obtained higher gross return (Tk.1183781) per hectare for producing sugarcane gur compared to local variety (Tk. 987248) farmer's. Moreover, farmers earned a higher net return (Tk. 759639) per hectare for cultivating BSRI-released variety than local variety (Tk. 547130) in the study areas. The estimated benefit-cost ratio of BSRI-released variety users (2.79) was higher for producing sugarcane gur than local variety users (2.24).

Table 5. Cost and return of BSRI-released and local variety for sugarcane *gur* production

Particulars		BSRI-released variety	local variety
A. Variable cost (Tk./ha)			
Human labor		140149	139332
Seed	Sett	41800	37155
	Intercrop (Garlic)	45356	43541
Land preparation		29028	33382
Fertilizer		24719	20435
Insecticide		25400	38607
Irrigation		19956	28515
Crusher machine		27213	29028
Transportation		9071	8708
Total Variable cost		362692	378704
B. Fixed cost (Tk./ha)			
Land rent		45356	43541
Interest on operating capital		16094	17872
Total Fixed cost		61450	61414
C. Total Cost (A+B)		424142	440117
Yield (*Gur*) (Kg/ha)		8345	6824
Yield (Intercrop: Garlic) (Kg/ha)		3991	3483
i. Return of *gur* (Tk./ha)		834543	682458
ii. Return of intercrop (Tk./ha)		349238	304790
Gross return (Tk./ha) (i+ii)		1183781	987248
Gross margin (Tk./ha)		821089	608544
Net margin (Tk./ha)		759639	547130
Benefit-cost ratio (BCR)		2.79	2.24

The inputs utilized in ratoon cane cultivation by ratoon with intercrop and sole ratoon farmer's in the study locations are illustrated in Table 6. The findings indicate that the human labor requirement per hectare for the ratoon with intercrop was more substantial (381 person-days/ha) compared to the sole ratoon (236 person-days/ha). During ratoon cane cultivation, there is no need for land preparation as well as sugarcane and intercrop plantation. Thus it is reducing the number of labor. This indicates that sole ratoon cultivation is less labor-intensive. The per hectare seed rate for the intercrop (Onion) was 680 kg for ratoon with intercropping practice. Farmers applied more significant quantities of fertilizer and insecticide on the ratoon with intercrop (783 kg/ha) compared to the sole ratoon (773 kg/ha).

Table 6. Input use pattern of ratoon cane cultivation with intercrop

Input Item	Ratoon with intercrop	Sole ratoon cane
Human labor (person-days/ha)	381	236
Family	91	109
Hired	290	127
Seed		
Intercrop (Onion) (kg/ha)	680	-
Fertilizer and insecticide (kg/ha)		
Urea	181	181
DAP	363	363
MoP	181	181
Gypsum	36	30
Furandan	22	18
Total	783	773

Table 7 illustrates the costs and returns associated with ratoon with intercrop and sole ratoon cane for sugarcane *gur* production. The findings indicate that the production cost per hectare for the ratoon with intercrop was Tk. 302866, which included Tk. 114296 for human labor and Tk. 29753 for land rental. In contrast, the total production cost for the sole ratoon was Tk. 196009, with human labor and land rental costs amounting to Tk. 70755 and Tk. 33382, respectively. This indicates that the total production cost for sole ratoon cane was approximately 35.28% lower than that of ratoon with intercrop for producing sugarcane *gur*. No seeding expenses are necessary for sole ratoon cane growing. Consequently, the production costs for farmers have decreased. The yield of *gur* from the ratoon cane with intercrop was 7260 kg/ha, which is about 44% higher than the sole ratoon's yield of 4063 kg/ha per hectare. The yield gap in cane occurred considering the supplementary inputs and intercultural practices necessary for intercropping. This explains why farmers obtained higher *gur* yields from ratoon cane with intercrop than sole ratoon in the study areas. Furthermore, it is found that the yield of intercrops with the ratoon with intercrop was 1965 kg/ha. According to the results presented in Table 7, farmers of the ratoon with intercrop achieved a higher gross return of Tk. 772859 per hectare for sugarcane *gur* production, compared to Tk. 406386 for sole ratoon cultivators. Additionally, farmers realized a greater net margin of Tk. 469993 per hectare from the ratoon with intercrop, compared to Tk. 210377 from the sole ratoon in the study areas. The estimated benefit-cost ratio for farmers of the ratoon with intercrop (2.79) exceeded that of sole ratoon farmer's (2.26) in the production of sugarcane *gur*.

Table 7. Cost and return of ratoon cane with intercrop and sole ratoon for *gur* production

Particulars	Ratoon with intercrop	Sole ratoon
A. Variable cost (Tk./ha)		
Human labor	114296	70755
Seed (Intercrop: Onion) (Tk./ha)	42500	-
Land preparation	14513	5806
Fertilizer	18687	18687
Insecticide	27866	12337
Irrigation	10885	14514
Crusher machine	19956	29390
Transportation	12700	4898
Total Variable cost	261403	156386
B. Fixed cost (Tk./ha)		
Land rent	29753	33382
Interest on operating capital	11710	6241
Total Fixed cost	41463	39623
C. Total Cost (A+B)	302866	196009
Yield (*Gur*) (Kg/ha)	7260	4063
Yield (Intercrop: Onion) (Kg/ha)	1965	-
i. Return of *gur* (Tk./ha)	653120	406386
ii. Return of intercrop (Tk./ha)	119739	-
Gross return (Tk./ha) (i+ii)	772859	406386
Gross margin (Tk./ha)	511456	250000
Net margin (Tk./ha)	469993	210377
Benefit-cost ratio (BCR)	2.55	2.07

PROFITABILITY OF NIPA PALM *GUR* PRODUCTION IN SOUTHERN AREAS OF BANGLADESH: FARMING PRACTICES AND LIVELIHOOD PERSPECTIVE

The study was designed to estimate the financial profitability and assess the production practices, farmers' perceptions, and problems with nipa palm *gur* production in southern areas of Bangladesh. The study was conducted in the Patuakhali and Borguna districts to collect the required data. Districts were selected purposively as the study area due to the availability of nipa palm trees. Ninety farm households, taking 45 from each location, were interviewed randomly for primary data collection from nipa palm *gur* producers. A combination of descriptive, mathematical, and statistical techniques was used to achieve the objectives and get meaningful data analysis results. In the study areas, it was observed that 52% of respondents had medium-sized families consisting of 5 to 6 members. The age distribution of the farmers was analyzed by grouping them into three categories: below 30, 30–65, and above 65. The majority (70%) of respondents were within the 30–65 age group, while only 30% were below 30 or above 65. Respondents were further classified into four educational levels (as shown in Table 8). The largest group, 46%, had no formal education, while 32% had attained a primary-level education. Only 8% had education beyond secondary school. Experience in nipa palm *gur* farming was examined, with 46% of respondents having 20 to 40 years of experience. Besides, 39% of the sample farmers had 20 to 40 years of experience producing nipa palm *gur*. On average, 88% of the farmers were primarily engaged in agriculture, with the remaining 17% involved in other activities. The study revealed that only 18% of respondents had received extension services, and 20% had participated in training related to nipa palm farming.

Table 8. Socio-demographic characteristics of the respondents

Particulars	Percentage (%) of respondent	Particulars	Percentage (%) of respondent
Family size (members)		Age distribution (years)	
Up to 4	26	Below 30	3
5 to 6	52	(30-65)	70
More than 6	22	Above 65	27
Educational level		Experience status (nipa palm farming)	
Illiterate	46	Below 20	23
Primary	32	20-40	46
Secondary	14	Above 41	31
Above Secondary	8	Experience status (nipa palm *gur* making)	
Access to extension support		Below 20	35
Received	18	20-40	39
Non-received	82	Above 41	26
Access to training		Occupational status	
Received	20	Agriculture	88
Non-received	80	Others	12

Table 9 highlights the production practices of nipa palm trees for producing *gur*. The nipa palm trees used in production are between 10 and 30 years old, indicating that mature trees are primarily utilized for tapping and *gur* production. On average, farmers used about 200 stalks per season, which provides a significant amount of juice for *gur* production. It is seen that the buds appear on a nipa palm tree from March to April, followed by the fruit maturing from April to June. After that, they tap the stem in the first week of August, and it continues through September. Tapping involves pulling down the stalks morning and evening for 15 days, which helps release them efficiently. The primary period for juice collection is from December to mid-March, the peak time for extracting juice. Farmers collected juice twice a day, in the morning and evening, which ensured them maximum collection. In the study area, juice extraction was divided into three phases: (0–10) days, (11–60) days, and (61–90) days. The finding reveals that the optimal production phase for increased juice throughout the 11 to 60-day interval in the study areas. Farmers boiled the collected juice in a furnace chamber to concentrate it into a thicker liquid. Most farmers used wood purchased from the market as fuel to boil the juice. Sometimes, they also used their nipa palm leaves for juice-boiling purposes. After boiling, the final *gur* is prepared manually using a wooden handle. This traditional method suggests that the production process of nipa palm *gur* is labor-intensive and requires fuel during the boiling phases.

Table 9. Production practices of nipa palm *gur*

Particulars	Farmers response
Age of the nipa palm tree	10 to 30 years
The average number of stalk	200
Nipa palm bud	Appear March to April
Nipa palm fruit	Mature April to June
Stem tapping	The first week of August and continued until September
Inflorescence stalk	Pulled down every morning and evening for 15days
Juice collection period	December to mid-March
Juice extraction times	2 (Morning and evening)
Juice extraction days phase	3 (0-10) (11-60) (61-90) days
Juice boiling	Furnace chamber
Gur preparation	Manually(wood handle)

Facts were collected to understand farmers' perceptions about nipa palm *gur* production. It was apparent from Table 10 that the availability of nipa palm trees, water salinity, sharing of work among household members, and *gur* price are the main factors influencing farmers' perception of nipa palm *gur* production. It is noted that the respondents in the study areas agreed on these particulars to different extents. Availability of nipa palm trees was the highest percentage (76.67%) who responded on agreed to nipa palm *gur* production, followed by water salinity (74.44%), sharing of work among household members (72.22%), etc. Still, the lowest percentage was related to credit facilities (18.89%). On the other hand, the rate of farmers who disagreed was highest (81.11%) related to credit facilities, followed by extension services (77.78%) and training facilities (75.56%), and lowest in the availability of nipa palm tree (23.33%).

Table 10. Factors affecting farmers' perception of nipa palm *gur* production

Particulars	Agree (no. of farmers)	Disagree (no. of farmers)	% of farmers agreed	% of farmers disagreed
Credit facilities	17	73	18.89	81.11
Water salinity	67	23	74.44	25.56
Extension services	20	70	22.22	77.78
Training facilities	22	68	24.44	75.56
Sharing of work among household members	65	25	72.22	27.78
Market facilities	30	60	33.33	66.67
Gur price	62	28	68.89	31.11
Consumers' preferences	53	37	58.89	41.11
Availability of nipa palm tree	69	21	76.67	23.33

To assess the feasibility of nipa palm *gur* production, it is essential to evaluate its financial profitability. Different cost items involved in nipa palm *gur* production were estimated. As shown in Table 11 the findings indicate that fuel and labor dominate the cost structure, accounting for nearly 88% of the total cost. Other cost items such as pan, shovel, net, bucket, and transportation make up a smaller portion but are necessary for operations. Among the different cost items, fuel was the highest portion of the total cost. The average cost of fuel per 200 stalks of nipa palm tree was Tk. 37625 covers 48.78

% of the total cost. In addition, human labor was necessary throughout the entire production process. At various phases of nipa palm *gur* production, multiple tasks are executed. They are required to cut inflorescence stalks, tap, extract juice, and boil. Table 11 indicates that the average expense for human labor associated with 200 stalks of nipa palm trees amounts to Tk. 30,000, which covers 38.90% of the total cost. It concluded that the total costs for producing nipa palm *gur* 200 stalks of nipa palm tree were estimated at Tk.77125.

Table 11. Cost involved for nipa palm *gur* preparation

Items	Amount (Tk./200stalks/year)	% of Total cost
Human labor	30000	38.90
Fuel	37625	48.78
Pan	1400	1.82
Shovel	1200	1.56
Net	400	0.52
Bucket	4000	5.19
Transportation	2500	3.24
Total cost	77125	100

Table 12 provides an overview of the return of nipa palm *gur* production per 200 stalks of nipa palm tree in the study areas. The juice extraction and *gur* output of the sample farmers were analyzed by categorizing them into three distinct day phases: (0-10), (11-60), and (61-90). During the initial 0-10 days, farmers harvested merely 400 liters of juice from 200 stalks of nipa palm trees. During 11 to 60 days, juice extraction significantly increased to 6,500 liters, representing the highest level of juice production. During the final 61-90 days, 1,800 liters of juice were produced, resulting in a cumulative juice extraction of 8,700 liters for the 90 days. Consistently, it was observed that within the initial 0-10 days, farmers produced only 26 kg of *gur* from 200 stalks of nipa palm trees. Most *gur* production proceeded during 11 to 60 days, yielding 845 kilograms, coinciding with the highest juice extraction phase. During the last 61-90 days, 216 kilograms of *gur* was produced, resulting in a cumulative production of 1,087 kg during the 90 days. The findings indicated that the optimal production phase for increased juice and *gur* transpired throughout the 11 to 60-day interval in the study areas. The return is the financial amount the farmer receives after deducting total costs. Table 12 indicates that the entire return from 200 stalks of nipa palm *gur* production reached Tk. 233,705. The benefit-cost ratio was calculated at 3.03, indicating substantial returns on investment in nipa palm *gur* production by considering the total cost.

Table 12. Return from Nipa palm *gur* production

Particulars	Days phase			Amount
	(0-10)days	(11-60)days	(61-90)days	(Tk./200stalks/year)
Juice (Liter)	400	6500	1800	8700
Gur (kilograms)	26	845	216	1087
Gur price (Tk./kilograms)				215
Return from *gur* (Tk.)				233705
Benefit-cost ratio				3.03

Table 13 presents the result of the logit regression model. Five of the eight independent variables were identified as significant determinants of farmers' adoption of nipa palm *gur* production in the study area. It is depicted that the estimated coefficient of educational level, farm size, work sharing members, training, and extension contact was positive and significant at 5% and 1% levels, respectively, which implies that having a higher educational level, availability of nipa palm tree, access to work share among household members, training and extension service facilitated had a higher probability of adopting nipa palm *gur* production in the study area.

Table 13. Result of logistic regression on adoption of nipa palm *gur* production

Variables	Coefficients	Standard Error	P value	Odds ratio
Constant	2.201	1.738	0.883	0.812
Age (years)	0.507	1.138	0.65	0.055
Education (years)	1.302**	0.644	0.032	0.081
Experience (years)	0.514	0.46	0.219	0.132
Farm size (number of trees)	0.425**	0.062	0.042	0.037
Work sharing members (number)	1.706**	0.514	0.011	0.294
Farm income	0.060	0.592	0.915	0.164
Off-farm income	1.374	1.883	0.738	0.182
Training	1.448***	0.428	0.007	0.301
Extension contact	0.276**	0.059	0.017	0.305

Note: ***,**, and * indicate significance at 1%, 5% and 1 0% probability levels, respectively.

Engagement with different activities of nipa palm *gur* production greatly impacted their livelihood. It is apparent from Table 14 that the *gur* producer's income was increased, which improved overall socioeconomic condition and livelihood status. As the farmer's were traditionally involved in nipa palm farming, it was found that their self-managerial capability, social networking, and efficiency were improved. Nipa palm tree growers' affirmed that they have a regular source of income from *gur* production and are now able to plan and buy inputs for other farming activities and pay school fees for their children. This means that their educational status, household stuff, etc., were enhanced through *gur* making. Moreover, due to food products, the least visible livelihood outcome was food security, which tends to improve health and boost immunity.

Table 14. Perceived livelihood status of nipa palm *gur* producers

Livelihood capitals	Change after adoption (%)			Livelihood capitals	Change after adoption (%)		
	Increased	Decreased	Constant		Increased	Decreased	Constant
	Human capital				Physical capital		
Health	78	00	22	Building	28	7	65
Education	70	00	30	Refrigerator	63	00	37
Training	72	08	20	Furniture	63	13	24
Knowledge/ Efficiency	66	18	16	Mobile phone	68	10	22
	Social capital				Natural capital		
Managerial capability	50	36	14	Cultivable land	42	28	30
Social Networking	79	09	12	Open water resources	10	35	55
Involved in social group	46	22	32	Forests	12	26	62
				Financial capital			
Cash in hand	72	12	16	Cash at bank	26	5	69

As shown in Table 15, most nipa palm tree growers commented that high fuel prices for *gur* preparation, lack of extension support and training facilities and insufficient flow of water salinity were the major constraints in the study areas. Furthermore, low price of nipa palm *gur* at the local market, and lack of direct linkage between producer and consumer was the main hindrance in case of marketing constraints of nipa palm *gur* production.

Table 15. Ranking constraints of nipa palm farming

Issues	Extend of constraints				PFI	Rank
	Severe (3)	Moderate (2)	Low (1)	Not at all (0)		
Insufficient flow of water salinity	27	32	30	2	174	4
Lack of training facility	41	29	16	4	195	3
High price of fuel for *gur* preparation	56	25	9	0	227	1
Lack of extension support	42	32	14	2	204	2
Insufficient credit facility	20	27	32	12	145	4
Low price of *gur* at local market	23	36	27	4	167	5
Lack of direct linkage between producer and consumer	23	27	29	11	153	6
Lack of sufficient capital	14	28	38	11	134	7

GROWTH AND TREND ANALYSIS OF SUGARCANE AREA, PRODUCTION AND YIELD: A SCENARIO OF SUGARCANE SECURITY IN BANGLADESH

A study was undertaken during the 2023-24 cropping season to examine the growth and trends in sugarcane area, production, and yield in Bangladesh. The analysis was formulated using secondary data from several Bangladesh Bureau of Statistics (BBS) publications. For the study, region-specific time-series data were categorized into four intervals: Period

I (1981-82 to 1990-91); Period II (1991-92 to 2000-01); Period III (2001-02 to 2010-11); and Period IV (2011-12 to 2021-22). The results, as shown in Table 16, reveal that among the regions highest growth rate of sugarcane area was found in Cumilla regions with a significant rate of 5.69 percent during the period I (1981-82 to 1990-91), followed by Dhaka and Rajshahi in the period I with a significant rate of 4.66 and 3.46 percent respectively. However, the situation was different in period III (2001-02 to 2010-11), where a negative growth rate of the sugarcane area was found in Cumilla and Dhaka regions with a significant rate of 10.18 and 11.00 percent respectively. The highest negative growth rate of the sugarcane area was found in Khulna regions during the period III (2001-02 to 2010-11) and IV (2011-12 to 2021-22), with a significant rate of 15.67 and 13.64 percent respectively.

Table 16. Period-wise compound growth rate analysis of area

Region	Period I	Period II	Period III	Period IV	Whole Period
Barishal	1.41	-10.42***	0.94	-0.75	-4.15***
Bogura	-3.53***	-1.22	-6.71***	-3.35	-2.56
Chattogram	-7.13***	0.05	-1.34	-4.30	-2.41
Cumilla	5.69***	3.28	-10.18***	0.12	-0.92
Dhaka	4.66***	2.29	-11.00***	-3.94	-2.71
Dinajpur	1.79	0.08	-4.66	-5.11	-1.79
Faridpur	2.60	-2.47	-4.08	-9.09	-3.51***
Jashore	3.13	-1.80	-7.96	-5.31	-4.10***
Khulna	2.71	2.15	-15.67***	-13.64***	-4.92***
Mymensingh	1.04	-2.05	-3.52	-2.14	-1.76
Rajshahi	3.46***	-0.99	-1.63	-3.88	-0.26
Rangamati	-2.60	1.95	0.47	0.39	0.79
Rangpur	-0.65	-4.43***	-5.82***	-3.59	-3.81***
Sylhet	-4.64***	0.71	-2.84	-2.91	-1.23

It is apparent from Table17 that the highest growth rate of sugarcane production was found in Sylhet region with a significant rate of 14.82 percent during period IV (2011-12 to 2021-22), followed by Khulna and Cumilla in period I (1981-82 to 1990-91) with a significant rate of 7.03 and 6.28 percent respectively. The positive growth rate of sugarcane production was found in Rajshahi, Jashore, Rangpur, and Dinajpur regions during the period I (1981-82 to 1990-91) with a rate of 2.78, 2.21, 1.80, and 1.39 percent respectively. The highest negative growth rate of sugarcane production was found in Khulna regions during the period III (2001-02 to 2010-11) with a significant rate of 28.09 percent, followed by Sylhet, Barishal, Cumilla and Chattogram region in period III (2001-02 to 2010-11), Period I (1981-82 to 1990-91) respectively.

Table 17. Period-wise compound growth rate analysis of production

Region	Period I	Period II	Period III	Period IV	Whole Period
Barishal	0.82	-15.47***	-16.98***	-0.54	-7.17***
Bogura	-4.80***	-2.16	-4.97	-5.26	-2.62
Chattogram	-10.74***	-4.82	-5.22***	1.81	-5.01***
Cumilla	6.28***	1.57	-13.77***	-3.05	-2.61
Dhaka	-2.71***	1.61	-10.59***	0.10	-3.12
Dinajpur	1.39	-0.47	-3.62	-4.46	-2.19
Faridpur	0.28	-1.90	-3.39	-8.71***	-3.91
Jashore	2.21	-0.81	-8.62***	-4.89	-3.61
Khulna	7.03***	1.67	-28.09***	-12.20***	-7.78***
Mymensingh	0.88	-1.61	-6.71	-0.94	-1.60
Rajshahi	2.78	-1.43	-1.28	-4.55	-0.07
Rangamati	-3.34	-0.30	1.18	-2.10	-0.24
Rangpur	1.80	-4.78	-3.57	-4.06	-3.21
Sylhet	-14.72***	1.04	-18.44***	14.82***	-4.86***

Table 18 illustrates a period-wise compound growth rate analysis of sugarcane yield. It is seen that the growth rate of sugarcane yield was found to be positive in Khulna regions during the period I (1981-82 to 1990-91) with a significant rate of 4.32 percent. But it was negative in period III (2001-02 to 2010-11) with a significant rate of 12.41 percent. The growth rate of sugarcane yield was found negative during period I (1981-82 to 1990-91) and positive during period IV (2011-12 to 2021-22), with a significant rate of 7.37 and 4.05 percent, respectively, in Dhaka region. On the other hand, in the case of the Chattogram region, the growth rate of sugarcane yield was found to be positive during period IV (2011-12 to 2021-22) and negative during period III (2001-02 to 2010-11) with a significant of the rate of 6.11 and 3.88 percent, respectively. The highest positive and negative growth rate of sugarcane yield was found in Sylhet and Barishal regions, respectively, with a significant rate of 17.73 and 17.92 percent during period IV (2011-12 to 2021-22) and period III (2001-02 to 2010-11).

Table 18. Period-wise compound growth rate analysis of yield

Region	Period I	Period II	Period III	Period IV	Whole Period
Barishal	-0.60	-5.05	-17.92***	0.21	-3.02***
Bogura	-1.27	-0.94	1.75	-1.92	-0.06
Chattogram	-3.61	-4.87	-3.88***	6.11***	-2.60***
Cumilla	0.59	-1.71	-3.58***	-3.17***	-1.70
Dhaka	-7.37***	-0.68	0.41	4.05***	-0.41
Dinajpur	-0.41	-0.56	1.03	0.65	-0.40
Faridpur	-2.33	0.57	0.69	0.39	-0.41
Jashore	-0.92	0.99	-0.67	0.43	0.48
Khulna	4.32***	-0.48	-12.41***	1.45	-2.86
Mymensingh	-0.17	0.44	-3.19	1.20	0.16
Rajshahi	-0.68	-0.44	0.35	-0.67	0.19
Rangamati	-0.73	-2.25	0.71	-2.48	-1.03
Rangpur	2.45	-0.35	2.25	-0.47	0.59
Sylhet	-10.07***	0.33	-15.60***	17.73***	-3.62***

REGIONAL SUGARCROP RESEARCH STATION, THAKURGAON

RESEARCH HIGHLIGHTS

- BSRI Akh 48 showed the best performance followed by Isd 37 and BSRI Akh 46 in Old Himalayan Piedmont Plain.
- Considering yield and brix % the best ratooning performance was obtained from the variety BSRI Akh 48 followed by BSRI Akh 46 and Isd 37 in Old Himalayan Piedmont Plain.
- Considering BCR, the best performance was obtained from Black Ruby, then BSRI Akh 41 and BSRI Akh 42 in Old Himalayan Piedmont Plain.
- Considering yield and economic return. Among the treatments, Sugarcane + groundnut - mungbean showed the best performance.

PERFORMANCE OF PROMISING SUGARCANE VARIETIES IN OLD HIMALAYAN PIEDMONT PLAIN

The experiment was conducted in farmer's field at Pirganj, Thakurgaon location during the cropping season 2023-24 with eight sugarcane varieties of Isd 34, Isd 37, Isd 39, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, BSRI Akh 46 and BSRI Akh 48. Data on germination (%), tiller, millable cane, stalk diameter, cane yield and brix (%) are shown in table 1. The highest germination percentage of 80.47 was found in variety BSRI Akh 45 which was statistically similar with Isd 37 and the lowest germination f 70.41% was seen in the variety BSRI Akh 43. The highest number of tiller (193.78 x 10^3 ha^{-1}) was found in Isd 39 which was statistically similar with Isd 34 (184.90 x 10^3 ha^{-1}) and the lowest number of tiller (158.73 x 10^3 ha^{-1}) was found in variety BSRI Akh 44. The highest number of millable cane (106.93 x 10^3 ha^{-1}) was seen in Isd 34 and the lowest number of millable cane was found in BSRI Akh 44 (85.57 x 10^3 ha^{-1}). The highest stalk diameter (2.38 cm) was measured in variety BSRI Akh 48 and the lowest (1.85 cm) was in Isd 34. The highest stalk height (3.23 m) was obtained from variety Isd 39 and the lowest (2.87 cm) was found in the variety Isd 34. The highest cane yield (93.77 tha^{-1}) was obtained from BSRI Akh 46 and the lowest cane yield (64.67 tha^{-1}) was obtained in Isd 34. The highest brix value (21.21%) was measured in variety BSRI Akh 48 and the lowest (18.13%) was measured in variety Isd 34.

Table 1. Germination (%) and growth parameters of different varieties of sugarcane

Treatments	Germination (%)	Tiller (x10^3 ha^{-1})	Millable cane (x10^3 ha^{-1})	Stalk diameter (cm)	Stalk height (m)	Yield (tha^{-1})	Brix (%)
Isd 34	71.78 bc	184.90 ab	106.93 a	1.85 e	2.87 c	64.67 d	18.13 c
Isd 37	80.1 a	173.41 bcd	96.44 abc	2.27 ab	3.12 ab	89.00 ab	19.64 abc
Isd 39	75.28 abc	193.78 a	104.50 ab	2.08 cd	3.23 a	79.83 c	20.33 ab
BSRI Akh 43	70.41 c	163.07 cd	91.28 bc	2.10 cd	3.00 bc	84.00 bc	19.37 abc
BSRI Akh 44	75.11abc	158.73 d	85.57 c	2.12 bcd	3.03 abc	75.67 c	20.45 ab
BSRI Akh 45	80.47 a	172.88 bcd	103.13 ab	2.06 d	3.11 ab	80.17 c	20.31 ab
BSRI Akh 46	76.78 abc	173.44 bcd	98.40 abc	2.23 abc	3.20 ab	93.77 a	19.14 bc
BSRI Akh 48	78.55 ab	176.78 abc	102.63 ab	2.38 a	3.14 ab	91.07 ab	21.21 a
LSD (0.05)	7.28	17.95	15.02	0.15	0.17	8.42	2.02

Overall results revealed that the best performance was obtained from the variety BSRI Akh 48, where Isd 37 and BSRI Akh 46 were statistically at par in Old Himalayan Piedmont Plain.

RATOONING POTENTIALITY OF BSRI BRED PROMISING SUGARCANE VARIETIES IN THE OLD HIMALAYAN PIEDMONT PLAIN

The experiment was conducted in farmer's field at Pirganj, Thakurgaon location during the cropping season 2023-24 with eight sugarcane varieties of Isd 34, Isd 37, Isd 39, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, BSRI Akh 46 and BSRI Akh 48. Data on tiller, millable cane, stalk height, stalk diameter, cane yield and brix (%) are shown in table 2. The highest number of tillers (207 × 10^3 ha^{-1}) was obtained from variety Isd 39 which was statistically similar with Isd 34 and the lowest (170.33 × 10^3 ha^{-1}) was measured in variety BSRI Akh 44 which was statistically similar with the varieties BSRI Akh 43, BSRI Akh 46, BSRI Akh 45 and BSRI Akh 48. The highest number of millable cane (117.50 × 10^3 ha^{-1}) was obtained from variety Isd 34 which was statistically similar with Isd 39, BSRI Akh 45 and BSRI Akh 46. The lowest number of millable cane (87 × 10^3 ha^{-1}) was measured in variety BSRI Akh 44 which was statistically similar with the varieties BSRI Akh 43, BSRI Akh 46, BSRI Akh 45 and BSRI Akh 48. In case of stalk height, highest value (3.23 m) was found from variety Isd 39 and the lowest value (2.87 m) was found in variety Isd 34. The highest stalk diameter (2.19 cm) was found from BSRI Akh 48 where as lowest value of diameter (1.88 m) was found in variety Isd 34. The highest cane yield (86.83 tha^{-1}) was found from variety BSRI Akh 46 which was statistically similar with Isd 37 (85.83 tha^{-1}) and BSRI Akh 48 (85.50 tha^{-1}) and the lowest cane yield (66.00 tha^{-1}) was obtained from variety BSRI Akh 44. The highest brix % (21.97) was obtained from variety BSRI Akh 48 and lowest (19.12%) was found in variety Isd 34. Found in variety BSRI Akh 44 which was statistically similar with other varieties except Isd 34 and BSRI Akh 48.

Table 2. Yield and yield contributing characters of different sugarcane varieties

Treatments	Tiller (x10^3 ha^{-1})	Millable cane (x10^3 ha^{-1})	Stalk height (m)	Stalk diameter (cm)	Yield (tha^{-1})	Brix (%)
Isd 34	198.67 ab	117.50 a	2.87 c	1.88 c	70.33 bc	19.12 c
Isd 37	182.67 c	98.00 bc	3.12 ab	2.18 ab	85.83 a	20.80 abc
Isd 39	207.00 a	106.70 ab	3.23 a	2.05 b	73.84 bc	21.13 ab
BSRI Akh 43	175.83 c	91.00 bc	3.00 bc	2.10 ab	72.00 bc	20.45 abc
BSRI Akh 44	170.33 c	87.83 c	3.03 abc	2.10 ab	66.00 c	20.20 bc
BSRI Akh 45	181.00 c	105.33 abc	3.11 ab	2.05 b	77.50 ab	21.14 ab
BSRI Akh 46	179.67 c	100.00 abc	3.20 ab	2.15 ab	86.83 a	20.43 abc
BSRI Akh 48	185.33 bc	98.17 bc	3.14 ab	2.19 a	85.50 a	21.97 a
LSD (0.05)	15.33	17.79	0.17	0.13	10.82	1.76

Considering yield and brix % the best ratooning performance was obtained from the variety BSRI Akh 48 followed by BSRI Akh 46 and Isd 37 in Old Himalayan Piedmont Plain.

EVALUATION OF DIFFERENT CHEWING SUGARCANE GENOTYPES IN OLD HIMALAYAN PIEDMONT PLAIN

The experiment was set up at RSRS farm during the cropping season 2023-2024 to find out the suitable chewing sugarcane genotypes for AEZ I. Six different chewing genotypes were used viz. BSRI Akh 41,

BSRI Akh 42, Black Ruby, Q 69, China and Modhumala. Data on tiller and chewable cane, Stalk height, Stalk diameter, No. of internode, Cane yield and brix (%) are presented in table 3. The highest number of tiller (174.33) was found in T_1 and the lowest (128.77) was in T_4. The highest number of millable cane (117.40) was observed in T_1 and the lowest (59.82) was observed in T_4. The highest stalk height (3.10 m) was found in T_6 and the lowest (2.23 m) was in T_4. The highest stalk diameter (2.90 cm) was found in T_4 and the lowest (2.27 cm) was in T_5. The highest number of internode (30.67) was found in T_3 and the lowest number of internode (18.81) was in T_2. The highest cane yield (164.09 tha^{-1}) was observed in T_1 which was statistically similar with T_2. The lowest cane yield (61.25 tha^{-1}) was in T_4. The highest brix (19.44 %) was found in T_5 and the lowest (15.20) was in T_6.

Table 3. Growth, yield and yield contributing characters of different chewing sugarcane varieties

Treatments	Tiller ($\times 10^3$ ha^{-1})	Millable cane ($\times 10^3$ ha^{-1})	Stalk height (m)	Stalk Diameter (cm)	No. of internode	Cane yield (tha^{-1})	Brix (%)
T_1 : BSRI Akh 41	174.33 a	117.40 a	2.78 c	2.57 c	25.61 b	164.09 a	18.28 ab
T_2: BSRI Akh 42	134.57 c	87.03 bc	2.23 e	2.68 bc	18.81 c	149.48 ab	17.18 bc
T_3 : Black Ruby	152.57 b	86.64 bc	2.43 d	2.90 a	30.67 a	147.37 b	16.20 cd
T_4: China	128.77 c	59.82 d	1.5 f	2.83 ab	26.33 ab	61.25 d	17.02 bc
T_5: Q 69	151.67 b	99.19 b	2.98 b	2.27 d	23.93 b	120.22 c	19.44 a
T_6 : Modhumala	160.93 b	79.83 c	3.10 a	2.56 c	30.64 a	123.02 c	15.20 d
LSD (0.05)	9.49	16.79	0.18	0.21	4.90	14.68	1.45

Economic aspect of different chewing sugarcane genotypes are shown in Table 4. The highest benefit cost ratio (BCR) 4.39 was found from treatment T_3 (black ruby) followed by T_1 (BSRI Akh 41) but the lowest BCR (1.55) was found from treatment T_4 (China). Considering BCR, the best performance was obtained from Black Ruby, then BSRI Akh 41 and BSRI Akh 42 in Old Himalayan Piedmont Plain.

Table 4. Economic aspect of different chewing sugarcane genotypes

Treatments	Cost of production (Tk ha^{-1})	Gross return (Tk ha^{-1})	Net return (Tk ha^{-1})	BCR
T_1: BSRI Akh 41	3,15,000	11,54,100	8,39,100	3.66
T_2: BSRI Akh 42	3,30,000	10,44,360	7,14,360	3.16
T_3: Black Ruby	3,55,000	15,59,520	12,04,520	4.39
T_4: China	2,70,000	4,18,740	1,48,740	1.55
T_5: Q 69	2,85,000	7,93,520	5,08,520	2.78
T_6 : Modhumala	2,90,000	6,38,640	3,48,640	2.20

Chewing cane price per stalk: BSRI Akh 41: 10 tk; BSRI Akh 42: 12 tk; Black Ruby: 18 tk; China: 7 tk; Q 69: 8 tk; Modhumala: 8 tk.

PRODUCTIVITY AND PROFITABILITY OF SUGARCANE WITH OIL SEED CROPS AS FIRST AND MUNGBEAN AS SECOND INTERCROP

The experiment was set up at Patuadangi farm, Thakurgaon during the cropping season 2023-2024 to find out the effect of intercropping of some oil crops viz; linseed, sunflower, groundnut, soybean and mustard as first intercrop and mungbean as second

intercrop with sugarcane (BSRI Akh 46). Six different treatments: Single row cane (sole), T_2: SRC + linseed-mungbean, T_3: SRC + sunflower-mungbean, T_4: SRC + groundnut-mungbean, T_5: SRC + soybean-mungbean and T_6: SRC + mustard – mungbean. Number of tiller and millable cane, cane yield and brix (%) of different treatments are presented in table 5. The highest number of tiller (176.35 x 10^3 ha^{-1}) was recorded in T_1 and the lowest number of tiller (92.95 x 10^3 ha^{-1}) was recorded in T_3 which was statistically similar with T_6. The highest number of millable cane (88.16 x 10^3 ha^{-1}) was obtained in T_2 which was statistically similar with T_4 and T_5. The lowest number of millable cane (64.93 x 10^3 ha^{-1}) was obtained in treatment T_3 which was statistically similar with T_6 and T_2. The highest cane yield 87.46 tha^{-1} was obtained from T_2 but which was statistically similar with T_4 and T_5. The lowest cane yield (51.88 tha^{-1}) was obtained from T_3 which was statistically similar with T_6. No significant different was observed in brix (%) among the treatments.

Table 5. Growth, yield and quality parameter of cane in sugarcane base intercropping system

Treatments	Tiller (×10^3 ha^{-1})	Millable cane (×10^3 ha^{-1})	Cane yield (t ha^{-1})	Brix (%)
T_1: Single row cane (sole)	176.35 a	88.16 a	87.46 a	19.28
T_2: SRC+linseed-mungbean	134.41 c	75.30 bc	75.97 b	19.06
T_3: SRC+sunflower-mungbean	92.95 d	64.93 c	51.88 c	18.29
T_4: SRC+groundnut-mungbean	148.22 bc	83.82 ab	86.24 ab	19.26
T_5: SRC+soybean-mungbean	158.80 ab	81.53 ab	77.42 ab	19.02
T_6: SRC+mustard -mungbean	94.10 d	67.33 c	58.98 c	18.38
LSD (0.05)	21.98	11.25	11.00	NS

Results presented in table 6 shows that the highest equivalent cane yield 40 tha^{-1} was found from T_3 and the lowest of 72.76 t ha^{-1} was from the treatment T_4. The highest total adjusted cane yield 105.14 tha^{-1} was calculated from the treatment T_4 and the lowest of 72.76 tha^{-1} was from the treatment T_6.

Table 6. Cane yield, intercrops yield, equivalent cane yield of intercrops and total adjusted cane yield of sugarcane

Treatments	Cane yield (tha^{-1})	1st Intercrop yield (tha^{-1})	2nd Intercrop yield (tha^{-1})	Eq. cane yield of intercrop (tha^{-1})	Total adj. cane yield (tha^{-1})
T_1: Single row cane (sole)	87.46	-	-	-	87.46
T_2: SRC+linseed-mungbean	75.97	0.75	0.56	25.28	99.25
T_3: SRC+sunflower-mungbean	51.88	1.20	-	40.00	91.52
T_4: SRC+groundnut-mungbean	86.24	1.62	-	18.90	105.14
T_5: SRC+soybean-mungbean	77.42	1.40	0.45	21.58	99.00
T_6: SRC+mustard-mungbean	58.98	0.81	0.61	13.78	72.76

Sugarcane seed price: 5,500 Tk. t^{-1}; Sugarcane selling price: 6000/- Tk. t^{-1}, Linseed: 1,50,000 Tk. t^{-1}, Sunflower: 2,00,000 Tk. t^{-1}, Groundnut: 70,000 Tk. t^{-1}, Soybean: 70,000 Tk. t^{-1}, Mustard: 70,000 Tk. t^{-1}, Mungbean: 70,000 Tk. t^{-1}

The economic aspect in sugarcane base intercropping system under the experiment (Table 7) showing that the highest benefit cost ratio (BCR) of 2.79 was found from treatment T_4. The lowest BCR of 1.98 was found from treatment T_6 which was followed by T_1. Considering yield and economic return Among the treatments, Sugarcane + groundnut - mungbean showed the best performance.

Table 7. Economic aspect in sugarcane base intercropping system

Treatments	Cost of production (Tk.ha^{-1})	Gross return (Tk.ha^{-1})	Net return (Tk.ha^{-1})	BCR
T_1: Single row cane (sole)	2,02,000	5,2,4760	3,22,760	2.59
T_2: SRC+linseed-mungbean	2,24,000	5,95,500	3,71,500	2.66
T_3: SRC+sunflower-mungbean	2,30,000	5,49,120	3,19,120	2.39
T_4: SRC+groundnut-mungbean	2,26,000	6,30,840	4,04,840	2.79
T_5: SRC+soybean-mungbean	2,25,000	5,94,000	3,69,000	2.64
T_6: SRC+mustard -mungbean	2,20,000	4,36,560	2,16,560	1.98

Sugarcane seed price: 5,500 Tk. t^{-1}; Sugarcane selling price: 6000/- Tk. t^{-1}, Linseed: 1,50,000 Tk. t^{-1}, Sunflower: 2,00,000 Tk. t^{-1}, Groundnut: 70,000 Tk. t^{-1}, Soybean: 70,000 Tk. t^{-1}, Mustard: 70,000 Tk. t^{-1}, Mungbean: 70,000 Tk. t^{-1}

QUARANTINE STATION, GAZIPUR

RESEARCH HIGHLIGHTS

- Bangladesh Sugarcrop Research Institute (BSRI) imports exotic sugarcane varieties/clones to enrich the genetic materials and to extend the hybridization program through the introduction. The main objective of quarantine is to remain vigilant about the entry and introduction of new pathogens and insect pests carried along with the germplasms during post entry quarantine procedures. This is a continuous program since 1979-80. During the reporting period quarantine station dealt with Nineteen (19) clones under 41th to 54th consignments. Consignment 41th, 51th and 54th were imported from China; 43th consignment from Senegal; 47th, 50th and 52nd from Egypt; 53rd from Taiwan; rest of the consignments i.e. 42th, 44th, 45th, 46th, 48th and 49th imported from different state of India through core program and personal contact. These nineteen clones were observed in the field of quarantine station as per quarantine rules.
- Thirteen local germplasms and eighteen BSRI released varieties were maintained to conserve and enrich the germplasms for further research in breeding aspect.

QUARANTINE FOLLOW UP OF IMPORTED VARIETIES/CLONES

During reporting period, two clones viz. Guitang 98296 and Xintaitang R_{22} under 41st consignment from China; five clones viz. Co 7704, Co 95005, Co 86032, Co 265 and Co 671 under 42nd from Coimbatore, India; one from Senegal under 43rd; one from India under 44th; one from Lucknow, India under 45th; Co 0265 from India under 46th; one unknown^{-1} germplasm from Egypt under 47th; Geeza-1 from India under 48th consignment; one germplasm Co 99006 from Coimbatore, India under 49th; one unknown-2 germplasm from Egypt under 50th consignment and C-9 under 51th were planted as 4th generation plant for further investigation. Another unknown-3 germplasm from Egypt under 52th consignment and one Taiwan germplasm under 53rd consignment namely Geeza-2 was also handed over to Breeding division, BSRI in January 2023 to enrich germplasm bank and hybridization program. Consignment 54th was imported from China maintaining as 1st generation plant inside the glass house. Inspection of diseases and insect pests was done and recorded by the scientists of the working site in all consignments.

No major and minor diseases and insect pests were recorded from these germplasms during the reporting period.

Table 1. Quarantine follow up of imported varieties/clones during 2023-2024 at Quarantine Station, Joydebpur, Gazipur

Consignments	Sources	Year of Import	Generation crop observation	Varieties/ Clones imported	Disease status	Insect pests status	Remarks
41th	China	28 May 2012	4th generation plant	Guitang 98296 Xintaitang R_{22}	No diseases	No major insects and pests	Handed over to Breeding Division in 2014
42nd	India (Coimbatore)	24 June 2012	4th generation plant	Co 7704 Co 95005 Co 86032 Co 265 Co 671	No diseases	No major insects and pests	Handed over to Breeding Division in 2014
43th	Senegal	17 June 2013	4th generation plant	unknown	No diseases	No major insects and pests	Handed over to Breeding Division in 2015
44th	India	16 July 2013	4th generation plant	unknown	No diseases	No major insects and pests	Do
45th	Lucknow (India)	18 August 2013	4th generation plant	Unknown	No diseases	No major insects and pests	Do
46th	India (Coimbatore)	07 May 2014	4th generation plant	COM 0269	No diseases	No major insects and pests	Handed over to Breeding Division in 2016
47th	Egypt-1	23 June 2014	4th generation plant	Unknown	No diseases	No major insects and pests	Do
48th	India	2014	4th generation plant	Geeza-1	No diseases	No major insects and pests	Do
49th	Coimbatore (India)	2016	4th generation plant	Co 99006	No diseases	No major insects and pests	Handed over on December 2018
50th	Egypt-2	October 2017	4th generation plant	Unknown	No diseases	No major insects and pests	Handed over on December 2019
51th	China-2	January 2019	4th generation plant	Unknown	No diseases	No major insects and pests	Handed over on December 2021
52nd	Egypt-3	July 2019	3rd generation plant	C-9	No diseases	No major insects and pests	Handed over on January 2023
53rd	Taiwan	September 2019	3rd generation plant	Geeza-2	No diseases	No major insects and pests	Do
54th	China-3	April 2024	1st generation plant	Unknown	No diseases	No major insects and pests	1st generation plant inside glass house, will be handed over to breeding division by 2026

QUARANTINE FOLLOW UP OF LOCAL GERMPLASMS

Local germplasms were collected to conserve and enrich for further research in breeding aspect. During the cropping season 2023-2024 total thirteen local germplasms viz. Misridana, Madhumala, Pochadana, Q 69, Co 527, Piashi, Kazla, Turpin, one unknown from Sylhet, Dholbazari, Blackruby, Shinduri and Malayasia were transplanted on January 2024 in the field of Quarantine station for seed multiplication. Seeds of all germplasms treated with fungicide under carbendazim group. No major diseases and insect pests recorded during the reporting period. Other intercultural operations like weeding, mulching, irrigation, fertilizer and insecticides application, earthing up, detrashing of old leaves and tying of cane were done as per schedule.

MAINTENANCE OF BSRI RELEASED SUGARCANE VARIETIES IN QUARANTINE STATION

To conserve the BSRI released sugarcane varieties for producing disease free seed cane for local usage eighteen varieties like Isd 2/54, Isd 16, Isd 20, Isd 32, Isd 34, Isd 36, Isd 37, Isd 38, Isd 39, Isd 40, BSRI Akh 41, BSRI Akh 42, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, BSRI Akh 46, BSRI Akh 47 and BSRI Akh 48 were transplanted on January 2024 in the field of Quarantine station. Setts of all varieties treated with fungicide under carbendazim group. Different intercultural operations like weeding, mulching, irrigation, fertilizer and insecticides application, earthing up, detrashing of old leaves and tying of cane were done when necessary.

REGIONAL SUGARCROP RESEARCH STATION, GAZIPUR

RESEARCH HIGHLIGHTS

- The experiment was conducted to enhance sett sprouting, tiller population, and yield attributes of chewing cane by applying plant growth regulators such as ethrel and gibberellic acid. Results showed that germination was significantly improved by ethrel soaking, and treatment T_3 produced the highest sprouting (84.49%) compared to the control T_1 (42.70%). Tillering and millable cane number were maximized in the combined treatment of ethrel soaking with GA_3 spray T_7 (89.25 × 10^3 ha^{-1} and 76.17 × 10^3 ha^{-1}) respectively, which also produced the highest cane yield (80.72 t ha^{-1}). Cane height was greatest (1.95 m) from setts soaked in ethrel overnight + foliar application of ethrel at 60 DAP (T_5), whereas T_7 produced the longest internodes (1.67 cm). Juice quality, measured as Brix, was highest in T_3 (19.36%) and lowest in T_1 (11.86%).
- To reducing the use of inorganic amendments and improving soil fertility the experiment was conducted at RSRS Farm, Gazipur. The experimental design was RCB following three replications. Planting material was BSRI Akh 41 and transplanted on 05 March 2024. Biochar was prepared from sugarcane bagasse and applied at different doses with RFD. Among the recorded data highest no. of tiller (87.61 x 10^3 ha^{-1}) was recorded in treatment T_7 and the highest no. of millable cane (66.78 x 10^3 ha^{-1}), stalk height (2.41 m), yield (106.83 tha^{-1}) were recorded in treatment T_6.
- The experiment was carried out at RSRS Farm, Gazipur with four sugarcane varieties viz Isd 34, BSRI Akh 41, BSRI Akh 45, and BSRI Akh 47. Multi spectral and thermal images were captured at the height of 50 m at 60 days intervals from settlings transplantation through drone with advanced sensors. The images were processed in ENVI Software (L3Harris Geospatial, USA). Among the four sugarcane varieties, Isd 34 exhibited superior performance across most traits, including plant height (2.97 m), Girth (6.45 cm), tiller number (121.1 ×10^3), millable cane number (67.5 ×10^3), yield (69.93 t ha^{-1}), brix content (18.9%), and chlorophyll content (12.22 µ mol m^{-2}) indicating its potential as a high-yielding and quality variety. Overall, BSRI Akh 47 was the least productive, with the lowest growth, yield, and quality traits in case of waterlogged conditions.
- The experiment was carried out at RSRS Farm, Gazipur with four sugarcane varieties viz BSRI Akh 41, BSRI Akh 45, BSRI Akh 47 and BSRI Akh 48. Multi spectral and thermal images were captured at the height of 50 m at 60 days intervals from settlings transplantation through drone with advanced sensors. The images were processed in ENVI Software (L3Harris Geospatial, USA). Among the tested sugarcane varieties, BSRI Akh 48 demonstrated the best overall performance, producing the highest tiller number (128.4 x 10^3 ha^{-1}), millable cane (60.3 x10^3 ha^{-1}), and yield (78.1 tha^{-1}), along with good plant height (4.22 m) and brix content (18.8%). BSRI Akh 45 also showed strong potential with high yield (71.1 tha^{-1}) and the highest juice quality (20.4% brix), making it a promising variety for both yield and sugar recovery. In contrast, BSRI Akh 47 consistently recorded the lowest values for growth, yield (36.3 tha^{-1}), and juice quality (15.2%), indicating poor performance.
- The experiment was conducted to determine the optimum time and level of earthing up of plant and ratoon cane. Among six treatments, treatment T_3L_2

(earthing up after 6 months of sprouting at 20 cm hight) showed the highest result in tiller (106.8 x 10^3 ha^{-1}), millable cane (76.38 x 10^3 ha^{-1}) and cane yield (122.72 t ha^{-1}) followed by T_2L_2 (earthing up after 5 months of sprouting at 20 cm height).

- The experiment was carried out at RSRS Farm, Gazipur. BSRI released chewing cane varieties viz BSRI Akh 41 was used as planting materials. After data collection all samples were sent to Central laboratory, Bangladesh Council of Scientific and Industrial Research (BCSIR) and Soil Science division of BARI for quantifying pesticide residues and nutritional values. The juice of BSRI Akh 41 showed a brix value of 19.6% with a sugar content of 11.3%, indicating good sweetness and juice quality. With no pesticide residue. It is low in energy (42.5 Kcal/100 ml) and contains no saturated fat, making it a healthy natural beverage. Mineral analysis revealed a rich presence of essential nutrients, particularly potassium (442.9 ppm), calcium (265 ppm), manganese (1.5 ppm), magnesium (150.1 ppm) and sodium (149.8 ppm) recorded respectively. In addition, trace elements like iron, zinc, copper, thiamine and selenium, enhancing its nutritional value.

ENHANCEMENT OF CHEWING CANE TILLER PRODUCTION THROUGH EXOGENOUS APPLICATION OF ETHREL AND GIBBERELLIC ACID

The experiment was set up at RSRS, Gazipur during the 2023-2024 cropping season to improve the sprouting, tiller population, yield attributes and yield of chewing cane by applying plant growth regulators such as ethrel and gibberellic acid. The experimental design was RCB with three replications and the treatments was T_1 (Un soaked) which was treated as control, T_2 (Setts soaked in water for overnight), T_3 (Setts soaked in ethrel 100 ppm for overnight), T_4 (Un soaked + foliar application of ethrel at 60 DAP), T_5 (Setts soaked in ethrel for overnight + foliar application of ethrel at 60 DAP), T_6 (Un soaked + foliar application of GA_3 at 90, 120 and 150 DAP) and T_7 (Setts soaked in ethrel for overnight + foliar application of GA_3 at 90, 120 and 150 DAP) where ethrel @100 ppm and gibberellic acid @ 5 ml/plant were applied. Two budded setts of china germplasm were used as plant materials. Experimental data on germination percentage were recorded 45 days after plantation. The highest (84.49%) sprouting was observed when cane setts were planted after overnight soaking in 100 ppm ethrel solution (Fig 1). Moreover, the highest (89.25 X 10^3 ha^{-1}) tillers production (at 150 DAP) was recorded from the treatment T_7 followed by T_3 (83.38 X10^3 ha^{-1}) and the lowest no. of tillers was obtained in T_4 (59.67 X10^3 ha^{-1}) treatment at the same growth stages (Table 1.). The highest number of millable cane (76.17 X10^3 ha^{-1}) was produced in T_7 treatment which was statistically similar with T_3 (70.29 X10^3 ha^{-1}) and T_5 (69.04X10^3 ha^{-1}).

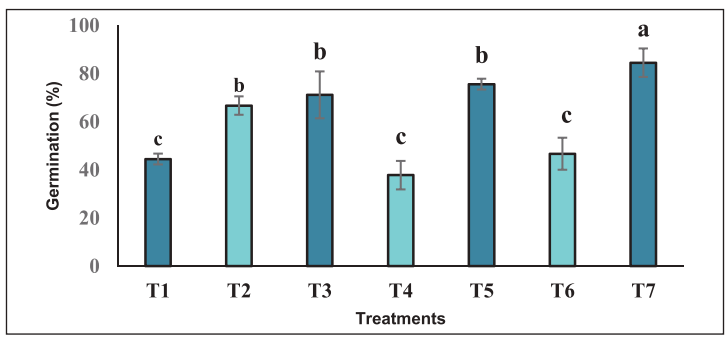


Fig 1. Germination (%) enhanced through ethrel and gibberellic acid application



Plate 1. Experimental field of enhancement of chewing cane tiller production through exogenous application of ethrel and gibberellic acid

Table 1. Effect of ethrel and gibberellic acid on yield and yield contributing parameters during 2023-2024 cropping season at RSRS, farm, Gazipur

Treatment	No. of Tiller ($\times 10^3$ ha^{-1})	No. of chewable canes ($\times 10^3$ ha^{-1})	Single cane wt. (Kg)	Yield (tha^{-1})	Height (m)	Girth (cm)	No. of internode	Average Length of internodes (cm)	Brix (%)
T_1	64.25 c	48.67 b	0.88 c	42.70 c	1.63 b	17.10	42.00	0.73 b	11.86 c
T_2	77.46 b	52.88 b	0.95 bc	50.19 b	1.73 ab	15.50	40.00	0.80 b	13.84 bc
T_3	83.38 ab	70.29 a	1.05 ab	73.66 a	1.25 c	13.70	35.00	0.72 b	19.36 a
T_4	59.67 c	47.21 b	1.03 ab	48.26 bc	1.74 ab	15.50	38.33	0.73 b	15.25 b
T_5	80.21 b	69.04 a	1.09 a	75.42 a	1.95 a	16.50	37.00	0.95 b	15.95 b
T_6	65.21 c	51.88 b	1.02 ab	52.60 b	1.64 b	14.00	43.33	0.69 b	13.88 bc
T_7	89.25 a	76.17 a	1.06 a	80.72 a	1.5 bc	13.00	39.00	1.67 a	14.34 bc
SE (±)	2.45	2.57	0.03	2.17	0.08	NS	NS	0.09	0.95
CD (0.05%)	8.11	8.49	0.1	7.18	0.28			0.32	3.31

The highest yield (80.72 tha^{-1}) were found in treatment T_7 followed by T_5 (75.42 tha^{-1}) and T_3 (73.66 tha^{-1}) accordingly. However, the highest (1.95 m) height was recorded in T_5 treatment and the lowest was T_3 (1.25 m). Whereas, there was no significant difference between the girth and no. of internodes measurements in all the treatments. The highest length of internodes (1.67 cm) was also recorded higher in treatment T_7 compare to others (Table 1). There is also a significant difference in case of brix (%) and the highest (19.36%) was found in T_3 and the lowest (11.86%) recorded in T_1 treatment. Overall, the results clearly indicate that exogenous application of ethrel and GA_3 improved both the growth and quality parameters of chewing cane. The combined treatment of ethrel soaking with GA_3 spray (T_7) was most effective for maximizing tiller production and cane yield, whereas ethrel soaking alone (T_3) was more beneficial for improving juice quality (Brix). Therefore, the choice of treatment may be guided by production goals whether to maximize yield or enhance sweetness of chewing cane.

EFFECT OF SUGARCANE BAGASSE BIOCHAR ON SOIL HEALTH AND SUGARCANE PRODUCTION

The experiment was conducted at RSRS Farm, Gazipur to reduce the use of inorganic

amendments and improve soil fertility. The experimental design was RCB following three replications. Planting material was BSRI Akh 41 and transplanted on 05 March 2024. Biochar was prepared from sugarcane bagasse and applied at different doses with Recommended Fertilizer dose. Treatments were T_0 - RFD, T_1 - RFD + Biochar @ 1.0 t/ha, T_2 - RFD + Biochar @ 1.25 t/ha, T_3 - RFD + Biochar @ 1.50 t/ha, T_4 - RFD + Biochar @ 1.75 t/ha , T_5 - RFD + Biochar @ 2.0 t/ha, T_6 - RFD + Biochar @ 2.25 t/ha and T_7 - RFD + Biochar @ 2.50 t/ha. Different morphological Characters were recorded. Among them highest no. of tiller (87.61 x 10^3 ha^{-1}) was recorded in T_7 and highest no. of millable cane (66.78 x 10^3 ha^{-1}), stalk height (2.41 m), yield (106.83 tha^{-1}) (Table 2.) were recorded in treatment T_6 followed by treatment T_5 (millable cane 65.83 x 10^3 ha^{-1} and yield 100.52 tha^{-1}) and treatment T_7 (millable cane 64.04 x 10^3 ha^{-1} and yield 102.85 tha^{-1}).

Table 2. Effect of Biochar on yield and yield contributing parameters in 2023-2024 cropping season

Treatment	Tiller no. ($\times 10^3$ ha^{-1})	Millable cane ($\times 10^3$ ha^{-1})	Height (m)	Single cane wt. (kg)	Brix (%)	Yield (tha^{-1})
T_0	62.02 e	47.85 d	1.79 d	1.35 e	19.35 c	64.49 d
T_1	65.23 de	49.40 d	1.85 d	1.39 de	20.49 bc	68.55 d
T_2	71.85 cd	56.66 c	1.87 d	1.43 cde	20.98 abc	81.11 c
T_3	77.15 bc	57.73 c	1.97 cd	1.48 bcd	21.13 abc	85.23 bc
T_4	77.38 bc	60.23 bc	2.08 bc	1.51 abc	21.33 ab	91.18 b
T_5	86.66 ab	65.83 ab	2.22 ab	1.52 abc	22.36 ab	100.52 a
T_6	86.78 ab	66.78 a	2.40 a	1.60 ab	22.56 a	106.83 a
T_7	87.61 a	64.04 ab	2.31a	1.61a	21.50 ab	102.85 a
CV (%)	9.74	5.73	0.18	0.12	1.95	9.26

EVALUATION OF SUGARCANE GROWTH AND YIELD PARAMETERS THROUGH MULTI SPECTRAL, THERMAL AND VEGETATION INDICES FROM UAVS IN WATERLOGGED CONDITION

The experiment was carried out at RSRS Farm, Gazipur with four sugarcane varieties viz Isd 34, BSRI Akh 41, BSRI Akh 45, and BSRI Akh 47. Multi spectral and thermal images were captured at the height of 50 m at 60 days intervals from settlings transplantation through drone with advanced sensors. The images were processed in ENVI Software (L3Harris Geospatial, USA). The atmospheric correction was conducted using FASH tool to eliminate the radiation errors caused by atmospheric scattering and other factors to a certain extent. The NDVI images was calculated by simple band equation. The decision tree (DT) algorithm was used to extract the sugarcane canopy from the soil, weed, shadow and other interfering factors. Among the four sugarcane varieties, Isd 34 exhibited superior performance across most traits, including plant height (2.97 m), girth (6.45 cm), tiller number (121.1 × 10^3), millable cane number (67.5 ×10^3), yield (69.93 tha^{-1}), brix content (18.9%), and chlorophyll content (12.22 µ mol m^{-2}) indicating its potential as a high-yielding and quality variety. Overall, BSRI Akh 47 was the least productive, with the lowest growth, yield, and quality traits in case of waterlogged conditions.

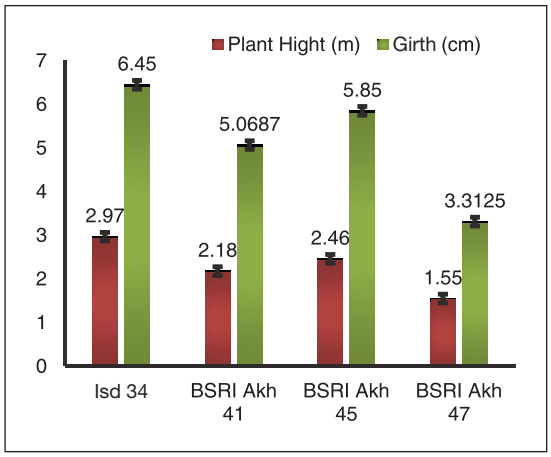


Fig: 2. Plant height and girth of sugarcane varieties under waterlogged condition

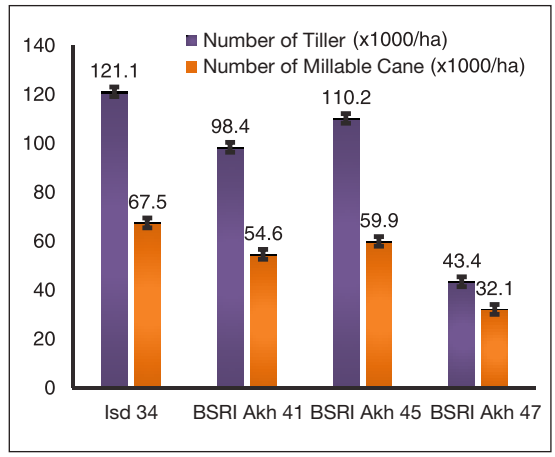


Fig: 3. Number of tillers and millable cane of sugarcane varieties under waterlogged condition

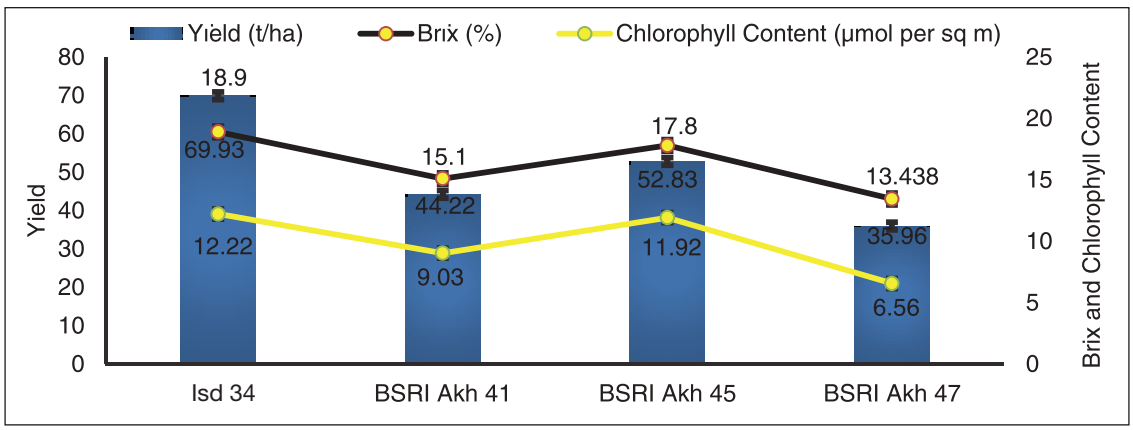


Fig: 4. Yield, brix and chlorophyll content of sugarcane varieties under waterlogged condition

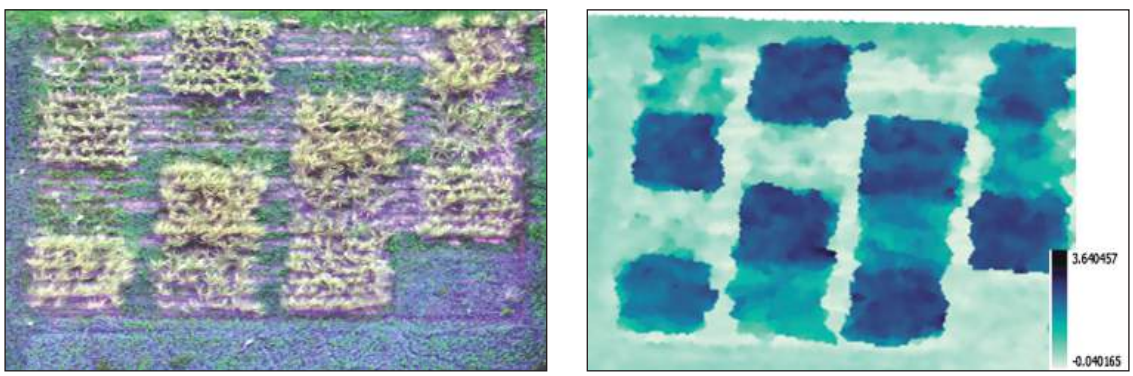


Plate 2. Experimental field and canopy height of sugarcane varieties under waterlogged condition captured by drone

Plate 3. Experimental plot after land preparation

COMPREHENSIVE ASSESSMENT OF MULTISPECTRAL AND THERMAL AND VEGITATION INDICES FOR DROUGHT MONITORING IN SUGARCANE USING UAV IMAGERY

The experiment was carried out at RSRS Farm, Gazipur with four sugarcane varieties viz BSRI Akh 41, BSRI Akh 45, BSRI Akh 47 and BSRI Akh 48. Multi spectral and thermal images were captured at the height of 50 m at 60 days intervals from settlings transplantation through drone with advanced sensors. The images were processed in ENVI Software (L3Harris Geospatial, USA). The atmospheric correction was conducted using FASH tool to eliminate the radiation errors caused by atmospheric scattering and other factors to a certain extent. The NDVI images was calculated by simple band math. The decision tree (DT) algorithm was used to extract the sugarcane canopy from the soil, weed, shadow and other interfering factors. Among the tested sugarcane varieties, BSRI Akh 48 demonstrated the best overall performance, producing the highest tiller number (128.4 x 10^3 ha^{-1}), millable cane (60.3 x 10^3 ha^{-1}), and yield (78.1 tha^{-1}), along with good plant height (4.22m) and brix content (18.8%). BSRI Akh 45 also showed strong potential with high yield (71.1 tha^{-1}) and the highest juice quality (20.4% brix), making it a promising variety for both yield and sugar recovery. In contrast, BSRI Akh 47 consistently recorded the lowest values for growth, yield (36.3 tha^{-1}), and juice quality (15.2%), indicating poor performance.

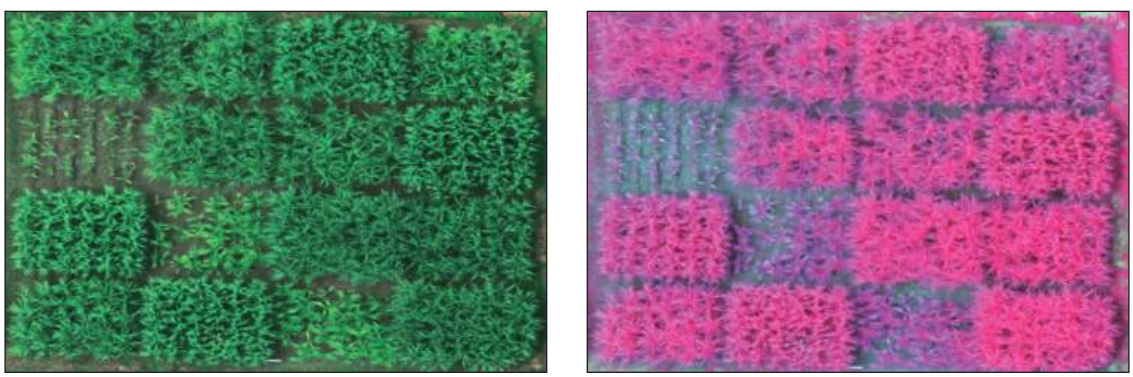


Plate 4. Drone image of sugarcane varieties under drought condition

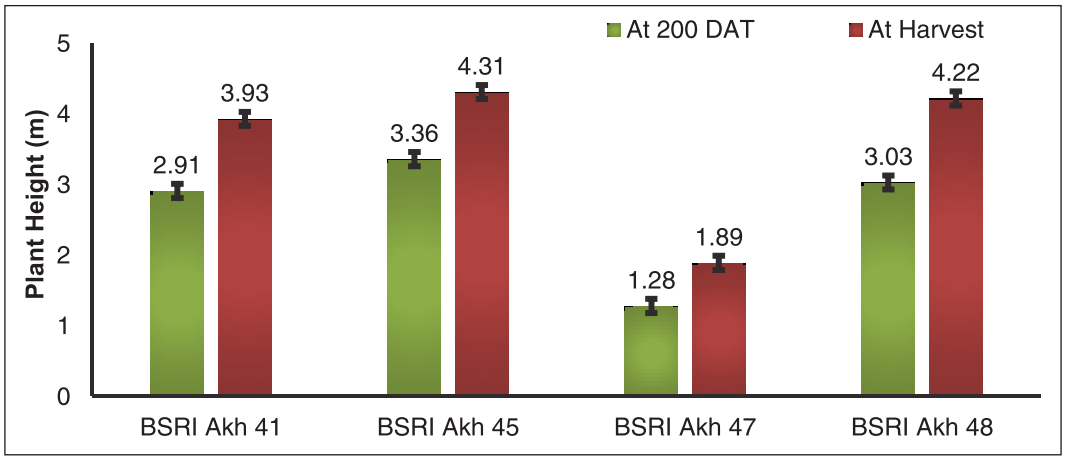


Fig: 5. Plant height of sugarcane varieties at 200 DAT and harvest under drought condition

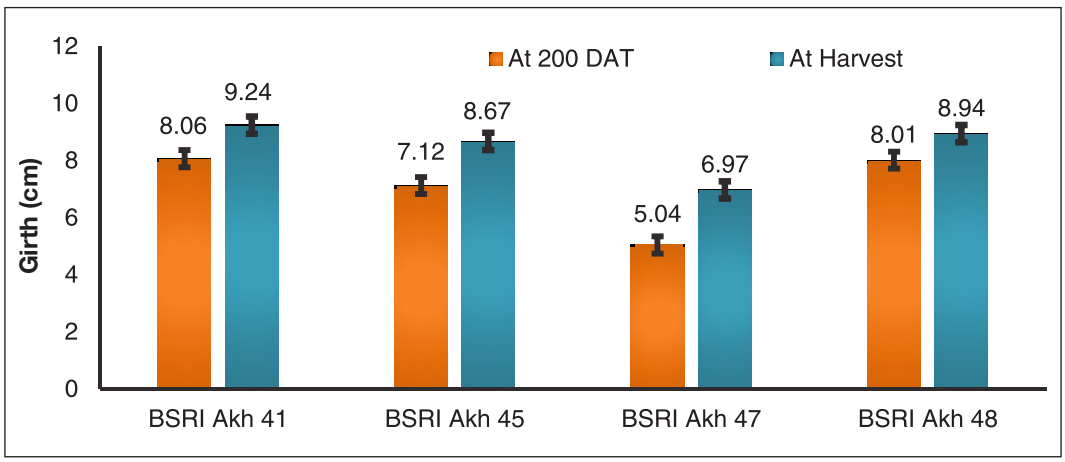


Fig: 6. Girth of sugarcane varieties at 200 DAT and at harvest under drought condition

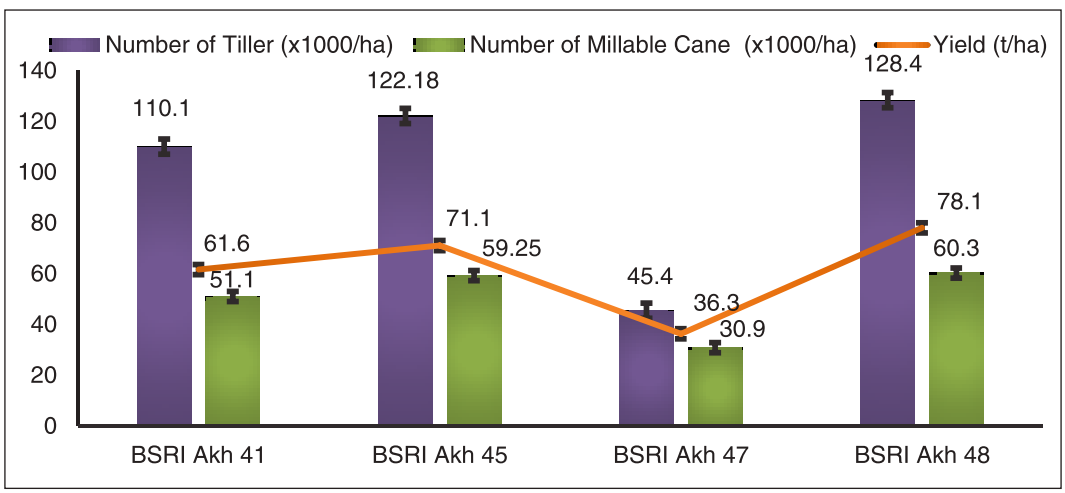


Fig: 7. Number of tillers and millable cane and yield of sugarcane varieties under drought condition

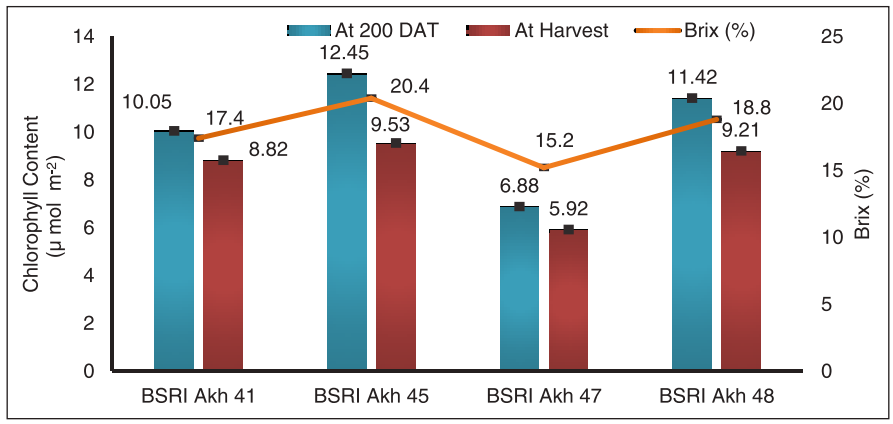


Fig: 8. Chlorophyll content and brix of sugarcane varieties under drought condition

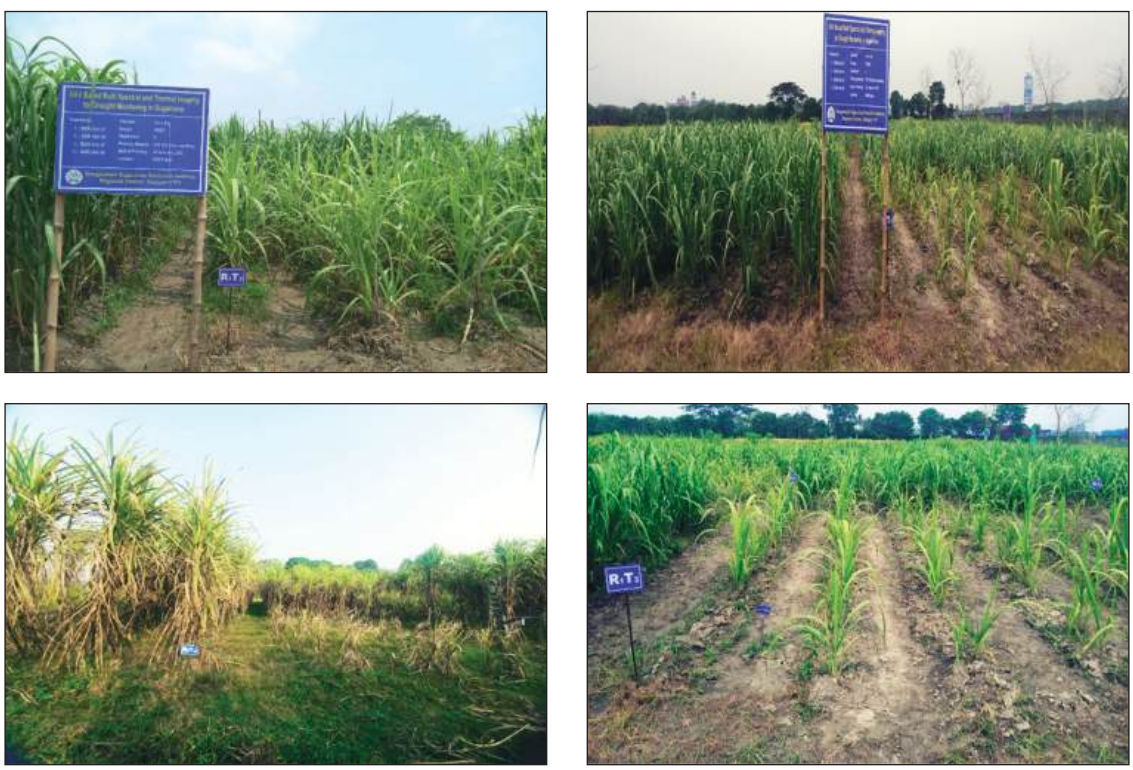


Plate 5. Experimental plot under drought condition at different stages

EFFECT OF TIME AND LEVEL OF EARTHING UP ON TILLER PRODUCTION OF PLANT AND RATOON CANE

This experiment was conducted at RSRS Farm, Gazipur during 2023-2024 cropping season to find out the optimum time and level of earthing up of plant and ratoon cane considering RCB design with three replications. It was a two factorial experiment. Factor one is earthing up time (T_1= earthing up after four months, T_2= earthing up after five months and T_3=earthing up after six months of transplanting) and another factor is earthing

up level (L_1=10cm and L_2=20cm high). Two eyed soil bed settlings were used as planting materials. Data on establishment (%), number of tiller, millable cane, yield and brix% were collected and enterpreted. Highest number of tiller (118.88 x 10^3 ha^{-1}), millable cane (83.54 x 10^3 ha^{-1}) and cane yield (132.82 t ha^{-1}) (Table 3) was recorded in treatment T_3L_2 (earthing up after 6 month of transplanting at 20 cm high).

Table 3. Yield and yield contributing characters of ratoon cane during 2023-2024 cropping season

Treatment	Tiller no ($\times10^3$ ha^{-1})	Millable cane ($\times10^3$ ha^{-1})	Plant height (m)	Single cane wt (kg)	Brix (%)	Yield (tha^{-1})
T_1L_1	98.40 b	68.57 b	2.29 a	1.45 a	14.88 a	99.88 b
T_2L_1	107.54 ab	71.63 ab	2.44 a	1.53 a	16.79 a	110.75 ab
T_3L_1	115.12 a	75.82 ab	2.56 a	1.60 a	16.82 a	121.35 ab
T_1L_2	96.68 b	67.12 b	2.35 a	1.52 a	15.75 a	95.36 b
T_2L_2	109.24 ab	80.23 a	2.50 a	1.63 a	16.49 a	124.68 ab
T_3L_2	118.88 a	83.52 a	2.63 a	1.88 a	16.56 a	132.82 a
Cv (%)	14.36	14.24	0.35	0.53	3.84	41.07

PESTICIDE RESIDUE AND NUTRIENT ASSESSMENT OF BSRI RELEASED CHEWING SUGARCANE VARIETIES

The experiment was be carried out at RSRS Farm, Gazipur. BSRI released chewing cane varieties viz BSRI Akh 41 was used as planting materials. After data collection all samples were sent to Central laboratory, Bangladesh Council of Scientific and Industrial Research (BCSIR) and Soil Science division of BARI for quantifying pesticide residues and nutritional values. The juice of BSRI Akh 41 showed a brix value of 19.6% with a sugar content of 11.3%, indicating good sweetness and juice quality with no pesticide residue. It is low in energy (42.5 Kcal/100 ml) and contains no saturated fat, making it a healthy natural beverage. Mineral analysis revealed a rich presence of essential nutrients, particularly potassium (442.9 ppm), calcium (265 ppm), manganese (1.5 ppm), magnesium (150.1 ppm) and sodium (149.8 ppm) recorded respectively. In addition, trace elements like iron, zinc, copper, thiamine and selenium, enhancing its nutritional value.

Table 4. Nutrient status of BSRI Akh 41 nutrient

Components	Value
Brix (%)	19.6
Sugar Content	11.3
Energy Kcal/100ml	42.5
Calcium (ppm)	265.0
Magnesium (ppm)	150.1
Sodium (ppm)	149.8
Potassium (ppm)	442.9

Components	Value
Iron (ppm)	3.1
Zinc (ppm)	1.77
Copper (ppm)	0.2
Selenium (ppm)	6.0
Manganese (ppm)	1.5
Thiamine (ppm)	0.3
Saturated Fat	0.0

BSRI SUB-STATION, JOYPURHAT

RESEARCH HIGHLIGHTS

- At Vadsa, Isd 37 produced maximum yields of 125.42 tha^{-1} and at Kotoalibag, BSRI Akh 48 produced maximum yields of 96.02 tha^{-1}.
- As ratoon crop, BSRI Akh 43 produced maximum yields of 93.22 tha^{-1} at Vadsa and Isd 39 produced maximum yields of 90.01 tha^{-1} at Ramvadrapur. These yields were statistically similar to that of Isd 34, Isd 38, BSRI Akh 43, BSRI Akh 45 and BSRI Akh 46.
- The integration of recommended dose fertilizers along with poultry litter @ 7.5 tha^{-1} showed superior results in case of sugarcane yield (127.67×10^3 tha^{-1}) to other treatments.

PERFORMANCE OF SOME BSRI RECOMMENDED SUGARCANE VARIETIES AS PLANT CROP IN TISTA MEANDER FLOODPLAIN SOIL

The experiment was conducted at Vadsa and Kotoalibag under Joypurhat sugar mill zone to find out the superior sugarcane varieties as plant crop under Tista Meander Flood Plain soil during the cropping season 2023-2024. This experiment was laid out in a randomized complete block design with three replications. The treatments were as T_1: Isd 2-54, T_2: Isd 16, T_3: Isd 26, T_4: Isd 33, T_5: Isd 34, T_6: Isd 37, T_7: Isd 39, T_8: BSRI Akh 43, T_9: BSRI Akh 45, T_{10}: BSRI Akh 46 and T_{11}: BSRI Akh 48. The unit plot size was 8m x 6m. Two eyed setts were used in this experiment. Application of fertilizers for sugarcane was done as per schedule. Intercultural operation was done as and when required. Data on different growth parameters were collected and analyzed statistically. At Vadsa, Isd 37 produced maximum yields of 125.42 tha^{-1} and at Kotoalibag, BSRI Akh 48 produced maximum yields of 96.02 tha^{-1}.

Table 1. Performance of sugarcane varieties as plant crop at Vadsa

Treatments	Tillers ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Brix (%)	Yield (tha^{-1})
T_1: Isd 2-54	151.52 d	93.75 a-d	18.46 a	114.87 b
T_2: Isd 16	184.40 bc	100.87 ab	18.04 ab	96.22 cd
T_3: Isd 26	172.40 b-d	71.98 e	17.93 ab	67.10 g
T_4: Isd 33	220.83 a	112.86 a	16.51 c	88.69 de
T_5: Isd 34	219.06 a	112.86 a	17.75 ab	83.00 ef
T_6: Isd 37	189.73 bc	98.64 a-c	18.44 a	125.42 a
T_7: Isd 39	184.85 bc	91.09 b-e	16.64 c	79.73 f
T_8: BSRI Akh 43	188.84 bc	95.98 a-d	17.20 bc	94.22 cd
T_9: BSRI Akh 45	177.65 b-d	92.81 a-d	18.31 a	84.11 ef
T_{10}: BSRI Akh 46	161.29 cd	78.65 c-e	16.35 c	96.47 cd
T_{11}: BSRI Akh 48	198.17 ab	76.42 de	18.29 a	97.85 c
LSD (0.05)	28.59	20.17	0.996	8.60

Table 2. Performance of sugarcane varieties as plant crop at Kotoalibag

Treatments	Tillers ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Brix (%)	Yield (tha^{-1})
T_1: Isd 2-54	139.17 bc	107.92 a	20.07 a-c	87.71 cd
T_2: Isd 16	161.25 ab	85.00 c	18.67 d	82.80 de
T_3: Isd 26	137.92 bc	92.08 a-c	16.56 e	81.62 e
T_4: Isd 33	120.83 c	101.67 a-c	20.65 ab	80.01 e
T_5: Isd 34	173.75 a	102.92 a-c	18.60 d	82.13 e
T_6: Isd 37	155.83 ab	88.33 bc	21.11 a	90.53 bc
T_7: Isd 39	163.33 ab	95.00 a-c	19.44 b-d	71.78 f
T_8: BSRI Akh 43	122.92 c	94.58 a-c	19.18 cd	80.85 e
T_9: BSRI Akh 45	175.00 a	107.50 ab	20.58 ab	95.39 ab
T_{10}: BSRI Akh 46	144.17 a-c	103.75 a-c	19.22 cd	84.53 de
T_{11}: BSRI Akh 48	119.58 c	85.42 c	19.56 b-d	96.02 a
LSD (0.05)	31.18	19.33	1.3	5.20

PERFORMANCE OF SOME BSRI RECOMMENDED SUGARCANE VARIETIES AS RATOON CROP IN TISTA MEANDER FLOODPLAIN SOIL

The experiment was conducted at Vadsa and Ramvadrapur under Joypurhat sugar mill zone to find out the superior sugarcane varieties for their ratooning potentiality under Tista Meander Flood Plain soil during the cropping season 2023-2024. This experiment was laid out in a randomized complete block design with three replications. The treatments were as T_1: Isd 2-54, T_2: Isd 16, T_3: Isd 34, T_4: Isd 37, T_5: Isd 38, T_6: Isd 39, T_7: BSRI Akh 43, T_8: BSRI Akh 45, T_9: BSRI Akh 46 and T_{10}: BSRI Akh 48. The unit plot size was 8m x 6m. Stubble shaving was done after harvesting the planted crop of 2022-2023 cropping season. Application of fertilizers for sugarcane was done as per schedule. Intercultural operation was done as and when required. Data on different growth parameters were collected and analyzed statistically. As ratoon crop, BSRI Akh 43 produced maximum yields of 93.22 tha^{-1} at Vadsa and Isd 39 produced maximum yields of 90.01 tha^{-1} at Ramvadrapur. These yields were statistically similar to that of Isd 34, Isd 38, BSRI Akh 43, BSRI Akh 45 and BSRI Akh 46.

Table 3. Performance of sugarcane varieties as ratoon crop at Vadsa

Treatments	Tillers ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Brix (%)	Yield (tha^{-1})
T_1: Isd 2-54	146.67 bc	93.75 b-d	19.64 b-e	74.44 d
T_2: Isd 16	145.83 bc	100.42 ab	20.75 bc	71.75 d
T_3: Isd 34	171.25 a	110.00 a	20.07 b-d	88.67 ab
T_4: Isd 37	140.83 bc	79.58 d	23.16 a	76.82 d
T_5: Isd 38	154.17 ab	96.25 a-c	21.10 b	89.20 ab
T_6: Isd 39	149.58 bc	102.50 ab	20.89 bc	91.87 ab
T_7: BSRI Akh 43	143.33 bc	100.42 ab	18.91 d-f	93.22 a
T_8: BSRI Akh 45	134.17 c	84.17 cd	17.40 f	84.64 bc
T_9: BSRI Akh 46	143.33 bc	83.75 cd	19.16 c-f	92.79 a
T_{10}: BSRI Akh 48	141.67 bc	60.00 e	17.93 ef	78.03 cd
LSD (0.05)	18.17	16.02	1.764	7.50

Table 4. Performance of sugarcane varieties as ratoon crop at Ramvadrapur

Treatments	Tillers ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Brix (%)	Yield (tha^{-1})
T_1: Isd 2-54	150.83 bc	114.58 ab	16.60 c	75.27 de
T_2: Isd 16	146.67 c	105.83 a-d	19.03 ab	71.28 e
T_3: Isd 34	198.33 b	106.67 a-c	19.47 a	85.73 a-c
T_4: Isd 37	143.33 c	82.92 d	17.67 bc	78.95 c-e
T_5: Isd 38	253.33 a	90.00 cd	17.53 bc	80.82 b-d
T_6: Isd 39	159.58 bc	89.17 cd	17.60 bc	90.01 a
T_7: BSRI Akh 43	164.17 bc	97.08 b-d	18.67 ab	87.06 ab
T_8: BSRI Akh 45	162.92 bc	126.25 a	16.53 c	83.46 a-c
T_9: BSRI Akh 46	123.75 c	87.50 cd	19.00 ab	88.63 ab
T_{10}: BSRI Akh 48	141.25 c	88.33 cd	16.87c	80.95 b-d
LSD (0.05)	49.39	22.94	1.642	8.09

EFFECT OF CHEMICAL FERTILIZERS AND POULTRY LITTER ON GROWTH AND YIELD OF SUGARCANE AND SOIL CHEMICAL PROPERTIES

The experiment was conducted at Bulupara under Joypurhat sugar mill zone to find out the effects of chemical fertilizer and poultry litter on growth and yield of sugarcane and to evaluate the effects of integrated use of chemical fertilizers and poultry litter on soil chemical properties and plant nutrient content under Tista Meander Flood Plain soil during the cropping season 2023-2024. This experiment was laid out in a randomized complete block design with three replications. The treatments were as T_1: Recommended Fertilizer Dose (RFD) only, T_2: RFD + Poultry Litter 2.5 tha^{-1}, T_3: RFD + Poultry Litter 5.0 tha^{-1}, T_4: RFD + Poultry Litter 7.5 tha^{-1}, T_5: RFD + Poultry Litter 10.0 tha^{-1}, T_6: RFD + Poultry Litter 12.5 tha^{-1} and T_7: RFD + Poultry Litter 15.0 tha^{-1}. The unit plot size was 8m x 6m. Two eyed setts were used in this experiment. Application of fertilizers for sugarcane was done as per schedule. Intercultural operation was done as and when required. Data on different growth parameters were collected and analyzed statistically. The integration of recommended dose fertilizers along with poultry litter @ 7.5 tha^{-1} showed superior results in case of sugarcane yield (127.67×10^3 tha^{-1}) to other treatments.

Table 5. Effect of poultry litter on agronomic characteristics of sugarcane

Treatment	Tillers ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Brix (%)	Yield (tha^{-1})
T_1: RFD	104.67 b	73.65 de	17.56 a	88.84 d
T_2: RFD+PL @ 2.5 tha^{-1}	104.67 b	72.30 e	17.44 a	89.11 d
T_3: RFD+PL @ 5.0 tha^{-1}	128.83 a	83.85 bc	17.11 ab	108.67 bc
T_4: RFD+PL @ 7.5 tha^{-1}	135.83 a	94.65 a	16.31 a-c	127.67 a
T_5: RFD+PL @ 10.0 tha^{-1}	124.33 a	88.50 ab	16.05 bc	114.66 b
T_6: RFD+PL @ 12.5 tha^{-1}	130.33 a	81.00 cd	15.15 c	106.27 c
T_7: RFD+PL @ 15.0 tha^{-1}	130.50 a	82.20 bc	16.71 ab	105.40 c
LSD (0.05)	13.43	7.42	1.39	8.08

BSRI SUB-STATION, RAJSHAHI

RESEARCH HIGHLIGHTS

- BSRI Akh 46, BSRI Akh 45 and Isd 34 performed better as ratoon cane than the other varieties in the mill zone of the Rajshahi region.
- BSRI Akh 41+Garlic performed better than other intercrop package in the mill zone of Rajshahi.
- BSRI Akh 46, BSRI Akh 43 and Isd 34 performed better than the other varieties in the Char land of Rajshahi.
- BSRI Akh 41 performed better than other varieties for Gur production in Chapai Nawabgang District.

FIELD PERFORMANCE OF SOME NEWLY RELEASED SUGARCANE VARIETIES AND THEIR RATOONING POTENTIALITY IN MILL ZONES

Sugarcane is being cultivated in mills and non-mill zone areas mainly for sugar, *gur* and chewing purpose. At present only few varieties are being cultivated which do not actually fulfill the farmers requirement, because the yield of cane of the existing varieties are very poor. Before recommendation of latest sugarcane varieties under high Ganges flood plain areas are required to be studied their ability to produce higher yield, quality and their ratooning potentiality. Therefore, the present study was undertaken to evaluate the ratooning potentiality of those varieties in mill zones of Rajshahi. This experiment was conducted in Puthia Upazilla of Rajshahi District with five treatments.

Treatments:

T_1 = Isd 34 (Check)
T_2 = Isd 39
T_3 = BSRI Akh 43
T_4 = BSRI Akh 45
T_5 = BSRI Akh 46

Table 1. Ratooning potentiality of some newly released sugarcane varieties in mill zones (1st ratoon)

Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Yield (tha^{-1})	Brix (%)
Isd 34	170.95 a	140.32 a	88.33 abc	19.44 c
Isd 39	149.58 b	120.22 b	83.41 c	21.52 a
BSRI Akh 43	122.75 d	97.43 e	85.82 bc	20.24 b
BSRI Akh 45	134.67 c	110.98 c	89.66 ab	21.74 a
BSRI Akh 46	125.54 cd	103.86 d	93.11 a	20.29 b
LSD (0.05)	10.70	6.11	5.84	0.74

In that experiment, the highest number of tillers was observed in Isd 34 (170.95 x 10^3 ha^{-1}). In contrast, the lowest number of tillers was observed in BSRI Akh 43 (122.75 x 10^3 ha^{-1}), which was statistically similar to BSRI Akh 46 (125.54 x 10^3 ha^{-1}). The highest number of millable cane was observed in Isd 34 (140.32 x 10^3 ha^{-1}). On the other hand, the lowest number of millable cane was observed in BSRI Akh 43 (97.43 x 10^3 ha^{-1}). The highest yield was observed in BSRI Akh 46 (93.11 t ha^{-1}), which was statistically similar to BSRI Akh 45 (89.66 t ha^{-1}) and Isd 34 (88.33 t ha^{-1}). Conversely, the lowest yield was recorded in Isd 39 (83.41 t ha^{-1}), which was statistically similar to BSRI Akh 43

(85.82 t ha^{-1}) and lsd 34 (88.33 t ha^{-1}). The highest brix (%) was recorded in BSRI Akh 45 (21.74%), which was statistically similar to lsd 39 (21.52%). In contrast, the lowest brix (%) was recorded in lsd 34 (19.44%). Based on these findings, BSRI Akh 46, BSRI Akh 45 and lsd 34 performed better as ratoon cane than the other varieties in the mill zone of the Rajshahi region.

PERFORMANCE OF DIFFERENT WINTER CROPS WITH SINGLE ROW OF CHEWING CANE

Presently due to competition of different short duration crops the sustainability of sugarcane is at threat. Sugarcane being a long duration crop occupies the land for 10-12 months. Without intercropping the poor cane growers cannot wait for such a long time to get economic return from sole crop sugarcane. In this circumstance, intercropping is one of the appropriate ways to get interim benefit from sugarcane by cultivating one or two short duration crop like potato, onion, garlic and cauliflower. Moreover, Chewing cane gives more profit to the farmers. Considering these facts the present experiment has been undertaken to ensure higher production and maximum profit through cultivation of intercrops with sugarcane. This experiment was conducted in Charghat Upazilla of Rajshahi District with five treatments.

Treatments:

T_1: Chewing Cane (Only)
T_2: T_1 + potato (BARI Potato 25)
T_3: T_1 + Onion (Taherpuri)
T_4: T_1 + Garlic (BARI Garlic 03)
T_5: T_1 + Cauliflower

Table 2. Performance of different winter crops with single row of chewing cane

Treatments	Millable Cane ($x10^3$ ha^{-1})	Cane Yield (tha^{-1})	Intercrop Yield (tha^{-1})	Brix (%)	Gross Return (tk ha^{-1})	BCR
T_1 = BSRI Akh 41 (Only)	73.75 a	147.10 a	-	15.97	11,06,250	2.21
T_2 = BSRI Akh 41 + Onion	70.25 ab	143.81 ab	13.57 b	16.33	17,41,250	2.40
T_3 = BSRI Akh 41 + Potato	68.54 b	137.21 bc	25.63 a	15.66	17,97,000	2.48
T_4 = BSRI Akh 41 + Garlic	69.59 b	138.56 abc	10.40 c	15.99	20,83,850	2.87
T_5 = BSRI Akh 41 + Cauliflower	67.17 b	134.42 c	23.36 a	15.76	13,57,950	2.26
LSD (0.05)	3.55	9.23	2.91	NS	-	-

Price of cane: 15tk/piece, Onion: 50tk/kg, Potato: 30tk/kg Garlic: 100tk/kg and Cauliflower: 15tk/kg.

The highest number of millable cane population was recorded from T_1 (73.75 $x10^3$ ha^{-1}) treatment which was statistically similar to the treatment T_2 (70.25 $x10^3$ ha^{-1}) and the lowest number of millable cane population was recorded from T_5 (67.17 $x10^3$ ha^{-1}) treatment which was statistically similar to the treatment T_3 (68.54 $x10^3$ ha^{-1}), T_4 (69.59 $x10^3$ ha^{-1}) and T_2 (70.25$x10^3$ ha^{-1}). The highest yield was obtained from T_1 (147.10 tha^{-1}) treatment which was statistically similar to the treatment T_2 (143.81 tha^{-1}) and T_4 (138.56 tha^{-1}). On the other hand, the lowest yield was obtained from T_5 (134.42 tha^{-1}) which was statistically similar to the treatment T_3 (137.21 $x10^3$ t ha^{-1}) and treatment T_4 (138.56 t ha^{-1}). The highest intercrop yield was obtained from T_3 (25.63 tha^{-1}) treatment which was statistically similar to the treatment T_5 (23.36 tha^{-1}) whereas the lowest intercrop yield was obtained from T_4 (10.40 tha^{-1}) treatment. There was no significant difference found in brix (%) in different treatments. The highest gross return and BCR were recorded from treatment T_4 = BSRI Akh 41 + Garlic and the lowest gross return and BCR were recorded from treatment T_1 = BSRI Akh 41 (Only). So, BSRI Akh 41 + Garlic can be practiced in that particular area.

PERFORMANCE OF BSRI NEWLY RELEASED SUGARCANE VARIETIES IN CHAR LANDS OF RAJSHAHI

The varieties of sugarcane developed by Bangladesh Sugarcrop Research institute do not perform equally in all agro-ecological zones (Miah *et al.*, 1994). The sugarcane yield of a particular variety depends upon the heredity potential of the genotype and the environment where it is exposed during the course of its life cycle. Pre-release test of BSRI bred sugarcane varieties are usually done in mill zones and do not cover all agro-ecological zones. At the same time BSRI released commercial varieties do not perform equally in all locations. Therefore, it is important to evaluate the performance of newly released varieties in the Char land of Rajshahi. This experiment was conducted in Charghat Upazilla of Rajshahi District with five treatments.

Treatments:

T_1 : Isd 33
T_2 : Isd 34 (Check)
T_3 : BSRI Akh 43
T_4 : BSRI Akh 45
T_5 : BSRI Akh 46

Table 3. Performance of BSRI newly released sugarcane varieties in Char Lands of Rajshahi

Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Yield (tha^{-1})	Brix (%)
Isd 33	147.25 b	102.50 ab	90.13 b	19.39 bc
Isd 34	173.33 a	112.46 a	92.56 ab	18.60 d
BSRI Akh 43	128.33 c	96.87 b	93.25 ab	19.76 b
BSRI Akh 45	135.17 bc	98.33 b	91.79 b	20.67 a
BSRI Akh 46	125.33 c	99.91 b	96.28 a	19.00 cd
LSD (0.05)	18.19	10.05	4.13	0.42

In that experiment, the highest number of tillers was recorded in Isd 34 (173.33 x 10^3 ha^{-1}). In contrast, the lowest number of tillers was observed in BSRI Akh 46 (125.33 x 10^3 ha^{-1}), which was statistically similar to BSRI Akh 43 (128.33 x 10^3 ha^{-1}) and BSRI Akh 45 (135.17 x 10^3 ha^{-1}). The highest number of millable canes was observed in Isd 34 (112.46 x 10^3 ha^{-1}), which was statistically similar to Isd 33 (102.50 x 10^3 ha^{-1}). Whereas, a lower number of millable canes was observed in all varieties except for variety Isd 34. The highest yield was observed in BSRI Akh 46 (96.28 t ha^{-1}), which was statistically similar to BSRI Akh 43 (93.25 t ha^{-1}) and Isd 34 (92.56 t ha^{-1}). Conversely, a lower yield of canes was observed in all varieties except for BSRI Akh 46. The highest brix (%) was recorded in BSRI Akh 45 (20.67%). In contrast, the lowest brix (%) was recorded in Isd 34 (18.60%), which was statistically similar to BSRI Akh 46 (19.00%).Based on these findings, BSRI Akh 46, BSRI Akh 43 and Isd 34 performed better than the other varieties in the Char land of Rajshahi.

SELECTION OF SUITABLE GENOTYPES FOR *GUR* PRODUCTION IN CHAPAI NAWABGANJ DISTRICT

Pre-release test of BSRI bred sugarcane varieties are usually done in mill zones and do not cover all agro-ecological zones. As such BSRI released commercial varieties do not perform equally in all locations. Therefore, it is important to evaluate the performance of those varieties in non-mill zones. The sugarcane yield of a particular variety depends upon the heredity potential of the genotype and the environment where

it is exposed during the course of its life cycle. Variety of a crop plays an important role as regards to the yield and quality, sugarcane is no exception (Anon. 1978). Non-mill zone farmers of Bangladesh continuously need high yielding and high sugar varieties. After a considerable period of cultivation sugarcane varieties show a tendency to decline in yield and vigor (Barnes, 1954 and Humbert, 1959). It is an obscure and puzzling problem to scientists, growers and processors. To maintain high yielding character, it is necessary to replace varieties every few years with newly released varieties. Therefore, the present study was undertaken to evaluate the performance of those varieties in non-mill zones. This experiment was conducted in Shibgonj of Chapai Nawabganj District with six treatments.

Treatments:

T_1 = BSRI Akh 41
T_2 = BSRI Akh 43
T_3 = BSRI Akh 45
T_4 = BSRI Akh 46
T_5 = Q 69
T_6 = Modhumala

Table 4. Selection of suitable sugarcane genotypes for *gur* production at Shibgonj, Chapai Nawabganj

Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Yield (tha^{-1})	Brix (%)	*Gur* recovery (%)
BSRI Akh 41	145.85 a	102.37 a	135.63 a	18.56 c	9.15
BSRI Akh 43	120.84 cd	95.88 b	93.27 cd	20.33 ab	9.28
BSRI Akh 45	132.25 bc	96.60 b	91.80 d	20.99 a	9.45
BSRI Akh 46	115.49 d	93.93 b	100.27 c	18.67 c	9.19
Modhumala	133.82 b	102.23 a	121.00 b	19.93 b	9.40
Q 69	147.79 a	105.08 a	90.39 d	19.75 b	9.43
LSD (0.05)	11.59	3.22	8.75	0.74	NS

In that experiment, the highest number of tillers was observed in Q 69 (147.79 x 10^3 ha^{-1}), which was statistically similar to BSRI Akh 41 (145.85 x 10^3 ha^{-1}).In contrast, the lowest number of tillers was observed in BSRI Akh 46 (115.49 x 10^3 ha^{-1}), which was statistically similar to BSRI Akh 43 (120.84 x 10^3 ha^{-1}). The highest number of millable cane was observed in Q 69 (105.08 x 10^3 ha^{-1}), which was statistically similar to BSRI Akh 41 (102.37 x 10^3 ha^{-1}) and Modhumala (102.23 x 10^3 ha^{-1}).On the other hand, the lowest number of millable cane was observed in BSRI Akh 46 (93.93 x 10^3 ha^{-1}), which was statistically similar to BSRI Akh 43 (95.88 x 10^3 ha^{-1}) and BSRI Akh 45 (96.60 x 10^3 ha^{-1}). The highest yield was observed in BSRI Akh 41 (135.63 t ha^{-1}). Conversely, the lowest yield was recorded in Q 69 (90.39 tha^{-1}), which was statistically similar to BSRI Akh 45 (91.80 t ha^{-1}) and BSRI Akh 43 (93.27 t ha^{-1}). The highest brix (%) was recorded in BSRI Akh 45 (20.99%), which was statistically similar to BSRI Akh 43 (20.33%). In contrast, the lowest brix (%) was recorded in BSRI Akh 41 (18.56%), which was statistically similar to BSRI Akh 46 (18.67%).Non-significant result was found in gur recovery. Considering the above data, BSRI Akh 41 performed better than other varieties for *Gur* production in Chapai Nawabgang District.

BSRI SUB-STATION, CHUADANGA

RESEARCH HIGHLIGHTS

- BSRI Akh 41 performed better in the Carew and Company (Bangladesh) Ltd. Sugar mill area with respect to cane yield and brix compared to other sugar producing varieties.
- Scrore 250 EC @ 1 ml/L of water (sett dipping for 30 minutes) performed better in controlling sett borne smut disease compared to other sett treating chemicals.

EXPLORING THE SUITABILITY OF BSRI Akh 41 AS SUGAR PRODUCING VARIETY IN CAREW AND COMPANY (BANGLADESH) Ltd. SUGAR MILL AREA

The experiment was conducted during the 2023-2024 cropping season in South Chadpur and Akterpur, located in the Chuadanga district, to assess the suitability of the BSRI Akh 41 sugarcane variety in the Carew and Company (Bangladesh) Ltd. sugar mill area. Five BSRI-bred sugarcane varieties Isd 37, BSRI Akh 41, BSRI Akh 43, BSRI Akh 45, and BSRI Akh 46 were used as treatments in the study. The experiments were conducted in RCB design with three replications. The research works were done in RCB design with three replications. The plantations were done with two budded setts in last week of November 2023. Necessary intercultural operations like irrigation, mulching and weeding, top dressing of fertilizers, pest and disease management, tying and earthing up, etc., were done as and when required. The canes were harvested in December 2024. Data on different growth parameters were taken, compiled, and presented in Table 1 and Table 2.

Table 1. Germination (%), number of tiller, number of Millable cane, Brix (%), cane yield of different sugarcane varieties at South Chadpur, in Chuadanga district

Treatment(s)	Germination (%)	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Brix (%)	Cane Yield (tha^{-1})
Isd 37	62.65 bc	158.19 b	102.54 bc	16.23 b	79.46 c
BSRI Akh 41	61.71 c	128.01 c	97.29 c	17.39 a	94.09 a
BSRI Akh 43	68.40 ab	155.88 b	105.00 b	15.78 bc	89.54 ab
BSRI Akh 45	68.83 a	185.42 a	114.17 a	18.17 a	85.93 bc
BSRI Akh 46	61.167 c	149.90 b	108.32 ab	15.22 c	77.82 c
LSD (0.05)	6.13	10.922	6.32	0.80	8.14

Table 2. Germination (%), number of tiller, number of Millable cane, Brix (%), cane yield of different sugarcane varieties at Akterpur in Chuadanga district

Treatment(s)	Germination (%)	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Brix (%)	Cane Yield (tha^{-1})
Isd 37 (Standard)	64.43 a	167.43 b	126.39 b	19.66 a	85.45 bc
BSRI Akh 41	63.43 a	136.50 c	92.31 d	19.78 a	92.86 a
BSRI Akh 43	69.97 a	166.33 b	126.82 b	17.27b	80.02 c
BSRI Akh 45	70.79 a	192.08 a	144.97 a	19.83 a	87.54 ab
BSRI Akh 46	56.79 b	157.08 b	114.85 c	16.61 b	71.25 d
LSD (0.05)	6.52	14.05	5.61	0.68	8.14

Germination

Data presented in Table 1 and Table 2 showed a significant difference in the germination percentage among the sugarcane varieties at both locations. In the South Chadpur site (Table 1), the highest germination found in BSRI Akh 45 was (68.83%), followed by BSRI Akh 43 (68.40%). However, in the Akterpur site highest germination percentage found in BSRI Akh 45 (70.79%) followed by BSRI Akh 43, BSRI Akh 41 and lsd 37, which were statistically similar (Table 2).

Number of Tiller

Data presented in Table 1 and Table 2 showed a significant difference in the tiller population among the sugarcane varieties at both locations. In South Chadpur site, BSRI Akh 45 produced the highest number of tillers 185.42 × 10^3 ha^{-1} followed by BSRI Akh 43 and lsd 37 (Table 1), and In the Akterpur site, BSRI Akh 45 produced the highest number of tillers (192.08 × 10^3 ha^{-1}) followed by lsd 37, BSRI Akh 43, BSRI Akh 46 (Table 2).

Number of Millable cane

Data on the number of millable cane at both locations showed that there was a significant difference among the varieties. At the South Chadpur site, the maximum number of millable cane (114.17 × 10^3 ha^{-1}) was recorded from the variety variety BSRI Akh 45 followed by BSRI Akh 46, which are statistically similar. However, at the Akterpur site, the maximum number of millable cane (144.97 × 10^3 ha^{-1}) was recorded from the variety BSRI Akh 45 followed by BSRI Akh 43 and lsd 37 (Table 2).

Total soluble solid (Brix %)

The brix data clearly shows that the varieties at both sites differed significantly from one another. BSRI Akh 41 and BSRI Akh 45 performed better than other varieties in brix percentage.

Cane yield

It is evident from the data on cane yield that, there were significant differences among the varieties at both locations. At the South Chadpur site (Table 1), the highest cane yield (94.09 tha^{-1}) was found in BSRI Akh 41, followed by BSRI Akh 43 (89.54 tha^{-1}).The lowest yield was obtained from the variety BSRI Akh 46 (77.82 tha^{-1}). However, at the Akterpur site, the highest yield (92.86 tha^{-1}) was recorded from BSRI Akh 41, followed by BSRI Akh 45 (87.54 tha^{-1}). The lowest yield was obtained from the variety BSRI Akh 46 (Table 2).

From the above results, it was concluded that BSRI Akh 41 performed better in the Carew and Company (Bangladesh) Ltd. Sugar mill area with respect to cane yield and brix compared to other sugar producing varieties.

EFFICACY OF DIFFERENT FUNGICIDES AS SETT-TREATING CHEMICALS IN CONTROLLING SUGARCANE SMUT DISEASE

A field experiment was conducted in Modna, Chuadanga and BSRI Ishwardi during the 2023-2024 cropping season to evaluate the efficacy of different fungicides as sett-treating chemicals in controlling sugarcane smut disease. The experiment was conducted with nine treatments in RCB design with three replications. The plantation was done with two budded setts in November 2023. Necessary intercultural operations like irrigation, mulching and weeding, top dressing of fertilizers, pest and disease management, tying and earthing up, etc., were done as and when required. The canes were harvested in December 2024. Data on different growth parameters were taken, compiled, and presented in Table 3 and Table 4.

Table 3. Germination (%), number of tiller, number of Millable cane, Brix (%), cane yield and Disease incidence of sumt (120 DAP) in Chuadanga

Treatment(s)	Germination (%)	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Brix (%)	Cane Yield (tha^{-1})	Disease Incidence (%)
T_0: MHAT treated sett	50.35 b	174.79 c	100.51 a	17.44 ab	80.80 a	o.oo f
T_1: Untreated infected sett	46.60 b	162.29 d	95.39 ab	16.89 b	66.28 b	2.81 a
T_2: Tilt 250 EC @ 0.5 ml/L	69.03 a	178.54 bc	97.07 ab	17.47 ab	70.74 b	1.81 b
T_3: Tilt 250 EC @ 1 ml/L	70.97 a	182.71 ab	91.55 b	17.33 ab	80.36 a	1.47 c
T_4: Tilt 250 EC @ 1.5 ml/L	70.49 a	186.18 a	95.75 ab	16.89 b	80.06 a	1.67 bc
T_5: Score 250 EC @ 0.5 ml/L	69.72 a	177.38 bc	95.21 ab	17.92 a	80.48 a	0.89 d
T_6: Score 250 EC @ 1 ml/L	71.18 a	183.06 ab	96.22 ab	17.00 b	84.66 a	0.49 e
T_7: Scrore 250 EC @ 1.5 ml/L	68.33 a	186.11 a	97.33 ab	17.17 ab	82.17 a	0.51 e
T_8: Knowin 50 WP @ 1 gm/L	68.13 a	173.13 c	100.44 a	17.39 ab	81.63 a	0.92 d
LSD (0.05)	4.32	7.02	6.23	0.86	5.07	0.25

Germination

Data presented in Table 2 showed a significant difference in the tiller population among the different treatments at Modna in the Chuadanga district. In the case of germination, the highest germination found in T_3 (Sett dipping with Tilt 250 EC @ 1 ml/L of water for 30 minutes) was 70.97%in Table 3. However, there is a significant difference in germination percentage at BSRI farm, Ishwardi, Pabna. The highest germination found in T_4 (Sett dipping with Tilt 250 EC @ 1.5 ml/L of water for 30 minutes) was 45.28%, followed by T_8 (Sett dipping with Knowin 50 WP @ 1 gm/L of water for 30 minutes) 44.86% in Table 4.

Number of Tiller

Data presented in Table 3 showed a significant difference in the tiller population among the different treatments at Modna in the Chuadanga district. In this site, The highest tiller was produced in T_4 (Sett dipping with Tilt 250 EC @ 1.5 ml/L of water for 30 minutes) (186.18×10^3 ha^{-1}) followed by T_6 (Sett dipping with Tilt 250 EC @ 1ml/L of water for 30 minutes) . In the Ishwardi site, there is no significant difference in tiller population (Table 4).

Table 4. Germination (%), number of tiller, number of Millable cane, Brix (%), cane yield and Disease incidence of smut (120 DAP) in BSRI Ishwardi, Pabna

Treatment (s)	Germination (%)	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Brix (%)	Cane Yield (tha^{-1})	Disease Incidence (%)
T_0: MHAT treated sett	41.74 b	118.33	87.97 ab	17.11	79.58 ab	0.00 f
T_1: Untreated infected sett	41.81 ab	118.50	86.29 abcd	16.56	68.32 c	3.99 a
T_2: Tilt 250 EC @ 0.5 ml/L	42.01 ab	118.42	84.21 cd	17.13	74.35 b	2.15 b
T_3: Tilt 250 EC @ 1 ml/L	43.40 ab	123.50	85.03 abcd	17.22	79.62 ab	1.76 bc
T_4: Tilt 250 EC @ 1.5 ml/L	45.28 a	120.33	86.03 abcd	16.89	79.19 ab	1.68 bc
T_5: Score 250 EC @ 0.5 ml/L	42.16 ab	120.33	84.39 bcd	17.56	79.32 ab	1.32 cd
T_6: Score 250 EC @ 1 ml/L	43.75 ab	122.08	83.67 d	17.48	78.79 ab	0.48 e
T_7: Scrore 250 EC @ 1.5 ml/L	43.96 ab	122.75	87.25 abc	17.28	80.67 a	0.47 e
T_8: Knowin 50 WP @ 1 gm/L	44.86 ab	120.17	88.35 a	17.40	80.72 a	0.93 de
LSD (0.05)	3.50	NS	3.58	NS	5.95	0.47

Number of Millable cane

Data on the number of millable cane at Modna in Chuadanga showed there was a significant difference among the treatments (Table 3). In this site, the highest number of millable cane (100.51 × 10^3 ha^{-1}) was recorded from the T_0 (MHAT treated sett) followed by T_8 (Sett dipping with Knowin 50 WP @ 1 gm/L of water for 30 minutes) was 100.44 × 10^3 ha^{-1}. However, at the Ishwardi site (Table 4), there was a significant difference in the millable cane production among the treatments. The maximum number of millable cane (88.38 × 10^3 ha^{-1}) was recorded from T_8 (Sett dipping with Knowin 50 WP @ 1 gm/L of water for 30 minutes).

Total soluble Solid (Brix)

In the case of Brix, there was a significant difference among the treatments in the Chuadanga site (Table 3). The highest brix (17.92) was found in T_5 (Sett dipping with Score 250 EC @ 0.5 ml/L of water for 30 minutes) and the lowest (16.89) observed in T_1 (untreated infected sett). But there was no significant difference in brix percentage at the Ishwardi site (Table 4).

Cane yield

It is evident from the data on cane yield that there were significant differences among the treatments at both locations. At the Modna, Chuadanga site (Table 3), the highest cane yield was observed in T_6 (Sett dipping with Score 250 EC @ 1 ml/L of water) (84.66 tha^{-1}) followed by T_7 (82.17 tha^{-1}).The lowest yield was obtained from the T_1 (Untreated Infected sett). However, in the Ishwardi site, the highest cane yield (80.72 tha^{-1}) was observed in T_8 (Sett dipping with Knowin 50 WP @ 1 gm/L of water for 30 minutes) followed by T_7 (80.67 tha^{-1}). The lowest yield was obtained from the T_1 (66.28 tha^{-1}) (Table 4).

Disease Incidence

At 120 days after planting, there were significant differences in disease incidence among the treatments at both locations. At the Modna, Chuadanga site, the highest disease incidence was observed in T_1 (untreated infected sett), while the lowest incidence was recorded in T_0 (MHAT-treated sett). A comparatively lower disease incidence was found in T_6 (sett dipping with Score 250 EC @ 1 ml/L of water), with an incidence rate of 0.49% (Table 3).Similarly, at the Ishwardi site, the highest disease incidence was found in T_1 (untreated infected sett), indicating that this treatment had the highest occurrence of smut disease. In contrast, the lowest incidence was observed in T_0 (MHAT-treated sett). A comparatively lower disease incidence was recorded in T_7 (sett dipping with Score 250 EC @ 1.5 ml/L of water), with an incidence rate of 0.47% (Table 4). Based on these results, it can be concluded that T_6 (sett dipping with Score 250 EC @ 1 ml/L of water) performed better in the Modna, Chuadanga, and Ishwardi, Pabna areas in reducing disease incidence compared to other treatments. This suggests that sett treatment with Score 250 EC@ 1 ml/L of water is an effective fungicide as sett treating chemicals against sugarcane smut disease.

BSRI SUB-STATION, JAMALPUR

RESEARCH HIGHLIGHTS

- The highest sugarcane yield 103.20 tha^{-1} was recorded in in T_4 treatment where Red amaranth was cultivated as intercrop with sugarcane. The highest yield of intercrop was recorded in Potato (21.52 tha^{-1}) and the highest adjusted cane yields of 212.33 tha^{-1} was observed in paired row cane while intercropping with potato.
- Considering the soil fertility status, Recommended Fertilizer Dose (RFD) 2018 (N_{180} P_{40} K_{90} S_{45} Mg_{10} Zn_4 kg ha^{-1}) + vermicompost@ 5 tha^{-1} is the best combination for sugarcane yield (95.150 tha^{-1}) and carbon accumulation of soil (1.82 tha^{-1}) at Young Brahmaputra and Jamuna Floodplain.

PERFORMANCE OF DIFFERENT INTERCROP WITH SUGARCANE IN PAIRED ROW SYSTEM

Sugarcane intercropping is a profitable practice. It helps the farmers to earn money in the interim time of sugarcane cultivation. The experiment was conducted to select suitable intercrops with paired row sugarcane at BSRI Jamalpur substation campus and Nokla during 2023-24 cropping season. The experiment was comprised of seven treatments viz. T_1-PRC, T_2-PRC+ Potato, T_3-PRC+Spinach, T_4-PRC+Red amaranth, T_5-PRC+Onion, T_6-PRC+Garlic and T_7-PRC+Tomato and the variety was BSRI Akh 42. The design of the experiment was RCBD with three replications. All agronomic practices were done as and when required.

At BSRI Jamalpur substation campus:

The land of BSRI Jamalpur substation were submerged due to excessive rain water caused waterlogging. Rain water washed out nutrient elements from soil lead to damage sugarcane crops. For this reason, the sugarcane (BSRI Akh 42) were not sustained in waterlogging.

At Nokla, Sherpur:

From the table 1 it was showed that the yield and yield contributing characters differed significantly among different treatments practiced. The highest sugarcane yield of 103.20 tha^{-1} was recorded in T_4 treatment where Red amaranth was cultivated as intercrop with sugarcane. However, the highest adjusted cane yield (212.33 tha^{-1}) was also recorded in T_2 treatment where potato was cultivated as intercrop. The % Brix were insignificant among the practiced different treatments.

Table 1. Performance of different intercrops with sugarcane in paired row system during 2023-24 cropping season (Nokla, Sherpur)

Treatments	Tiller ($\times 10^3$ ha^{-1})	Millable cane ($\times 10^3$ ha^{-1})	Cane Yield (tha^{-1})	Brix (%)	Intercrop yield (tha^{-1})	Adjusted cane yield (tha^{-1})
T_1	141.17 a	105.90 ab	90.35 a	19	--	-
T_2	148.36 a	129.00 a	94.95 a	20	21.520 a	212.33 a
T_3	159.05 a	92.60 b	101.79 a	19.50	12.220 b	124.01 d
T_4	161.25 a	105.36 ab	103.20 a	19	5.4100 c	113.04 e
T_5	156.70 a	92.69 b	100.28 a	19	6.2500 c	145.73 c
T_6	147.86 a	108.29 ab	94.63 a	19	3.4700 d	189.27 b
T_7	140.82 a	102.92 ab	90.13 a	20.50	11.900 b	122.58 d
LSD (0.05)	15.135	8.25	9.68	NS	0.62	1.35

T_1-PRC, T_2-PRC+Potato, T_3-PRC+Spinach, T_4-PRC+Red amaranth, T_5-PRC+Onion, T_6-PRC+Garlic and T_7-PRC+Tomato

EFFECT OF VERMICOMPOST ON SUGARCANE YIELD AND CARBON ACCUMULATION IN SOILS

Vermicompost is a nutrient rich organic compost. The use of vermicompost improves the soil condition and crop yield. Crop qualities are now fairly accepted as a general practice over the country. Adoption of vermiculture technology helps in improving the soil fertility on a sustainable basis and minimizing the use of chemical fertilizers. The experiment was conducted during 2023-2024 cropping season at Jamalpur Substation, Jamalpur of Young Brahmaputra and Jamuna Floodplain (Agro ecological zone 8) to find out the effect of vermicompost on sugarcane yield and to determine the carbon accumulation in soils from vermicompost application. The experiment was laid out in Randomized Complete Block Design. There were eight treatments comprised of T_1: Control, T_2: Recommended fertilizer dose' 2018, T_3: Recommended fertilizer dose' 2018+ Vermicompost @ 2.5 t/ha, T_4: Recommended fertilizer dose' 2018+ Vermicompost @ 5 t/ha, T_5: 75% Recommended fertilizer dose' 2018+ Vermicompost @ 2.5 t/ha, T_6: 75% Recommended fertilizer dose' 2018+ Vermicompost @ 5 t/ha, T_7: 50% Recommended fertilizer dose' 2018+ Vermicompost @ 2.5 t/ha, T_8: 50% Recommended fertilizer dose' 2018+ Vermicompost @ 5 t/ha. This experiment was partially damaged due to waterlogged condition.

From table 2 and 3 results revealed that application of vermicompost along with chemical fertilizer or chemical fertilizer alone showed all the growth parameters and yield of cane deferred significantly. The highest yield of cane was found in T_4 of 95.150 tha^{-1} where recommended fertilizer dose'2018 (N_{180} P_{40} K_{90} S_{45} Mg_{10} Zn_4 kg ha^{-1}) along with vermicompost@ 5 tha^{-1} was applied follwed by T_3 of 84.226 tha^{-1} where recommended fertilizer dose'2018 (N_{180} P_{40} K_{90} S_{45} Mg_{10} Zn_4 kg ha^{-1}) along with vermicompost@ 2.5 tha^{-1} was applied. Besides, the highest carbon accumulation of soil 1.82 tha^{-1} was found where recommended fertilizer dose 2018 (For Jamalpur: N_{180} P_{40} K_{90} S_{45} Mg_{10} Zn_4) with 5 tha^{-1} vermicompost were applied. The application of vermicompost along with chemical fertilizer increased cane yield in T_4 by 50.77% and in T_3 of 33.45% over control treatment, whereas T_2 (only chemical fertilizer) increased cane yield by 11.64% over control. Considering the crop productivity, N_{180} P_{40} K_{90} S_{45} Mg_{10} Zn_4 kg ha^{-1} along with vermicompost @ 5 tha^{-1} is best combination for sugarcane yield at Young Brahmaputra and Jamuna Floodplain.

Table 2. Carbon accumulation of soil using different vermicompost combinations

Treatments	Initial Soil			Post Harvest Soil			Carbon Accumulation (tha^{-1})
	SOC (%)	BD (%)	C Stock (tha^{-1})	SOC (%)	BD (%)	C Stock (tha^{-1})	
T_1	0.84	1.43	18.02	0.83	1.44	17.92	-0.10
T_2	0.84	1.43	18.02	0.87	1.44	18.74	0.77
T_3	0.84	1.43	18.02	0.88	1.45	19.14	1.12
T_4	0.84	1.43	18.02	0.90	1.47	19.84	1.82
T_5	0.84	1.43	18.02	0.88	1.45	19.14	1.12
T_6	0.84	1.43	18.02	0.90	1.46	19.71	1.69
T_7	0.84	1.43	18.02	0.87	1.45	18.92	0.90
T_8	0.84	1.43	18.02	0.87	1.46	19.05	0.93

Table 3. Effect of vermicompost on sugarcane yield and yield contributing characters of sugarcane during 2023-24 cropping season

Treatments	Tiller ($\times 10^3$ ha^{-1})	Millable cane ($\times 10^3$ ha^{-1})	Yield (tha^{-1})	Brix (%)
T_1	117.92 c	71.77 c	63.108 b	18.50
T_2	130.97 bc	80.38 bc	70.465 b	18.50
T_3	158.19 ab	96.59 ab	84.226 ab	19.00
T_4	178.06 a	109.42 a	95.150 a	19.50
T_5	150.14 a-c	91.08 a-c	80.103 ab	19.50
T_6	142.06 a-c	86.84 a-c	75.952 ab	18.50
T_7	144.58 a-c	88.13 a-c	76.973 ab	19.00
T_8	139.17 bc	84.92 bc	74.256 ab	19.00
LSD (0.05)	17.84	11.35	9.98	NS

T_1-Control, T_2-RFD'2018, T_3-RFD'2018+VC@2.5 tha^{-1}, T_4- RFD'2018+VC@5 tha^{-1},T_5- 75% RFD'2018+VC@2.5 tha^{-1}, T_6- 75% RFD'2018+VC@5 tha^{-1}, T_7- 50%, RFD'2018+VC@2.5 tha^{-1} and T_8- 50% RFD'2018+VC@5 tha^{-1}

BSRI SUB-STATION, RAHMATPUR, BARISHAL

RESEARCH HIGHLIGHTS

- The BSRI Akh 46 performed better as cane yield. The experiment was partially affected by cyclone Remal on May 2024. Farmer was not interest on making *gur* due to salinity. He sold all the varieties to juice vendor and as well by himself. No adverse effect was found on yield but taste of juice wassalighly salty in all of the varieties due to salinity among the eight studied varieties at Kalapara Upazilla in Patuakhali district under southern region.
- In chewing experiment, Local (Bombay) performed better as yield and no adverse effect was found on yield and taste of juice in cane due to salinity among the five studied varieties at Babuganj Upazilla in Barishal district under southern region.
- Madhumala insignificantly perform in the study at tidal affected area. Brix and other important character were normal though the field regularly inundated in March to August.
- In Golpata juice production experiment, treatment Urea 1.5 kg, Mop 1.5 Kg, TSP .75kg cluster^{-1} performed better in juice production and no adverse effect was found on yield and taste of juice in cane due to inorganic manuring at kalapara, Patuakhali.
- In Sorjan farming system, BSRI Akh 41 + Broccoli + Fish+Vine crop perform better compare to other treatments under this study and gain the highest BCR at BSRI sub-station, Barishal.

SELECTION OF SUGARCANE VARIETIES SUITABLE FOR *GUR* PRODUCTION IN SALINE BELT OF SOUTHERN REGION

The experiment was conducted at Kalapara Upazila under Patuakhali district in 2023-24 cropping season to select the suitable varieties for *gur* production in saline belt. Eight (8) varieties were evaluated in farmers field with three replications in RCB design. The varieties were Isd 37, Isd 39, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45, BSRI Akh 46, BSRI Akh 48 and Madhumala. Two eyed setts of each variety were planted in 10 January, 2024. Intercultural operations (irrigation, rouging, weeding, earthing up, drainage, mechanical pest control) were carried out as per required. Crop was harvested in 26 December, 2024. Data on different growth parameters were collected. Results are presented in Table 1; Fig. 1.

Table 1. Performance of sugarcane varieties for yield and yield contributing traits at Hazipur locations in Patuakhali District under southern region

Genotypes	Tiller ($\times10^3$ha^{-1})	Millable cane ($\times10^3$ha^{-1})	Brix (%)	Yield (t ha^{-1})
Isd 37	138.67 ab	89.69 ab	18.53 ab	82 ab
Isd 39	141.33 a	98.65 a	19.27 a	73.86 cd
BSRI Akh 43	130b c	82.82 b	17.32 b	69.15 d
BSRI Akh 44	122.33 c	86.9 b	18.21 ab	74.02 cd
BSRI Akh 45	123.33 c	89.07 ab	18.52 ab	77.26 bc
BSRI Akh 46	133.67 ab	89.4 ab	18.76 a	86.82 a
BSRI Akh 48	135.33 ab	89.07 ab	18.83 a	83.70 ab
Madhumala	136.67 ab	91.35 ab	18.55 ab	83.71 ab
P value	0.00506	0.119	0.126	0.000511

At experiment site, Isd 39 showed significantly higher tiller population (141.33×10^3 ha^{-1}) which was followed by Isd 37 (138.67×10^3 ha^{-1}) (Table 1). The highest number of millable cane was found to produce by Isd 39 (98.65×10^3 ha^{-1}) followed by Madhumala (91.35×103 ha^{-1}), BSRI Akh 46 (89.40×10^3 ha^{-1}), BSRI Akh 48 (89.07×10^3 ha^{-1}) and significantly different for BSRI Akh 43 (82.82×10^3 ha^{-1}), BSRI Akh 44 (86.90×10^3 ha^{-1}) (Table 1). In respect of cane yield BSRI Akh 46 scored the insignificantly highest (86.82 tha^{-1}) among the eight varieties which was followed by BSRI Akh 48 (83.70 tha^{-1}) and Madhumala (83.71 tha^{-1}). The variety BSRI Akh 43 showed significantly lowest cane yield (69.15 tha^{-1}) compared among varieties (Table 1). The varital performance for gur can't be measured due to salinity effect. Isd 39, BSRI Akh 46 and BSRI Akh 48 showed highest (19.27-18.76) brix (%) followed by Madhumala (18.55%) and significantly lowest (17.32%) was in BSRI Akh 43 among the varieties. The parameter of salinity level was 1.5-11.8 ds/m. The highest salinity was found in the month of April (11.8 ds/m) and lowest in December (1.5ds/m).

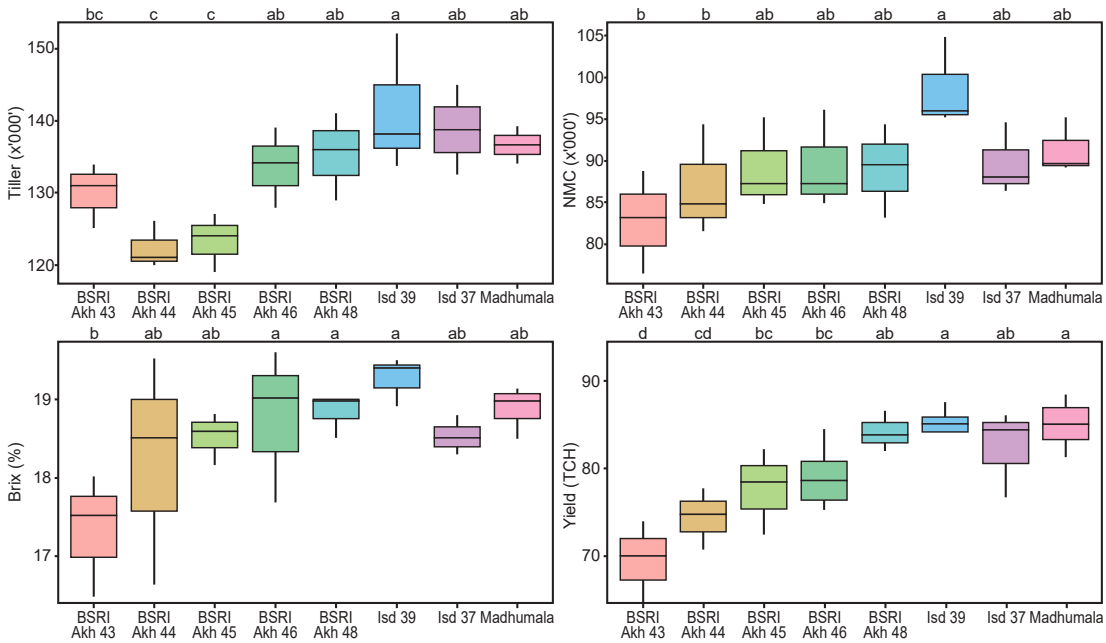


Fig. 1. Box plot for different important traits of sugarcane varieties and clone

Therefore, it may be concluded that the variety BSRI Akh 46 performed better as cane yield (86.82 tha^{-1}) among the eight studied varieties. It is necessary to mention that no adverse effect was found on yield but taste of gur was slightly salty. It is important to informed that the experiment plot was affected by cyclone Remalon May 2024.

PERFORMANCE OF CHEWING VARIETIES IN SALINE BELT OF SOUTHERN REGION

The experiment was conducted at one location at Baherchar site of Babuganj Upazilla in Barishal district during 2023-2024 cropping season to select the suitable varieties for chewing in Southern region. Five (5) varieties were tested in farmers field with three replications in RCB design. The varieties were BSRI Akh 41 (Amrita), BSRI Akh 42 (Rongbilash), BSRI Akh 47, Misrimala, and Local (Bombay). Two eyed settlings of each variety were raised in soilbed in time and transplanting of settlings was done in 31 December, 2023. Intercultural operations were done as and when necessary. Crop was harvested on 11November, 2024. Data on different growth parameters were collected. Results are presented in Table 2.

Table 2. Performance of chewing sugarcane varieties and clone for tillers, millable cane, yield and brix percent at Babuganj under Barishal district

Varieties	Tiller ($\times 10^3 ha^{-1}$)	Millable cane ($\times 10^3 ha^{-1}$)	Brix (%)	Yield (t ha^{-1})
BSRI Akh 41	112.53 a	88.65 a	18.17 a	98.02 a
BSRI Akh 42	101.37 b	81.09 abc	17.5 b	95.79 a
BSRI Akh 47	98.1 b	74.61 c	18.27 a	94.46 a
Madhumala	97.91 b	77.24 bc	17.67 ab	92.98 a
Local (Bombay)	106.55 ab	84.71 ab	16.83 c	99.52 a
p value	0.0249	0.0192	0.00253	0.297

At experimental site, the highest tiller population was recorded in BSRI Akh 41 (112.53 x 10^3 ha^{-1}) which was followed by Bombay (106.55 x 10^3 ha^{-1}) and significantly different from Madhumala, BSRI Akh 47 and BSRI Akh 42 (Table 2). Millable cane was found to produce significantly higher by BSRI Akh 41 (88.65 x 10^3 ha^{-1}) which was followed by Bombay and BSRI Akh 42 (Table 2). In respect of cane yield, local variety (Bomby) showed non significantly highest yield (99.52 tha^{-1}) followed by BSRI Akh 41 (98.02 tha^{-1}) (Table 2). The Madhumala showed non-significantly lower yield (92.98 tha^{-1}) compare among the varieties. BSRI Akh 41 and BSRI Akh 47 showed significantly higher brix (%) than Madhumala, BSRI Akh 42 and Bombay. The parameter of salinity level was 1.3-4.5 ds/m. The highest salinity was found in the month of April (4.5 ds/m) and lowest in December (1.3 ds/m).

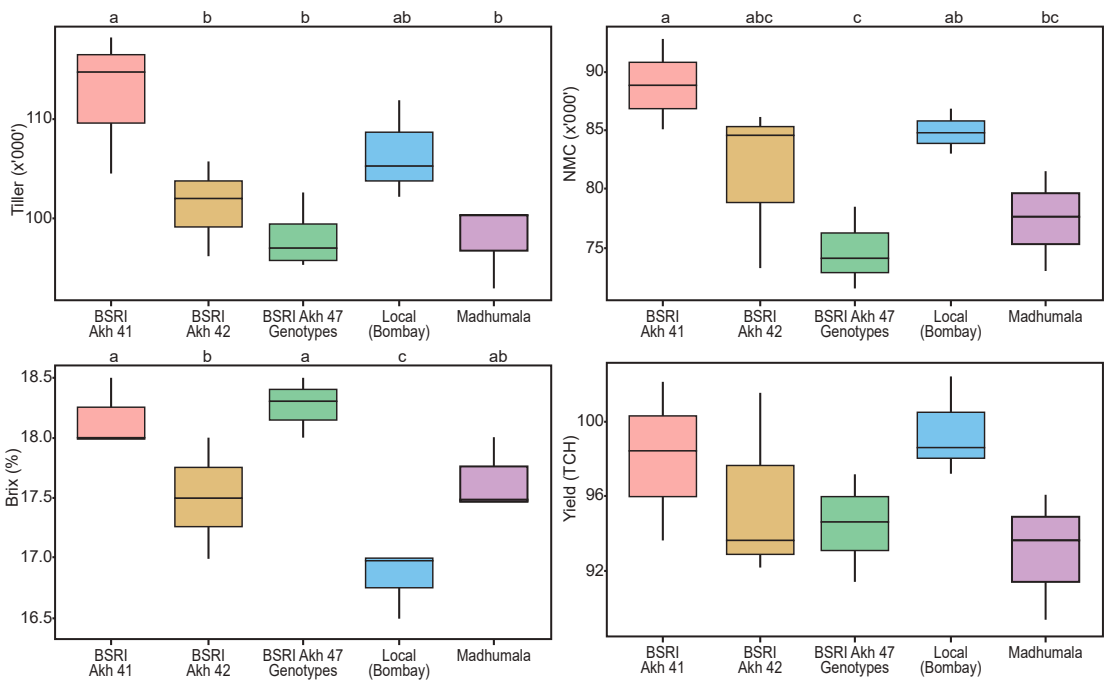


Fig. 2. Box plot for different important traits of sugarcane varieties and clone

Therefore, it may be concluded that Local variety Bombay performed better as yield among the studied varieties. It also may be mentioned that no adverse effect was found on yield and taste of juice in cane due to salinity.

EFFECT OF TIDAL WATER ON GROWTH AND YIELD OF SUGARCANE

The experiment was conducted at the area which is mostly inundated by tidal water at Rangopaldi, Dasmina, Galichipa, Patuakhali. Three BSRI bred varieties including one local vatiety was tested in three replications RCBD design under this study. Two eyed settlings of each variety were raised in soil bed in time and transplanting of settlings was done in 25 December, 2023. Intercultural operations were carried out as per needed. Crop was harvested on 21 December, 2024. Data on different growth parameters were collected. Results are presented in Table 3 and fig. 3.

Table 3. Performance of sugarcane varieties and clone for important traits at tidal affected area, Patuakhali district

Varieties/Clone	Tiller ($\times 10^3 ha^{-1}$)	Millable cane ($\times 10^3 ha^{-1}$)	Brix (%)	Yield (tha^{-1})
BSRI Akh 41	93.1 ab	79.9 a	17.67 a	82.07 a
BSRI Akh 42	91.6 b	78.46 a	16.83 a	79.83 a
BSRI Akh 47	94.94 ab	78.12 a	17.03 a	77.84 a
Madhumala	99.52 a	83.37 a	17.6 a	83.03 a
P value	0.145	0.527 (NS)	0.214 (NS)	0.418 (NS)

At tidal affected area, Madhumala performed statistically higher (99.52 $x10^3$ ha^{-1}) for tiller number among the varieties and BSRI Akh 42 acieve lowest (91.6 x 10^3 ha^{-1}) tiller number. In respect of NMC, highest (non-significant) millable cane was found to produce by Madhumala (83.37$x10^3$ ha^{-1}), followed by BSRI Akh 41 (79.90x 10^3 ha^{-1}) and BSRI Akh 42 (78.46 $x10^3$ ha^{-1}). BSRI Akh 47 performed the lowest (78.12x 10^3 ha^{-1}) in performance regarding millable cane (Table 3). In respect of cane yield highest (non-significantly) yield was obtained by Madhumala (83.03 tha^{-1}), BSRI Akh 41 (82.07 tha^{-1}). Lowest yield was obtained by BSRI Akh 47 (77.84 tha^{-1}) compared to other varieties. Brix percent of the varieties showed non-significant comperisons where highest Brix % was obtained by BSRI Akh 41 and lowest was for BSRI Akh 47. The parameter of tidal water level was 30 cm-90 cm. The highest tidal water was found in the month of August (90 cm) and lowest in March (30 cm).

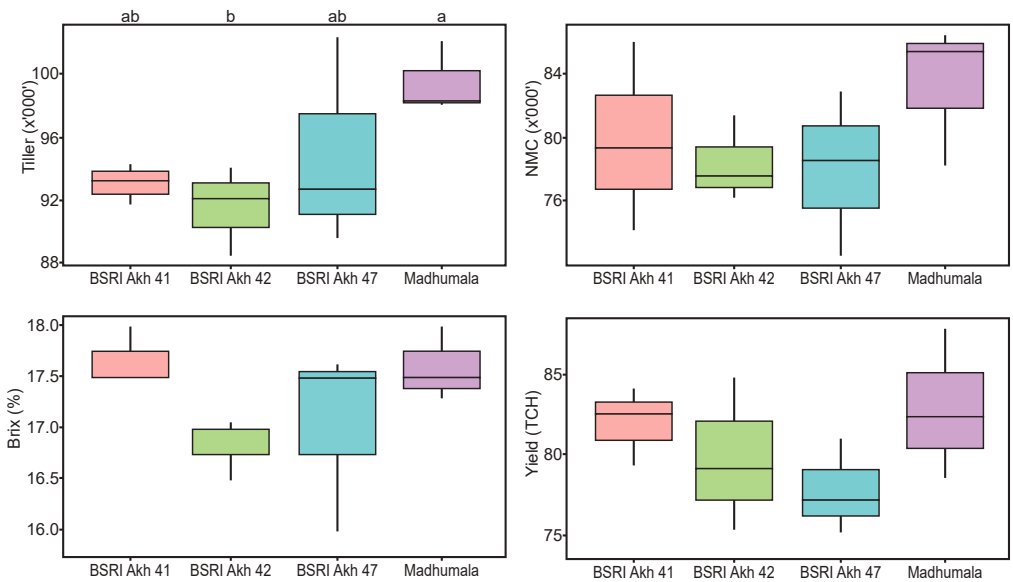


Fig. 3. Box plot for different important traits of sugarcane varieties and clone

Therefore, it may be concluded that Madhumala performed better as yield among the studied varieties at Patuakhali. It also may be mentioned that no adverse effect was found on yield and taste of juice in cane due to salinity.

EFFECT OF FERTILIZER ON YIELD AND QUALITY OF NIPA PALM *GUR*

The experiment was conducted at farmer's Nipa palm (Golpata) garden at Kalapara, Patuakhali. Six varying inorganic nutrient combination along with 'Zero' additional nutrient treated as 'control' were used as treatments on naturally grown Golpata plant clusters (4-6 plants/cluster). According to treatment combination the gardens were fertigation on deep placement at sub-soil root zone area in 03 April, 2023. Intercultural operations (removal of debris, lowering of bunches etc.) were carried out as per needed. The juice collection was started from December 2024. The data were recorded mid of the season 12 January, 2024. Data on juice yield and brix % were collected accordingly. Results are presented in Table 4 and Fig. 4.

Table 4. Yield performance of different fertilizer treatment(s) on Golpata juice production

Treatments	Juice production (ml/stalk/day)	Brix (%)
T_1	877.5 ab	12.33
T_2	912.5 ab	12.69
T_3	922.09 a	12.99
T_4	801.25 abc	12.18
T_5	817.5 abc	12.76
T_6	800 bc	12.98
T_{7c}	730 c	12.96
P value	0.0399	0.524(NS)

Note: T_1.Urea 2 kg, Mop 1.5kg, TSP .75kg Per cluster; T_2. Urea 2 kg, Mop 1.5 Kg, TSP .5kg Per cluster; T_3. Urea 1.5 kg, Mop 1.5 Kg, TSP .75kg Per cluster; T_4.Urea 1 kg, Mop 1.5kg, TSP .75kg Per cluster; T_5. Urea 2 kg, Mop 1 kg, TSP .5kg Per cluster; T_6. Urea 1.5 kg, Mop .5 Kg, TSP .75kg Per cluster and T_7 c. Control (no Fertilizer)

Under this study, the juice yield of Golpata performed statistically significant among the treatments. And of them treatment T_3 showed highest juice production (922.09 ml/day/session) followed by T_2 (912.5 ml/day/session). Lowest juice production was observed for control T_7 c (730 ml/day/session). In brix percent all the treatments perform in significantly in Fig. 4. Highest brix percent was observed in T_3 (12.99) followed by T_6 (12.98%) in table 4. The lowest brix was given by treatment T_4 (12.18%).

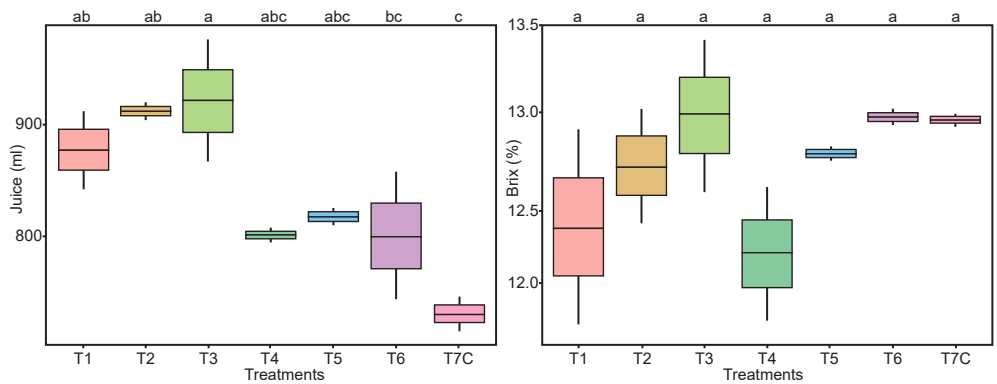


Fig. 4. Box plot for juice yield and brix percent of Golpata juice production

Therefore, it may be concluded that fertilizer combination, Urea 1.5 kg, Mop 1.5 Kg, TSP .75 kg Per cluster performed better as juice yield among the studied treatments compared for golpata juice production.

SUGARCANE BASED INTEGRATED FARMING IN SORJAN SYSTEM UNDER SOUTHERN REGION

Sorjan is an innovative land use multi crop farming system for low land swamp area. This system's base structures were modified in adequation to introduce sugarcane as a main crop along with intercrops, vine trelies and aquaculture together. The experiment was conducted at experimental field of BSRI sub-station, Rahmatpur, Barishal. Three intercrops combination with BSRI Akh 41 were used as treatments. Single eyed settlings of BSRI Akh 41 were raised in soilbed in time and transplanting of settlings were done in 22 November, 2023 as spaced Transplanting (STP) method. Four treatments, T_1: BSRI Akh 41+ Fish+ Vine crop; T_2: BSRI Akh 41 + Garlic + Fish+ Vine crop; T_3: BSRI Akh 41+ Chilli + Fish+Vine crop; T_4: BSRI Akh 41 + Broccoli + Fish+Vine crop was evaluated in sorjan system. Intercultural operations were carried out as per needed. The matured cane was harvested on 12 November, 2024. Data on different growth parameters were collected accordingly. Results are presented in Table 5.1 and Table 5.2.

Table 5.1 Performance of different treatment combinations for yield contributing parameters in sugarcane based sorjan system

Treatments	Cane Yield (tha^{-1})	Intercrop Yield (tha^{-1})			Equivalent Cane Yield (tha^{-1})	Adjusted Cane Yield (tha^{-1})
		vegetables	Vine crop	Fish		
T_1	112.61 a	00.00 c	34.76 a	14.20 a	106.05 d	218.65 d
T_2	101.63 b	29.32 ab	30.05 b	14.86 a	447.02 c	548.65 c
T_3	110.00 a	26.30 b	32.96 a	14.61 a	629.68 b	739.68 b
T_4	102.83 b	32.05 a	33.77 a	14.73 a	646.67 a	749.51 a
P value	0.008737	1.67 E-10	2.64E-10	0.7587(ns)	2.2E-16	2.2E-16

Table 5.2 Economic calculations of different treatments evaluated on sugarcane based sorjan system

Treatments	Total production Cost ('000' Tk. ha^{-1})	Gross Return ('000' Tk. ha^{-1})	Gross Margin ('000' Tk. ha^{-1})	BCR	NBCR
T_1	704.48 d	2186.50 d	1482.03 d	3.10 c	2.10 c
T_2	1787.33 a	5486.53 c	3699.20 c	3.07 c	2.07 c
T_3	1541.32 b	7396.75 b	5855.44 b	4.80 b	3.80 b
T_4	1521.20 c	7495.05 a	5973.85 a	4.93 a	3.93 a
P value	2.2E-16	2.2E-16	2.2E-16	2.2E-16	2.2E-16

In this study, treatment T_1 performed the highest (112.61 tha^{-1}) cane yield followed by T_3 (110.00 tha^{-1}) and are statistically significant compare to the remaining two treatments. The lowest cane yield was found in T_2 treatment (101.63 tha^{-1}) table 5.1. Treatment T_4 perform highest equivalent cane yield (646.67 tha^{-1}) of the intercrops components followed by T_3 (629.68 tha^{-1}) and T_1 perform the lowest (106.05 tha^{-1}) equivalent cane yield in the sorjan system (Table 5.1). In adjusted cane yield, T_4 perform highest equivalent cane yield (749.51 tha^{-1}) of the inter-crop components followed by T_3 (739.68 tha^{-1}) and T_1 perform the lowest (218.65 tha^{-1}) adjusted cane yield.

In economic calculation, project expenditure T_2 required highest cost of production (1787.33 thousand taka/ha^{-1}) whereas T_1 required lowest (704.48 thousand taka/ha^{-1}) amount of money. In farm outcome T_4 showed insignificantly higher (7495.05 at thousand taka/ha^{-1}) followed by treatment T_3 (7396.75 thousand taka). The lowest amount of outcome from treatment combination T_1 (2186.50 thousand taka). Resulting T_4 gain highest BCR (4.93) followed by T_3 (4.80) and the lowest BCR obtained by T_2 (3.07) in table 5.2.

Therefore, it may be concluded that T_4: BSRI Akh 41 + Broccoli + Fish + Vine crop performed better as yield among the studied treatments compared to other treatment for production.

BSRI SUB-STATION, SIRAJGANJ

RESEARCH HIGHLIGHTS

- In ratoon cane production, the sugarcane varieties of Isd 37, Isd 38 and BSRI Akh 46 ratoon field performance were good in Jamuna char land under AEZ 4.
- Onion and potato performed better as intercrop in terms of adjusted cane yield than other intercrops treatments while cultivated with Isd 37 and Isd 38.

RATOONING POTENTIALITY OF SOME NEWLY RELEASED BSRI BRED SUGARCANE VARIETIES AT JAMUNA CHAR LAND UNDER AEZ 4

Bangladesh Sugarcrop Research Institute has developed 48 (forty eight) sugarcane varieties of which only few varieties are occupied a major part of total cane areas. Sirajganj district is a non mill zone and one of the major *gur* producing areas in Bangladesh. The progress of dissemination of latest developed sugarcane varieties is very low in all non mill zones of Bangladesh. The main reason for poor dissemination of the latest developed varieties is that, the adaptive trial of the varieties is not carried out successfully in growers' field at non mill zones. To maintain high yielding character, it is necessary to replace varieties every few years with newly released varieties. The Sugarcane yield of a particular variety depends upon the heredity potential of the genotype and the environment where it is exposed during the course of its life cycle. Variety of crop plays an important role as regards to the yield and quality, sugarcane is no exception (Anon. 1978). After a considerable period of cultivation sugarcane varieties show a tendency to decline in yield and vigor (Barnes, 1954 and Humbert, 1959). It is an obscure and puzzling problem to scientists, growers and processors. Beside this, sugarcane production through ratoon management is a common practice in sugarcane growing areas of the world. This practice significantly reduces the cost of land preparation, planting and seed material. Good ratoon variety (s) is not available among the growers of non mill zones at sirajganj. There is ample scope to introduce ratooning practice if good ratoon variety is made available to farmers. Therefore the present study was undertaken to evaluate the performance of those varieties as plant and ratoon under AEZ 4.

The experiment was designed in RCBD method with three replications and plantation was conducted in the first week of October 2020 with plot size 6m × 5m and total area of land is 0.33 acre. 6 (six) varieties i.e. Isd 34, Isd 37, Isd 38, BSRI Akh 45, BSRI Akh 46 and Local variety were selected for this research during the cropping season 2023-2024. The experiment was set up at two locations (Shoilabari & Brahmmonboira) in Sirajganj district. The harvesting of sugarcane was conducted in the month of November, 2024. Appropriate amount of basal dose of fertilizer, pesticides, necessary intercultural operations like irrigation, mulching, weeding, earthing up, top dressing of fertilizers, insect, pest and diseases management, tying of cane etc. were done when these were required. The canes were harvested at 12 months after planting that is November, 2024. It is expected that, these results will be helpful for future crossing and hybridization programme of sugarcane variety development and also it may help growers to know the suitable variety in those locations that will help them financially profitable and also farmers would be able to take correct decision about the selection of high yielding, pest and disease tolerant variety (s) for ratoon cane cultivation.

The varieties were assessed under the

parameters of number of tiller raised, number of millable cane production, average height of cane, yield of cane and brix % of cane. Data of different growth parameters of sugarcane were taken, complied and presented in table 1 and 2.

Table 1. Number of Tiller, number of millable cane, cane height, cane yield and brix % of different cane varieties (Location: Brahmonboyra)

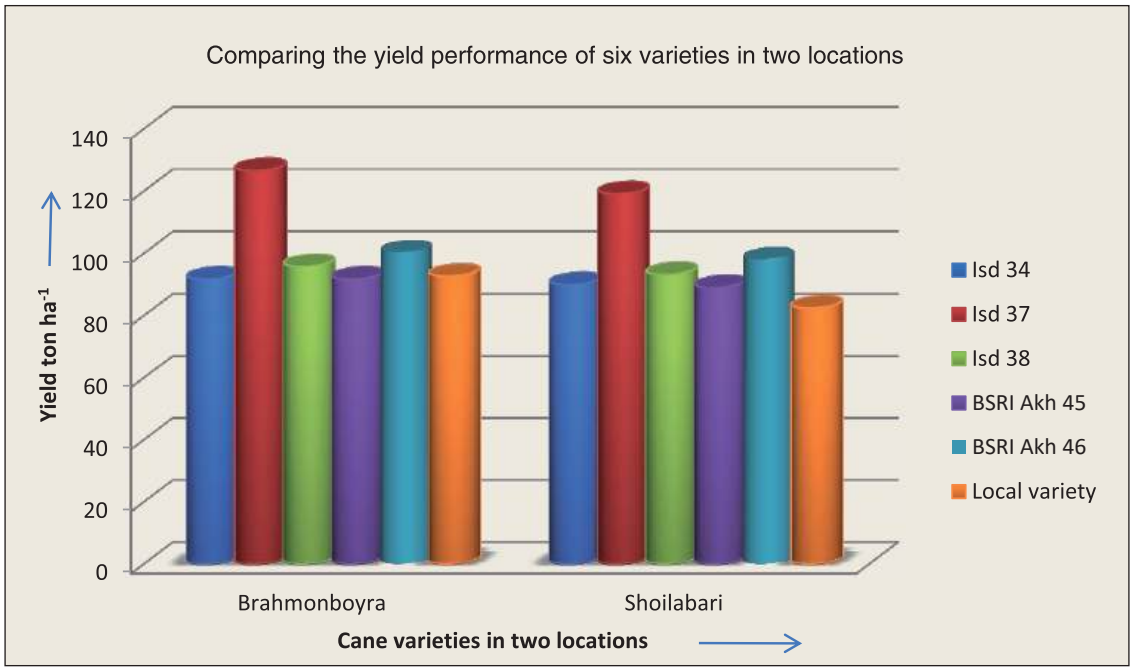
Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Cane height (m/cane)	Cane yield (tha^{-1})	Brix %
Isd 34	157.33 f	89.35 bcd	3.00 a	91.67 d	18.71 c
Isd 37	221.75 a	111.71 a	3.04 a	126.56 a	21.03 a
Isd 38	213.67 b	87.08 d	2.97 a	95.78 c	19.82 b
BSRI Akh 45	175.92 d	91.38 bc	3.05 a	91.69 d	18.51 c
BSRI Akh 46	186.33 c	92.17 b	2.98 a	100.45 b	20.15 c
Local variety	166.67 e	88.06 cd	2.99 a	92.69 d	18.27 c
LSD (0.05)	7.32	3.76	0.08	6.80	0.93

From Table 1, it was observed that, the highest number tiller was from Isd 37 (221.75×10^3 ha^{-1}) and the highest number of millable cane was found in Isd 37 (111.71×10^3 ha^{-1}) followed by BSRI Akh 46 (92.17×10^3 ha^{-1}), BSRI Akh 45 (91.38×10^3 ha^{-1}), Isd 34 (89.35×10^3 ha^{-1}), Local variety (88.06×10^3 ha^{-1}), and Isd 38 (87.08×10^3 ha^{-1}). The highest cane height was found in BSRI Akh 45 (3.05 meter) the lowest was in Isd 38 (2.97 meter). For brix %, the Isd 37 (21.03%) gave the top value and the varieties BSRI Akh 46 (20.15 %), Isd 38 (19.82%), Isd 34 (18.71%), BSRI Akh 45 (18.51%) and Local variety (18.27,%) are statistically similar. In case of yield, the highest yield was produced from the variety Isd 37 (126.56 ton ha^{-1}) followed by BSRI Akh 46 (100.45 ton ha^{-1}), Isd 38 (95.78 ton ha^{-1}), Local variety (92.69 ton ha^{-1}), BSRI Akh 45 (91.67 ton ha^{-1}) and lastly the lowest yield was found in Isd 34 (91.67 ton ha^{-1}).

Table 2. Number of Tiller, number of millable cane, cane height, cane yield and brix % of different cane varieties (Location: Shoilabari)

Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Cane height (m/cane)	Cane yield (tha^{-1})	Brix %
Isd 34	123.33 d	81.77 d	2.99 a	89.93 d	17.25 d
Isd 37	186.44 a	105.13 a	2.98 a	119.16 a	20.36 a
Isd 38	153.33 b	86.56 c	3.05 a	93.18 c	19.39 b
BSRI Akh 45	133.95 c	83.18 d	2.96 a	88.98 d	18.12 c
BSRI Akh 46	156.33 b	90.62 b	3.04 a	98.18 b	19.35 b
Local Variety	120.94 d	81.77 d	3.01 a	82.48 e	17.46 d
LSD (0.05)	5.60	2.02	0.09	3.17	0.56

From Table 2, it was observed that, the highest number tiller was from Isd 37 (186.44×10^3 ha^{-1}) and the highest number of millable cane was found in Isd 37 (105.13×10^3 ha^{-1}) followed by BSRI Akh 46 (90.62×10^3 ha^{-1}), Isd 38 (86.56×10^3 ha^{-1}), BSRI Akh 45 (83.18×10^3 ha^{-1}), Local variety (81.77×10^3 ha^{-1}), and Isd 34 (81.77×10^3 ha^{-1}). The highest cane height was found in Isd 38 (3.05 meter) the lowest was in Isd 37 (2.98 meter). For brix %, the Isd 37 (20.36%) gave the top value and the varieties Isd 38 (19.39 %), BSRI Akh 46 (19.35 %), BSRI Akh 45 (18.12 %) and Local variety (17.46,%), Isd 34 (17.25%). In case of yield, the highest yield was produced from the variety Isd 37 (119.16 ton ha^{-1}) followed by BSRI Akh 46 (98.18 ton ha^{-1}), Isd 38 (93.18 ton ha^{-1}), Isd 34 (89.93 ton ha^{-1}), BSRI Akh 45 (88.98 ton $ha^{-1)}$ and lastly the lowest yield was found in Local variety (82.48 ton ha^{-1}).



According to above figure, it is observed that the range of cane yield is from 82.48 ton ha^{-1} to 129.37 ton ha^{-1}. At a glance, it is appeared that, Shoilabari location has slightly poor yield than Brahmonboyra location and the apex yield was found from the variety Isd 37 (126.56 ton ha^{-1} & 119.16 ton ha^{-1}) in both locations. Similarly the variety BSRI Akh 46 has performed the second highest result. On the other hand, there is a variation for lowest yield result. The lowest cane yield was from the Local variety (82.48 ton ha^{-1}). in Shoilabari location & in Brahmonboyra location, it is for Isd 34 (91.67 ton ha^{-1}). In Shoilabari location, the field result was not up to the mark compared to another one. The field position was slight low land and due to high rainfall a water logging condition was created. This may induce the poor yield.

PRODUCTION OF SUGARCANE WITH DIFFERENT INTERCROPS FOR INCREASING THE LIVELIHOOD OF CHAR LAND PEOPLE IN SIRAJGANJ

Sugarcane (*Saccharum officinarum* L.) is the world`s most crucial sugar and energy crop and it is mainly cultivated in tropical and subtropical climates with an annual production of about 16 million tons worldwide. Among various farming practices, intercropping farming systems have been deemed as one of the sustainable agricultural practices globally (Tang *et al.*, 2021). If we can establish sugarcane with intercrops, it will easy to make acceptance of farmers and they will be economically benefited with this. As such, an experiment is aimed to find out the effect on growth, yield and quality of sugarcane with intercrops and to maximize the productivity and economic return from sugarcane. The Flood is that natural calamity which damages completely about all the crops except sugarcane. In Sirajganj district, there are notable amounts of char land which are being fallow round the year because of flood. Because these lands are immersed under water about 2 to 3 months. In this condition sugarcane can be the best crop for these lands because sugarcane is the only crop which can survive after heavy flood stress. Bangladesh Sugarcrop Research Institute

has developed 48 (forty eight) varieties. All are not flood resistant in Jamuna char lands. That's why it is necessary to evaluate the suitable varieties which are appropriate at char lands. To maintain high yielding and existence character, it is necessary to replace varieties every few years with newly released varieties hence this experiment has undertaken with the objectives to identify the sugarcane varieties suitable for Jamuna char land in flood stress condition and to popularize the intercrops which can be practiced with sugarcane among the farmers at char land in Sirajganj. The experiment was conducted in RCBD method with three replications and plantation was done with two budded setts in the second week of December 2021 with plot size 6m × 8m and total area of land is 0.33 acre. 06 (six) treatments i.e. T_1= Isd 38 + Potato, T_2= Isd 38 + Onion, T_3= Isd 38 + black cumin, T_4= Isd 38 + linseed, T_5= Isd 38 + Lentil and T_6= Isd 38 (Control) were selected for this research during the cropping season 2023-2024. By executing this experiment, farmers can differentiate their traditional cultivation system with BSRI technology. The experiment was set up at two locations (Charpara & Shoilabari) in Sirajganj char land. Appropriate amount of basal dose of fertilizer, pesticides, necessary intercultural operations like irrigation, mulching, weeding, earthing up, top dressing of fertilizers, insect, pest and diseases management, tying of cane etc. were done when these were required. The canes were harvested at 12 months after planting. It is expected that these results will be helpful for growers to know the suitable intercrop in those. The treatments were assessed under the parameters of number of tiller raised, number of millable cane production, average height of cane, yield of cane and brix % of cane. Data of different growth parameters of sugarcane were taken, complied and presented in table 3,4,5 and 6 .

Table 3. Number of Tiller, number of millable cane, cane height, cane yield and brix % of different treatmens (Location: Charpara)

Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Cane yield (tha^{-1})	Cane height (m/cane)	Brix %
T_1 = Isd 38 + Potato	122.06 ab	86.94 c	100.55 bc	3.11 a	18.22 ab
T_2 = Isd 38 + Onion	120.83 b	91.33 ab	109.57 a	3.11 a	17.80 abc
T_3 = Isd 38 + Black cumin	120.67 b	90.32 b	101.75 bc	3.08 a	18.35 a
T_4 = Isd 38 + Linseed	123.83 ab	90.14 b	103.73 b	3.08 a	17.28 c
T_5 = Isd 38 + Lentil	124.67 a	93.05 a	99.54 c	3.06 a	17.60 c
T_6 = Isd 38 (Control)	125.61 a	92.09 ab	101.6 bc	3.09 a	17.62 bc
LSD (0.05)	3.75	2.56	3.22	0.07	0.60

From Table 3, it was observed that, the highest number tiller was from Isd 38 (Control) (125.61 $\times 10^3$ ha^{-1}) and the lowest from Isd 38 + black cumin (120.67$\times 10^3$ ha^{-1}). The highest number of millable cane was found in Isd 38 + Lentil (93.05 $\times 10^3$ ha^{-1}) followed by Isd 38 (Control) (92.09 $\times 10^3$ ha^{-1}), Isd 38 + Onion (91.33 $\times 10^3$ ha^{-1}), Isd 38 + black cumin (90.32 $\times 10^3$ ha^{-1}), Isd 38 + linseed (90.14 $\times 10^3$ ha^{-1}) and Isd 38 + Potato (86.94 $\times 10^3$ ha^{-1}). The top most cane height was found in Isd 38 + Potato and Isd 38 + Onion (3.11 meter) and the lowest was in Isd 38 + Lentil (3.06 meter). For brix %, the Isd 38 + Black cumin (18.35 %) gave the top value and the lowest from Isd 38 + Linseed (17.28 %). In case of yield, the highest yield was produced from the variety Isd 38 + Onion (109.57 ton ha^{-1}) and the lowest yield was found in Isd 38 + Lentil (99.54 ton ha^{-1}).

Table 4. Cane yield, intercrop yield and adjusted cane yield of different treatmens (Location: Charpara)

Treatments	Cane yield (tha^{-1})	Yield of Intercrops (tha^{-1})	Adjusted cane Yield (tha^{-1})
T_1 = Isd 38 + Potato	100.55	6.5	124.18
T_2 = Isd 38 + Onion	109.57	8.5	171.39
T_3 = Isd 38 + Black cumin	101.75	0.10	105.38
T_4 = Isd 38 + Linseed	103.73	0.13	109.64
T_5 = Isd 38 + Lentil	99.54	0.41	106.99
T_6 = Isd 38 (Control)	101.6	-	101.6

Lentil/kg = 100/-, Potato/kg = 20/-, Onion/kg = 40/-, Linseed/kg = 250/-, Black cumin/kg = 200/- Unit price of sugarcane /Kg= 5.5/- (Per ton= 5,500/-)

The result shows from table 4 that, In case of adjusted cane yield, the highest yield was produced from the treatment Isd 38 + Onion (171.39 ton ha^{-1}) and the lowest yield was found in Isd 38 (Control) (101.6 ton ha^{-1}).

Table 5. Number of Tiller, number of millable cane, cane height, cane yield and brix % of different treatmens (Location: Shoilabari)

Treatments	Tiller ($x10^3\ ha^{-1}$)	Millable cane ($x10^3\ ha^{-1}$)	Cane yield (tha^{-1})	Cane height (m/cane)	Brix %
T_1 = Isd 38 + Potato	125.18 b	104.54 a	112.89 b	3.0542 a	20.09 a
T_2 = Isd 38 + Onion	125.36 b	100.87 b	111.98 bc	2.9883 ab	20.11 a
T_3 = Isd 38 + Black cumin	122.87 b	77.03 e	95.27 e	2.9908 ab	18.64 ab
T_4 = Isd 38 + Linseed	125.56 b	91.18 c	109.1 c	3.0133 ab	18.71 ab
T_5 = Isd 38 + Lentil	124.58 b	84.66 d	99.62 d	3.0217 ab	18.15 b
T_6 = Isd 38 (Control)	128.7 a	99.44 b	119.32 a	2.97 b	18.95 ab
LSD (0.05)	2.97	2.72	5.8	0.08	1.51

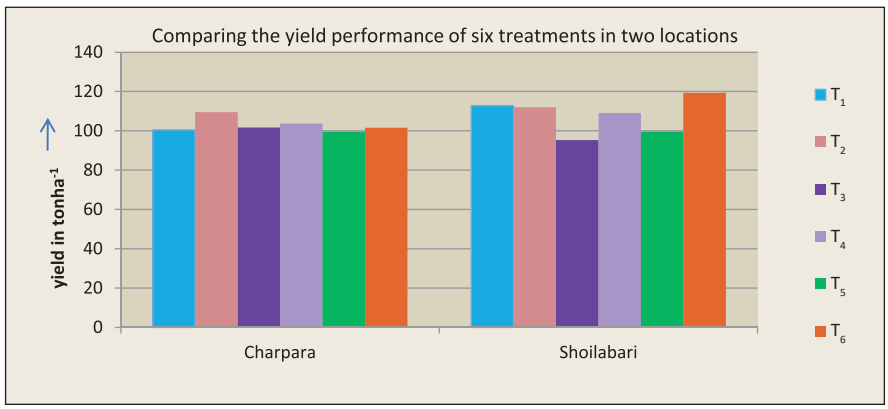
From Table 5, it was observed that, the highest number tiller was from Isd 38 (Control) (128.7 $\times 10^3$ ha^{-1}) and the lowest from Isd 38 + black cumin (122.87 $\times 10^3$ ha^{-1}). The highest number of millable cane was found in Isd 38 + potato (104.54$\times 10^3$ ha^{-1}) and the lowest was in Isd 38 + Black cumin (77.03$\times 10^3$ ha^{-1}). The top most cane height was found in Isd 38 + Potato (3.0542 meter) and the lowest was in Isd 38 (Control) (2.97 meter). For brix %, the Isd 38 + Onion (20.11 %) gave the top value and the lowest from Isd 38 + Lentil (18.15 %). In case of yield, the highest yield was 119.32 ton ha^{-1} produced from Isd 38 (Control) and the lowest yield was found in Isd 38 + Black cumin (95.27 ton ha^{-1}).

Table 6. Cane yield, intercrop yield and adjusted cane yield of different treatmens (Location: Shoilabari)

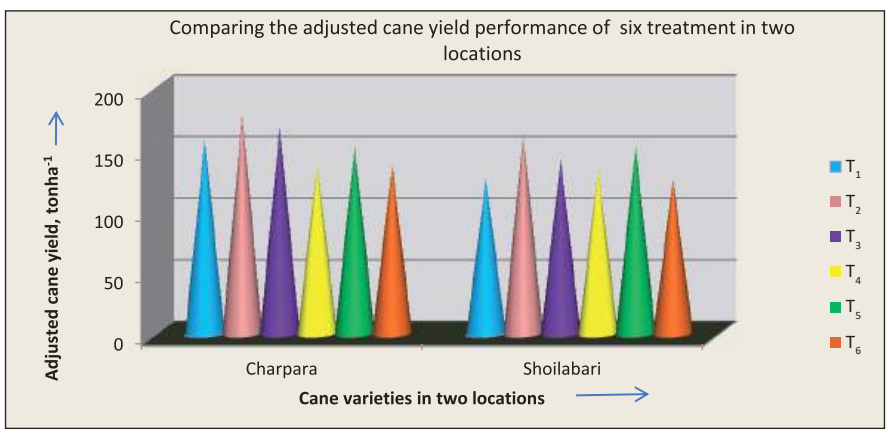
Treatments	Cane yield (tha^{-1})	Yield of intercrop (tha^{-1})	Adjusted Cane Yield (tha^{-1})
T_1 = Isd 38 + Potato	112.89	6.34	135.94
T_2 = Isd 38 + Onion	111.98	4.5	144.70
T_3 = Isd 38 + Black cumin	95.27	0.15	100.72
T_4 = Isd 38 + Linseed	109.1	0.17	116.82
T_5 = Isd 38 + Lentil	99.62	0.46	107.98
T_6 = Isd 38 (Control)	119.32	-	119.32

Lentil/kg = 100/- , Potato/kg = 20/- , Onion/kg = 40/- , Linseed/kg = 250/- , Black cumin/kg = 200/-
Unit price of sugarcane /Kg= 5.5/- (Per ton= 5,500/-)

The result shows from table 6 that, In case of adjusted cane yield, the highest yield was produced from the treatment Isd 38 + Onion (144.70 ton ha^{-1}) and the lowest yield was found in Isd 38 + Black cumin (100.72 ton ha^{-1}).



According to above figure, it is observed that the range of cane yield is from 95.27 ton ha^{-1} to 119.32 ton ha^{-1}. At a glance, it is appeared that, Charpara location has slightly poor yield than Shoilabari location and the apex yield was found from Isd 38 (Control) (119.32 ton ha^{-1}) in Shoilabari and Isd 38 + Onion (109.57 ton ha^{-1}) in Charpara.



Here from the above chart, the top most adjusted cane yield value (171.39 ton ha^{-1}) was found from T_2 (Isd 38 + Onion) and the lowest found from Isd 38 (Control) in Charpara. In Shoilabari, the apex adjusted cane yield value 144.70 tha^{-1} from T_2 (Isd 38 + Onion) treatment and the lowest found from T_3 (Isd 38 + Black cumin) treatment. The overall adjusted cane yield performance is satisfactory. However, in both locations, T_2 (Isd 38 + Onion) is the best.

PRODUCTIVITY OF SUGARCANE WITH SOME WINTER VEGETABLES AS FIRST INTERCROP AND MUNG BEAN AS SECOND INTERCROP WITH SINGLE & PAIRED ROW PLANTING SYSTEM UNDER AEZ 4

The experiment was conducted at Sirajganj under BSRI sub-station, Sirajganj to find out productivity of sugarcane, winter vegetable as intercrop with single and paired row planting system during the cropping season 2023-2024. This experiment was laid out in a randomized complete block design with three replications. Isd 37 + Potato, Isd 37 + Onion, Isd 37 + Cauliflower, Isd 37 + Cabbage, Isd 37 + Carrot and Isd 37 (control) were planted in single as wel as souble row planting system. The unit plot size was 8m x 6m. Two budded setts were used in this experiment. Application of fertilizers for sugarcane was done as per schedule. Intercultural operation was done as and when required. Data on different growth parameters were collected and analyzed statistically.

Table 7. Productivity of sugarcane with some winter vegetables as first intercrop with single row and double row planting system (Location: Gupirpara)

Single row planting system (R_1)					Double row planting system (R_2)				
Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Cane yield (tha^{-1})	Brix %	Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Cane yield (tha^{-1})	Brix %
T_1R_1 = Isd 37 +Cauliflower	213.87 b	104.81 b	114.91 b	18.57 b	T_1R_2 = Isd 37 + Cauliflower	224 ab	98.965 a	115.13 a	19.423 a
T_2R_1= Isd 37 + Cabbage	212.6 b	96.4 c	102.51 d	18.24 b	T_2R_2= Isd 37 + Cabbage	228.6 a	97.17 ab	104.91 b	19.253 a
T_3R_1= Isd 37 + Potato	194.13 c	108.78 a	119.66 a	18.28 b	T_3R_2= Isd 37 + Potato	222.4 b	96.412 b	99.94 c	18.513 a
T_4R_1 = Isd 37 + Onion	218.87 ab	104.32 b	119.61 a	18.26 b	T_4R_2 = Isd 37 + Onion	226.4 ab	96.289 b	112.01 a	18.973 a
T_5R_1= Isd 37 + Carrot	222.87 a	97.29 c	106.05 c	18.45 b	T_5R_2= Isd 37 + Carrot	222.87 b	95.803 b	106.01 b	18.863 a
T_6R_1 = Isd 37 (Control)	225.87 a	98.19 c	108.00 c	19.21 a	T_6R_2 = Isd 37 (Control)	224.77 ab	95.885 b	105.76 b	18.607 a
LSD (0.05)	7.58	2.88	2.90	0.48	LSD (0.05)	4.71	2.40	4.31	0.97

From Table 7, it was observed that, In Single row planting the highest number tiller was from T_6R_1 = Isd 37 (Control) and the lowest from T_3R_1= Isd 37 + Potato. The highest number of millable cane was found in T_3R_1= Isd 37 + Potato and the lowest from T_2R_1= Isd 37 + Cabbage. For brix %, the T_6R_1 = Isd 37 (Control) gave the top value and the lowest from T_2R_1= Isd 37 + Cabbage. In case of yield, the highest yield was produced from the variety T_3R_1= Isd 37 + Potato and the lowest yield was found in T_2R_1= Isd 37 + Cabbage.

It was observed that, In Double row planting the highest number tiller was from T_2R_2= Isd 37 + Cabbage and the lowest from T_3R_2= Isd 37 + Potato. The highest number of millable cane was found in T_1R_2 = Isd 37 + Cauliflower and the lowest from T_5R_2= Isd 37 + Carrot. For brix %, the T_1R_2 = Isd 37 + Cauliflower gave the top value and the lowest from T_3R_2= Isd 37 + Potato. In case of yield, the highest yield was produced from the variety T_1R_2 = Isd 37 + Cauliflower and the lowest yield was found in T_3R_2= Isd 37 + Potato.

Table 8. Productivity of sugarcane with some winter vegetables as first intercrop with single row and double row planting system (Location: Gupirpara)

Single row planting system (R_1)				Double row planting system (R_2)			
Treatments	Cane yield (tha^{-1})	Yield of Intercrops (tha^{-1})	Adjusted cane yield (tha^{-1})	Treatments	Cane yield (tha^{-1})	Yield of Intercrops (tha^{-1})	Adjusted cane yield (tha^{-1})
T_1R_1 = Isd 37 + Cauliflower	114.91	21.50	173.55	T_1R_2 = Isd 37 + Cauliflower	115.13	20.50	171.04
T_2R_1= Isd 37 + Cabbage	102.51	23.25	153.23	T_2R_2= Isd 37 + Cabbage	104.91	23.45	156.07
T_3R_1= Isd 37 + Potato	119.66	18.52	187.00	T_3R_2= Isd 37 + Potato	99.94	17.52	163.65
T_4R_1 = Isd 37 + Onion	119.61	10.10	193.06	T_4R_2 = Isd 37 + Onion	112.01	9.51	181.17
T_5R_1= Isd 37 + Carrot	106.05	19.70	159.77	T_5R_2= Isd 37 + Carrot	106.01	20.59	162.16
T_6R_1 = Isd 37 (Control)	108.00	-	108.00	T_6R_2 = Isd 37 (Control)	105.76	-	105.76

Carrot/kg = 15/- , Potato/kg = 20/- , Onion/kg = 40/- , Cabbage/kg = 12/- , Cauliflower/kg = 15/-
Unit price of sugarcane/Kg= 5.5/- (Per ton= 5,500/-)

Here from the above chart (Table 8), the top most adjusted cane yield value (193.06 ton ha^{-1}) was found from T_4R_1 = Isd 37 + Onion and the lowest found from T_6R_1 = Isd 37 (Control) in single row planting system. The top most adjusted cane yield value 181.17 tha^{-1} from T_4R_2 = Isd 37 + Onion and the lowest found from T_6R_2 = Isd 37 (Control). The overall adjusted cane yield performance is satisfactory.

Table 9. Productivity of sugarcane with some winter vegetables as first intercrop with single row and double row planting system (Location: Dholdob)

Single row planting system (R_1)					Double row planting system (R_2)				
Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Cane yield (tha^{-1})	Brix %	Treatments	Tiller ($x10^3$ ha^{-1})	Millable cane ($x10^3$ ha^{-1})	Cane yield (tha^{-1})	Brix %
T_1R_1= Isd 37 + Cauliflower	216.47 cd	105.47 a	115.32 b	19.5 a	T_1R_2= Isd 37 + Cauliflower	220.83 bc	99.45 a	111.05 a	19.13 a
T_2R_1= Isd 37 + Cabbage	215.73 cd	97.39 c	103.55 d	19.75 a	T_2R_2= Isd 37 +Cabbage	222.55 bc	97.63 b	104.16 ab	19.17 a
T_3R_1= Isd 37 + Potato	212.93 d	102.97 b	118.75 ab	19.65 a	T_3R_2= Isd 37 + Potato	219.04 c	96.13 c	103.17 b	19.39 a
T_4R_1 = Isd 37 + Onion	219 bc	104.32 ab	119.6 a	19.5 a	T_4R_2= Isd 37 + Onion	223.33 b	95.77 c	110.13 ab	19.55 a
T_5R_1= Isd 37 + Carrot	222.6 ab	98.22 c	107.06 cd	20.01 a	T_5R_2= Isd 37 + Carrot	227.73 a	96.74 bc	105.45 ab	19.10 a
T_6R_1 = Isd 37 (Control)	226 a	98.47 c	108.32 c	20.13 a	T_6R_2= Isd 37 (Control)	228.6 a	95.48 c	104.06 ab	19.50 a
LSD (0.05)	5.06	2.88	3.52	1.23	LSD (0.05)	3.98	1.39	7.56	1.42

From Table 9, it was observed that, In Single row planting the highest number tiller was from T_6R_1 = Isd 37 (Control) and the lowest from T_3R_1= Isd 37 + Potato. The highest number of millable cane was found in T_1R_1 = Isd 37 + Cauliflower and the lowest from T_2R_1= Isd 37 + Cabbage. For brix %, the T_6R_1 = Isd 37 (Control) gave the top value and the lowest from T_1R_1 = Isd 37 + Cauliflower and T_4R_1 = Isd 37 + Onion. In case of yield, the highest yield was produced from the variety T_4R_1 = Isd 37 + Onion and the lowest yield was found in T_2R_1= Isd 37 + Cabbage.

It was observed that, In Double row planting the highest number tiller was from T_6R_2 = Isd 37 (Control) and the lowest from T_3R_2= Isd 37 + Potato. The highest number of millable cane was found in T_1R_2 = Isd 37 + Cauliflower and the lowest from T_6R_2 = Isd 37 (Control). For brix %, the T_4R_2 = Isd 37 + Onion gave the top value and the lowest from T_5R_2= Isd 37 + Carrot. In case of yield, the highest yield was produced from the variety T_1R_2 = Isd 37 + Cauliflower and the lowest yield was found in T_3R_2= Isd 37 + Potato.

Table 10. Productivity of sugarcane with some winter vegetables as first intercrop with single row and double row planting system (Location: Dholdob)

Single row planting system (R_1)				Double row planting system (R_2)			
Treatments	Cane yield (tha^{-1})	Yield of Intercrops (tha^{-1})	Adjusted cane yield (tha^{-1})	Treatments	Cane yield (tha^{-1})	Yield of Intercrops (tha^{-1})	Adjusted cane yield (tha^{-1})
T_1R_1 = Isd 37 + Cauliflower	115.32	14	153.50	T_1R_2 = Isd 37 + Cauliflower	111.05	13	146.50
T_2R_1= Isd 37 + Cabbage	103.55	18	142.82	T_2R_2= Isd 37 + Cabbage	104.16	17	141.25
T_3R_1= Isd 37 + Potato	118.75	10	155.11	T_3R_2= Isd 37 + Potato	103.17	10.5	141.35
T_4R_1 = Isd 37 + Onion	119.6	9	185.05	T_4R_2 = Isd 37 + Onion	110.13	9.2	177.04
T_5R_1= Isd 37 + Carrot	107.06	6.5	124.79	T_5R_2= Isd 37 + Carrot	105.45	6.57	123.37
T_6R_1 = Isd 37 (Control)	108.32	-	108.32	T_6R_2 = Isd 37 (Control)	104.06	-	104.06

Carrot/kg = 15/- , Potato/kg = 20/- , Onion/kg = 40/- , Cabbage/kg = 12/- , Cauliflower/kg = 15/-
Unit price of sugarcane/Kg= 5.5/- (Per ton= 5,500/-)

Here from the above chart (Table 10), the top most adjusted cane yield value (185.05 ton ha^{-1}) was found from T_4R_1 = Isd 37 + Onion and the lowest found from T_6R_1 = Isd 37 (Control) in single row planting system. The top most adjusted cane yield value 177.04 tha^{-1} from T_4R_2 = Isd 37 + Onion and the lowest found from T_6R_2 = Isd 37 (Control). The overall adjusted cane yield performance is satisfactory.

BSRI SUB-STATION, GAIBANDHA

RESEARCH HIGHLIGHTS

- Balck Ruby produced maximum yields of 45.81 tha^{-1} at Bogura, 150.99 tha^{-1} at Rangpur and the BCR value was also highest (4.06 at Bogura, 4.10 at Rangpur) in both locations. Considering yield and BCR, the highest performance and benefitted genotype was Black ruby followed by Q-69, BSRI Akh 47 & BSRI Akh 42.
- In the study of milling sugarcane varieties, BSRI Akh 48 performed better for millable cane, yield and brix (%) followed by lsd 37 and BSRI Akh 46.

EVALUATION OF CHEWING SUGARCANE GENOTYPES AT TISTA MEANDER FLOODPLAIN SOILS IN BANGLADESH

The experiment was conducted at sadar, Bogura and sadar, Rangpur under BSRI sub-station, Gaibandha to find out the superior chewing sugarcane genotypes under Tista Meander Floodplain soils during the cropping season 2023-2024. This experiment was laid out in a randomized complete block design with three replications. The treatments were as T_1: BSRI Akh 41, T_2: BSRI Akh 42, T_3: BSRI AKh 47, T_4: Q-69, T_5: Modhumala, T_6: Black Ruby and T_7: Shung (Local). The unit plot size was 8m x 6m. Two budded setts were used in this experiment. Application of fertilizers for cane cultivation was done as per schedule. Intercultural operation was done as and when required. Data on different growth parameters were collected and analyzed statistically. In both locations, tiller number ($269.52x10^3$ ha^{-1} and $274.64x10^3$ ha^{-1}) and number of chewable cane ($118.60x10^3$ ha^{-1} and $117.00x10^3$ ha^{-1}) was highest in Shung (local). As plant crop, Balck Ruby produced maximum yields of 145.81 tha^{-1} at Bogura, 150.99 tha^{-1} at Rangpur and the BCR value was also highest (4.06 and 4.10 respectively at Bogura and Rangpur). In both locations, highest performed and benefitted chewing sugarcane genotype was Black ruby followed by Q-69, BSRI Akh 47 & BSRI Akh 42.

Table 1. Yield and yield contributing characters of chewing sugarcane genotypes at Bogura

Treatments	Tillers ($x10^3$ ha^{-1})	Chewablecane ($x10^3$ ha^{-1})	Stalk height (m)	Diameter (cm)	Yield (tha^{-1})	Brix (%)
T_1: BSRI Akh 41	179.52 b	84.59 c	2.73 bc	2.59 a	137.78 ab	17.09 b
T_2: BSRI AKh 42	129.72 d	71.97 e	2.52 d	2.67 a	126.17 bc	17.69 ab
T_3: BSRI AKh 47	131.37 d	73.29 e	2.54 d	2.69 a	127.67 bc	17.70 ab
T_4: Q-69	182.73 b	106.53 b	2.76 b	2.15 b	121.38 c	18.62 a
T_5: Modhumala	129.75 b	75.35 de	2.73 bc	2.67 a	138.67 ab	17.57 ab
T_6: Black Ruby	156.00 c	82.31 cd	2.65 c	2.79 a	145.81 a	16.73 b
T_7: Shung (Local)	269.52 a	118.60 a	2.91 a	2.05 b	93.07 d	16.66 b
LSD (0.05)	13.85	7.73	0.11	0.27	13.15	1.19

Table 2. Production cost, gross return, net return and benefit cost ratio (BCR) of Chewing Sugarcane genotypes at Bogura

Treatments	Cost of production (Tk.ha^{-1})	Gross return (Tk.ha^{-1})	Net return (Tk.ha^{-1})	BCR
T_1: BSRI Akh 41	320000	845900	525900	2.64
T_2: BSRI AKh 42	335000	935610	600610	2.79
T_3: BSRI AKh 47	335000	952770	617770	2.84
T_4: Q-69	280500	8,52240	571740	3.04
T_5: Modhumala	345000	678150	333150	1.97
T_6: Black Ruby	365000	1481580	1116580	4.06
T_7: Shung (Local)	270000	593000	323000	2.20

Chewing cane price per stalk: (at Bogura)
BSRI Akh 41 : 10 tk.
BSRI Akh 42 : 13 tk.
BSRI Akh 47 : 13 tk.
Q 69 : 08 tk.
Modhumala : 9 tk.
Black Ruby : 18 tk.
Shung : 05 tk.

Table 3. Yield and yield contributing characters of chewing sugarcane genotypes of chewing sugarcane at Rangpur

Treatments	Tillers (x10^3 ha^{-1})	Chewablecane (x10^3 ha^{-1})	Stalk height (m)	Diameter (cm)	Yield (tha^{-1})	Brix (%)
T_1: BSRI Akh 41	169.92 c	81.38 c	2.78 ab	2.49 c	130.5 bc	17.23
T_2: BSRI AKh 42	137.62 d	80.11 c	2.64 b	2.71 ab	131.11 bc	17.85
T_3: BSRI AKh 47	136.37 d	82.65 c	2.61 b	2.73 ab	133.33 b	17.52
T_4: Q-69	187.47 b	97.66 b	2.77 ab	2.22 d	116.94 c	17.27
T_5: Modhumala	137.75 d	69.47 d	2.72 ab	2.63 bc	134.08 b	17.65
T_6: Black Ruby	164.29 c	85.51 c	2.69 ab	2.85 a	150.99 a	17.05
T_7: Shung (Local)	274.64 a	117.00 a	2.81 a	2.03 e	98.42 d	16.26
LSD (0.05)	12.77	8.93	0.17	0.16	15.23	NS

Table 4. Production cost, gross return, net return and benefit cost ratio (BCR) of Chewing Sugarcane genotypes at Rangpur

Treatments	Cost of production (Tk.ha^{-1})	Gross return (Tk.ha^{-1})	Net return (Tk.ha^{-1})	BCR
T_1: BSRI Akh 41	320500	813800	493300	2.54
T_2: BSRI AKh 42	346000	961320	615320	2.78
T_3: BSRI AKh 47	348000	1157100	809100	3.33
T_4: Q-69	265500	781280	515780	2.94
T_5: Modhumala	346500	625230	278730	1.80
T_6: Black Ruby	375500	1539180	1163680	4.10
T_7: Shung (Local)	265000	585000	320000	2.21

Chewing cane price per stalk: (at Rangpur)
BSRI Akh 41 : 10 tk.
BSRI Akh 42 : 12 tk.
BSRI Akh 47 : 14 tk.
Q-69 : 08 tk.
Modhumala : 9 tk.
Black Ruby : 18 tk.
Shung : 05 tk.

PERFORMANCE OF NEWLY RELEASED MILLING SUGARCANE VARIETIES AT ACTIVE TISTA FLOODPLAIN SOILS IN BANGLADESH

The experiment was conducted at shibganj, Bogura under BSRI sub-station, Gaibandha under Active Tista Floodplain soils during the cropping season 2023-2024. This experiment was laid out in a randomized complete block design with three replications. The treatments were as T_1: Isd 34, T_2: Isd 37, T_3: BSRI Akh 43, T_4: BSRI Akh 44, T_5: BSRI Akh 45, T_6: BSRI Akh 46 and T_7: BSRI Akh 48. The unit plot size was 8m x 6m. Two budded setts were used in this experiment. Application of fertilizers for sugarcane was done as per schedule. Intercultural operation was done as and when required. Data on different growth parameters were collected, analyzed statistically and shown in table 5. The highest number of tiller (182.06x10^3 ha^{-1}) was found in BSRI Akh 48 and lowest (155.84 x10^3 ha^{-1}) was obtained from Isd 34. The highest number of millable cane (118.71x10^3 ha^{-1}) was found from BSRI Akh 46 and lowest was in BSRI Akh 44. The highest cane yield (105.32 tha^{-1}) was obtained from BSRI Akh 48 which was statistically similar with BSRI Akh 46 (98.12 tha^{-1}) and lowest cane yield (75.62 tha^{-1}) was found in BSRI Akh 44 which was statistically similar with BSRI Akh 43 (77.12 tha^{-1}). The highest brix (%) of 21.26 was observed in BSRI Akh 48 which was statistically different from others. Among the tested varieties, the best performance was observed in the variety BSRI Akh 48. Isd 37 and BSRI Akh 46 were statistically similar with BSRI Akh 48 in active tista floodplain soils.

Table 5. Performance of newly released milling sugarcane varieties at AEZ 2

Treatments	Tillers (x10^3 ha^{-1})	Millable cane (x10^3 ha^{-1})	Stalk height (m)	Plant height (m)	Diameter (cm)	Yield (tha^{-1})	Brix (%)
Isd 34	155.84 e	109.49 abc	3.19 bc	4.38 de	2.08 de	85.78 c	20.13 e
Isd 37	170.39 c	116.27 a	3.25 ab	4.34 e	2.21 bc	92.86 bc	21.01 b
BSRI Akh 43	149.91 f	97.58 bc	3.12 cd	4.56 c	2.13 cd	77.12 d	19.87 f
BSRI Akh 44	145.91 g	95.18 c	3.05 d	4.42 d	2.16 cd	75.62 d	20.24 b
BSRI Akh 45	165.53 d	111.09 ab	3.14 c	4.86 b	2.03 e	88.49 c	21.03 d
BSRI Akh 46	176.48 b	118.71 a	3.28 a	4.45 d	2.26 ab	98.12 ab	20.56 c
BSRI Akh 48	182.06 a	114.12 a	3.15 c	4.95 a	2.34 a	105.32 a	21.26 a
LSD (0.05)	3.65	14.93	0.09	0.07	0.10	7.65	0.06

BSRI SUB-STATION, CHUNARUGHAT

RESEARCH HIGHLIGHTS

- Tomato-based intercropping systems (T_2 and T_4) consistently enhanced cane growth and productivity, with T_2 showing the highest cane yield and adjusted cane yield, while T_4 produced the maximum intercrop yield across both locations.
- Chili-based systems (T_3 and T_5) performed comparatively lower, particularly in millable cane, intercrop yield, and adjusted cane yield, indicating that tomato is a more suitable component for sequential intercropping with sugarcane in the wider row system.

PERFORMANCE OF WINTER VEGETABLES AS INTERCROPS WITH SUGARCANE IN WIDER ROW SYSTEM

A trail was conducted in two locations (Ladia and Chaganagar, Chunarughat) in wider row system of sugarcane with intercrops to select suitable intercrops for sequential intercropping in wider row system and to evaluate the potentiality of intercropping on growth yield and quality of sugarcane. Tasted first intercrops were Tomato and Chili associated with Mungbean and Yard long bean as second intercrop into the cropping season 2023-2024. The present study was consisting of the following treatment.

T_1 = Wide rrow cane (WRC) only
T_2 = WRC+Tomato-Mungbean
T_3 = WRC+Chili-Yard long bean
T_4 = WRC+Tomato- Yard long bean
T_5 = WRC+Chilli-Mungbean

This experiment was laid out in a randomized complete block design with three replications. The tested sugarcane variety was BSRI Akh 48. The unit plot size was 8m × 6m. Two budded setts were used in this experiment. The distances between two rows of sugarcane were 0.60 meter, sett to sett distance were 0.45 meter then 1.2 meter used as intercropping. The results obtained are shown in Table 1a and 1b.

Table 1a. No. of tiller, millable cane, brix (%), cane yield, intercrop yield and adjusted cane yield performance in paired row system (location: Ladia, Chunarughat)

Treatment	No. of tillers ($\times 10^3$ ha^{-1})	No. of millable cane ($\times 10^3$ ha^{-1})	Brix (%)	Yield (tha^{-1})	Yield of intercrops (tha^{-1})		Adjusted cane yield (tha^{-1})
					1st	2nd	
T_1=WRC cane only	95.5 a	82.2 ab	20 a	101.6 abc	-	-	101.6 e
T_2=WRC +Tomato-Mungbean	107.6 a	91.4 a	18.9 b	120 a	13.8 b	0.45 a	175.4 a
T_3=WRC+Chili –Yard long bean	79.6 a	67.1 b	18.1 b	86.3 cd	11.20 c	0.41 a	160.2 b
T_4=WRC+Tomato-Yard long bean	101.1a	77.1 b	21.4 a	91.1 bcd	15.61 a	0.37 a	118.5 d
T_5=WRC+Chilli-Mungbean	96.7 a	61.3 b	19.1 b	95.1 d	9.5 d	0.39 a	127.6 c
LSD (0.05)	NS	21.93	2.06	23.24	1.25	NS	30.1

Figures followed by the same letter (s) are not significantly different at 5% level as per LSD test

Table 1b. No. of tiller, millable cane, brix (%), cane yield, intercrop yield and adjusted cane yield performance in paired row system (location: Chaganagar, Chunarughat)

Treatment	No. of tillers ($\times 10^3$ ha^{-1})	No.of millable cane ($\times 10^3$ha^{-1})	Brix (%)	Cane Yield (tha^{-1})	Yield of intercrops (tha^{-1})		Adjusted yield (tha^{-1})
					1st	2nd	
T_1=WRC cane only	98.2 a	84.6 ab	20.3 a	104.3 abc	-	-	104.3 e
T_2=WRC+Tomato-Mungbean	110.7 a	93.8 a	19.0 b	127.5 a	14.5 b	0.46 a	170.8 a
T_3=WRC+Chili –Yard long bean	82.1 a	63.3 a	18.2 b	89.7 ab	12.8 c	0.25 b	164.4 b
T_4=WRC+Tomato-Yard long bean	119.2 a	79.1 b	21.6 a	94.5 bcd	16.2 a	0.48 a	122.6 d
T_5=WRC+Chilli-Mungbean	97.6 b	63.7 b	19.3 b	96.8 d	10.1 d	0.32 b	131.5 c
LSD (0.05)	NS	22.7	2.08	19.49	1.40	0.29	16.58

Figures followed by the same letter (s) are not significantly different at 5% level as per LSD test

From the Table 1a and 1b it was revealed that number of tillers do not show significant results in Ladia location though the highest tiller was obtained the treatment T_2 (107.6 × 10^3 ha^{-1}) whereas Chaganagar location, no. of tiller showed significant results. Maximum number of tillers was obtained from the treatment T_4 (WRC+ Tomato + Yard long bean) followed by the treatment T_2 (WRC + Tomato - Mungbean). The lowest number was obtained from the treatment T_3 (WRC+ Chili-Yard long bean). Number of millable cane, Yield, intercrop yield, adjusted cane yield also showed difference significantly whereas maximum number of millable cane, Cane Yield, adjusted cane yield were 91.4×10^3 ha^{-1},120. tha^{-1}, 175.4 tha^{-1} and 93.8 × 10^3 ha^{-1}, 127.5 tha^{-1},170.8 tha^{-1} in Ladia and Chaganagar respectfully. In case of intercrop, the highest yield of 1st intercrop 15.6 tha^{-1} was obtained from the treatment T_4 followed by the treatment T_2, while the lowest was from the treatment T_5 in Chaganagar region. In case of Ladia region, the highest yield of 1st intercrop 14.6 tha^{-1} was obtained from the treatment T_4 followed by the treatment T_2 while the lowest was from the treatment T_5; The yield of 2nd intercrop showed significant differs in Chaganagar region whereas the highest yield of 2nd intercrop 0.48 tha^{-1} was obtained from the treatment T_4 followed by the treatment T_2 while the lowest was from the treatment T_5.

ANNUAL RESEARCH PROGRAMME
(2024-2025)

BREEDING DIVISION

1.0 : Hybridization for high sugar, high yield, Stress tolerant, short duration, and self-detrash varieties of sugarcane
2.0 : Evaluation of sugarcane clone Modhumala as location specific *gur* variety
3.0 : Collection, characterization, and conservation of indigenous and exotic germplasm of sugar crops
4.0 : Genetic enhancement of sugarcane (*Saccharum* sp. Hybrids) for resistance to red rot disease
5.0 : Preservation of sugarcane pollen and evaluation of pollen viability for cross synchronization
6.0 : Varietal improvement of sugarcane through induced mutation
7.0 : Photoperiodic regulation of flowering in sugarcane
8.0 : Investigating the flowering behavior and breeding potential of sugarcane germplasm
9.0 : Evaluation of promising sugarcane clones under different yield trials at varying agro-climatic conditions
10.0 : Breeder seed multiplication of promising clones/varieties of sugarcane
11.0 : Characterization of stevia germplasm
12.0 : Improvement of date palm using artificial pollination
13.0 : Characterization and documentation of local and exotic date palm
14.0 : Selection of palmyra palm germplasm based on juice yield and quality

BIOTECHNOLOGY DIVISION

1.0 : Characterization and documentation of sugar crops using molecular markers
2.0 : Genetic enhancement of sugarcane containing desirable characters through tissue culture techniques
3.0 : Genetic transformation of desirable genes in sugarcane
4.0 : Micropropagation for multiplication of sugar crops
5.0 : Development of somaclones of stevia through tissue culture techniques and subsequent molecular diversity analysis
6.0 : CRISPR/CAS9 based genome editing for improvement of stevia

PHYSIOLOGY & SUGAR CHEMISTRY DIVISION

1.0 : Screening of sugarcane genotypes under ZYT-I, II & III against stress condition (a. Water logging, b. Flood, c. Drought and d. Salinity)
2.0 : Germination potentiality of advanced sugarcane clones under low temperature stress condition
3.0 : Determination of stevioside at different growth stage of stevia
4.0 : Screening sugarcane clones based on maturity behavior and *gur* quality
5.0 : Studies on preservation techniques of sugarcane juice
6.0 : Optimization study of storage time on liquid palmyra palm *gur* to develop *Tal misri*

AGRONOMY & FARMING SYSTEMS DIVISION

1.0 : Performance of BSRI developed advanced sugarcane clones at different planting dates
2.0 : Location based sequential intercropping with sugarcane
3.0 : Optimizing pit diameter and number of setts per pit for profitable sugarcane production
4.0 : Evaluation of new herbicides for weed management in sugarcane
5.0 : Effect of spacing and fertilizer levels on growth and productivity of stevia
6.0 : Effects of gibberellic acid on growth and quality of sugarbeet

SOILS & NUTRITION DIVISION

1.0 : Nutrient requirement for sustainable sugar crops production under different AEZs
1.1 Nutrient requirement for sustainable sugarcrop production under different AEZs
1.2 Effect of integrated nutrient management on growth, biomass yield, quality and nutrient content of stevia (*stevia rebaudiana* ber.)
2.0 : Nutrient management of sugarcane for different spacing
3.0 : IPNS based nutrient management for cultivation of sugarcane with intercrops
4.0 : Effect of vermicompost on nutrient uptake, growth and yield of sugarcane in saline soil
5.0 : Effect of fertilizer management on growth, yield and quality of chewing cane Black ruby

ON-FARM RESEARCH DIVISION

1.0 : On-Farm trial of promising sugarcane clones at farmers' field of different AEZs
2.0 : Performance of popular sugarcane varieties in char land ecosystem
3.0 : Adaptive trial of chewing cane in different region of Bangladesh
4.0 : On-Farm trial of maize as intercrop with sugarcane in different planting times
5.0 : Effect of boron on yield, quality and cracking of chewing cane in different region of Bangladesh

AGRICULTURAL ENGINEERING DIVISION

1.0 : Development and performance evaluation of a real cut sugarcane planter
2.0 : Design and development of a jaggery dryer
3.0 : Conservation agriculture approach for sustainable sugarcane farming in Bangladesh
4.0 : Developing an IoT-based irrigation system and residue management practices for sustainable sugarcane farming
5.0 : Field performance test of BSRI developed agricultural engineering technologies

ENTOMOLOGY DIVISION

1.0 : Screening of selected sugarcane clones In ZYT I, II & III for resistance against major insect pests in the field
2.0 : Field evaluation of *Trichogramma chilonis* for biological control of sugarcane stem borer
3.0 : Evaluation of new molecules for management of major insect pests of sugarcane
4.0 : Efficacy of green insecticides against the incidence of sugarcane mealy bug

5.0 : Effects of different insecticides on incidence of scale insect (*Melanaspis glomerata* green), yield and quality of sugarcane
6.0 : Isolation, screening and characterization of entomopathogenic fungi from agricultural soils of Bangladesh
7.0 : Effects of nutritional supplements to improve the health of honey bee colony (*Apis mellifera*)
8.0 : Morphological characterization and diversity analysis of honeybee
9.0 : Development of IoT based early detection system of red palm weevil infestation on date palm in Bangladesh

PATHOLOGY DIVISION

1.0 : Screening of sugarcane genotypes under commercial varieties, ZYT-III, ZYT-II, ZYT-I, AYT, PYT and advanced clones to red rot
2.0 : Screening of sugarcane genotypes under commercial varieties, ZYT-III, ZYT-II and ZYT-I against wilt disease
3.0 : Screening of sugarcane genotypes under commercial varieties, ZYT-III, ZYT-II, ZYT-I and AYT against smut disease
4.0 : Performance of different sett treating chemicals in controlling sett rot disease of sugarcane
5.0 : Management of red rot of sugarcane through chemical and biological means
6.0 : Management of *Orobanche* in sugarcane cultivation
7.0 : Identification and documentation of date palm and stevia diseases in Bangladesh
8.0 : Production, quality control and distribution of disease free clean seed of sugarcane

TRAINING & TECHNOLOGY TRANSFER DIVISION

1.0 : Adoption of modern BSRI technologies in selected sugar mills and non-mill zones
2.0 : Effects of subsidy program on sugarcane production
3.0 : Modern technologies of sugarcrop production for SACDO of BSFIC
4.0 : Modern technologies of sugarcrop production for sub assistant agriculture officers (SAAO) of DAE
5.0 : Improved sugarcrop production technologies for Farmers, Gachi, Entrepreneur of Bangladesh

AGRICULTURAL ECONOMICS DIVISION

1.0 : Forecasting sugarcane production in Bangladesh through ARIMA model
2.0 : Impact of BSRI-modified Bee hive technology on honey productivity and income of beekeepers of Bangladesh
3.0 : Evaluating the determinants of farmers' perception in sugarcane cultivation: A case study on mill zone

RSRS,THAKURGAON

1. 0 : Performance of BSRI bred latest sugarcane varieties grown in Old Himalayan Piedmont Plain
2. 0 : Ratooning potentiality of BSRI bred latest sugarcane varieties in Old Himalayan Piedmont Plain
3. 0 : Effects of pruning on vegetative traits and biomass production of stevia

QUARANTINE STATION, GAZIPUR

1.0 : Quarantine follow-up of imported germplasms
2.0 : Quarantine follow-up of local germplasms

RSRS, GAZIPUR

1.0 : Comprehensive assessment of multi spectral, thermal and vegetation indices for drought monitoring in sugarcane using UAV imagery
2.0 : Evaluation of sugarcane growth and yield parameters through multi spectral, thermal and vegetation indices from UAVS in waterlogged condition
3.0 : Effect of sugarcane bagasse biochar on soil health and sugarcane production
4.0 : Yield performance of Arabian date palm at Gazipur
5.0 : Estimation of water requirement for optimal growth and yield of stevia
6.0 : Influence of various growing media on growth and yield of *Stevia rebaudiana*

RSRS, SUBARNACHAR, NOAKHALI

1.0 : Performance of winter vegetable as intercrops with sugarcane in single row system in AEZ 18
2.0 : Performance of chewing varieties with intercrops under young Meghna estuarine floodplain (AEZ 18)
3.0 : Selection of sugarcane varieties suitable for *gur* production under Subarnachar area

BSRI SUB-STATION, JOYPURHAT

1.0 : Effect of three sequential intercropping on growth, yield and profitability of sugarcane cultivation
2.0 : Performance of some BSRI recommended sugarcane varieties as plant crop in Tista Meander Floodplain soil
3.0 : Ratooning Potentiality of Some Popular BSRI Sugarcane Varieties in JSM zone

BSRI SUB-STATION, RAJSHAHI

1.0 : Field performance of some newly released sugarcane varieties and their ratooning potentiality in mill zones
2.0 : performance of BSRI newly released sugarcane varieties in char lands of Rajshahi
3.0 : Performance of different winter crops with single row of chewing cane
4.0 : Selection of suitable genotypes for *gur* production in low land of Chapai Nawabganj district

BSRI SUB-STATION, CHUADANGA

1.0 : Exploring the suitability of BSRI Akh 41 as sugar producing variety in Carew & Company (Bangladesh) Ltd. Sugar mill area
2.0 : Efficacy of different insecticides against sugarcane rootstock borer (*Emmalocera depressella*) in Carew & Company (Bangladesh) Ltd. Sugar mill area

BSRI SUB-STATION, JAMALPUR

1.0 : Effect of intercropping on enhancing sugarcane productivity and soil fertility
2.0 : Effect of vermicompost on sugarcane yield and carbon accumulation in soils
3.0 : Evaluation of yield and yield attributes of sugarcane varieties under waterlogged condition

BSRI SUB-STATION, RAHMATPUR, BARISHAL

1.0 : Selection of sugarcane varieties suitable for *gur* production in saline belt under Southern Region
2.0 : Performance of chewing varieties in saline belt under Southern Region
3.0 : Collection and Conservation of Nipa palm Germplasms
4.0 : Sugarcane based integrated farming in SORJAN system under Southern Region
5.0 : Management of saline soil in sugarcane field by biochar and chemical fertilizer

BSRI SUB-STATION, SIRAJGANJ

1.0 : Production of sugarcane with different intercrops for increasing the livelihood of char land people in Sirajganj
2.0 : Selection of sugarcane varieties suitable for *gur* production in AEZ 4

BSRI SUB-STATION, CHUNARUGHAT

1.1 : Performance of winter crop as intercrops on sugarcane cultivation in wider row system
2.0 : Performance of newly released sugarcane varieties suitable for *gur* production in Akhaura Terrace soil

BSRI SUB-STATION, GAIBANDHA

1.0 : Evaluation of chewing sugarcane genotypes at Tista Meander floodplain soils in Bangladesh
2.0 : Evaluation of BSRI bred sugarcane varieties under water-logging condition at active Tista floodplain soils in Bangladesh
3.0 : Performance of newly released milling sugarcane varieties at active Tista floodplain soils in Bangladesh

BSRI SUB-STATION, BANDARBAN

1.0 : Selection of suitable sugarcane varieties for *gur* production under Bandarban Hill tracts of Bangladesh

Ph.D. degree completion in 2023-2024

01. Dr. Mst. Ismat Ara, PSO; Biology and Sustainable Management of Sugarbeet Caterpillar *Spodoptera Litura* (Fabricius). BAU, 2023.

02. Dr. Nilufar Islam, PSO; Genotypic Variation on Yield and Juice Quality of Chewing Sugarcane as Affected By Mustard Oil Cake and Postharvest Approaches. GAU, 2023.

03. Dr. Md. Nuray Alam Siddiquee, PSO; Eco-friendly Management of Sugarcane Stem Borer with the Egg Parasitoid *Trichogramma Chilonis*. BAU, 2023.

04. Dr. Ratan Kumar Ganapati, SSO; QTL Mapping and Favorable Allele Mining of Saline and Alkaline Tolerance at Seedling Stage in Rice. Chinese Academy of Agricultural Science, 2023.

05. Dr. Hasan Mohammad Tarique, PSO; Isolation and Molecular Characterization of Entomopathogenic Fungi from Bangladesh and Their Efficacy against Bean Aphid. BAU, 2024.

Scientific Publication (2023-2024)

Azim, M.A.; Mahmud K.; Islam N.; Islam T.; Rahman M.; Emran M.A. and Bhuiyan, S.A. 2024. History and Current Status of Sugarcane Breeding, Germplasm Development and Molecular Approaches in Bangladesh. *Sugar Tech*, 1-11.

Islam, N.; Ghose A.K.; Azim M.A.; Rajib R.R. and Mahmud K., Biotechnological Advancement of Different Sugarcrops in Bangladesh Sugarcrop Research Institute. Annual Plant Tissue Culture & Biotechnology Conference 2023. BCSIR, Rajshahi.

Islam, N.; Ghose A.K.; Azim M.A.; Rajib R.R. and Mahmud K., Biotechnological Approaches Applied in Bangladesh Sugarcrop Research Institute for the Development of Different Sugarcrops. International Conference on Climate Smart Agriculture & the 4AR-2023, Agrotechnology Dscipline, Khulna University,19-20 October 2023.

EXECUTIVE HEADS SINCE 1974

Sl. No.	Name with designation	Working period
1.	**Dr. M Motlubur Rahman** M. Ag. (D.U); Ph.D. (Phillippines) Director	January 25, 1974 to March 30, 1978
2.	**Dr. Hamizudding Ahmed** M. Ag. (D.U); Ph.D. (Phillippines) Director (In-charge)	March 30, 1978 to August 27, 1978
3.	**Dr. M. Shahjahan** M. Ag. (D.U); MS, Ph.D. (USA) Director	August 28, 1978 to July 28, 1984
4.	**Dr. M. A. Karim** M. Ag. (D.U); Ph.D. (Phillippines) Director (In-charge)	July 28, 1984 to December 1, 1984
5.	**Mr. Md. Yasin Ali** M. Ag. (D.U); MS (Hawaii, USA) Director	December 2, 1984 to January 31, 1993
6.	**Dr. Sk. Md. Erfan Ali** M. Sc. (Ag.); Ph.D. (USA) Director	January 30, 1993 to March 31, 1997
7.	**Dr. Sk. Md. Erfan Ali** M. Sc. (Ag.); Ph.D. (USA) Director General (In-charge)	April 1, 1997 to May 11, 1998
8.	**Mr. A. H. M. Delwar Hossain** M. Sc. (Ag.); (BAU); M. Sc. (UK) Director General (In-charge)	May 10, 1998 to January 1, 2002
9.	**Dr. Sk. Md. Erfan Ali** M. Sc. (Ag.); Ph.D. (USA) Director General (In-charge)	January 2, 2002 to July 4, 2002
10.	**Dr. A B M Mafizur Rahman** M. Sc. (Ag.); (BAU); Ph.D. (USA) Director General	July 4, 2002 to March 15, 2005
11.	**Mr. ATM Saleh Uddin Choudhury** M. Sc. (Ag.) Director General	March 15, 2005 to December 28, 2005
12.	**Dr. Md. Abdul Mannan** M. Sc. (Ag.); Ph.D. Director General	January 15, 2006 to April 20, 2009
13.	**Dr. M A Samad Miah** M. Sc. (Ag.), Ph.D. (UK); Post Doc. (USA); PDT (India) Director General	April 19, 2009 to February 28, 2011

14.	**Dr. Gopal Chandra Paul** M. Sc. (Ag.), Ph.D. Director General	February 28, 2011 to November 3, 2011
15.	**Mr. Md. Khairul Bashar** M. Sc. (Ag.) Director General	November 3, 2011 to January 22, 2013
16.	**Dr. Kamal Humayun Kabir** M. Sc. (Ag.), Ph.D. (New Zealand) Director General	January 22, 2013 to October 1, 2014
17.	**Dr. S M Nurun Nahar,** Ph.D. Director General	October 1, 2014 To December 30, 2014
18.	**Dr. M. Khalilur Rahman,** Ph.D. (USSR) Director General	December 29, 2014 To January 31, 2016
19.	**Dr. Md. Amzad Hossain,** Ph.D. (Japan) Director General	January 30, 2016 To February 21, 2016
20.	**Dr. M. Khalilur Rahman,** Ph.D. (USSR) Director General	February 22, 2016 To February 21, 2017
21.	**Dr. Md. Amzad Hossain,** Ph.D. (Japan) Director General	February 28, 2017 To October 30, 2022
22.	**Dr. Md. Omar Ali,** Ph.D. Director General	December 20, 2022 To July 07, 2024
23.	**Dr. Ferdouse Islam,** Ph.D. Director General	July 14, 2024 To September 25, 2024
24.	**Dr. Kabir Uddin Ahmed,** Ph.D. Director General	September 30, 2024 To Continued

PERSONNEL

DIRECTOR GENERAL OFFICE	DESIGNATION
Kabir Uddin Ahmed, Ph.D.	Director General
Mst. Ismat Ara, Ph.D. (Entomology)	Principal Scientific Officer
Md. Faysal Mahamud, MSS in Mass Communication & Journalism	Public Relation Officer
Md. Shariful Islam, M.Com. in Accounting	Assistant Coordinating Officer (Add. Charge)

DIRECTOR (RESEARCH) OFFICE	
Md. Ataur Rahman, Ph.D. (Entomology)	Director (Research)

DIRECTOR (TRANSFER OF TECHNOLOGY) OFFICE	
Shalina Akhter, Ph.D. (Entomology)	Director (Transfer of Technology)
Md. Abu Taher Sohel, Ph.D. (Agronomy)	Principal Scientific Officer

BREEDING DIVISION	
Md. Anisur Rahman, Ph.D. (Biochemistry and Molecular Biology)	Principal Scientific Officer & Head
Md. Mahbubur Rahman, Ph.D. (Genetics & Plant Breeding)	Principal Scientific Officer
Md. Rahimul Alam, Ph.D. (Genetics)	Principal Scientific Officer
K M Rezaul Karim, Ph.D. (Genetics & Breeding)	Principal Scientific Officer
Hasan Mohammad Tarique, Ph.D. (Mycoinsecticides Development)	Principal Scientific Officer
Md. Mostake Ahmed, MS in Genetics & Plant Breeding	Senior Scientific Officer
Naznin Akter Munna, MS in Genetics & Plant Breeding	Scientific Officer
Md. Marju Alam, MS in Horticulture	Scientific Officer
Mst. Ishrat Zahan, MS in Genetics & Plant Breeding	Scientific Officer
Shamima Nasrin Asha, MS in Genetics & Plant Breeding	Scientific Officer

BIOTECHNOLOGY DIVISION	
Nadira Islam, Ph.D. (Biotechnology)	Principal Scientific Officer & Head
Asish Kumar Ghose, Ph.D. (Biotechnology)	Senior Scientific Officer
Md. Abdul Azim, MS in Biotechnology	Scientific Officer
Md. Rashedur Rahman Rajib, MS in Biotechnology	Scientific Officer

PHYSIOLOGY & SUGAR CHEMISTRY DIVISION	
Md. Shamsul Arefin, Ph.D. (Agril. Chemistry)	Principal Scientific Officer & Head
Md. Shariful Islam, Ph.D. (Crop Botany)	Senior Scientific Officer
Faria Hossain Santa, MS in Food Technology	Senior Scientific Officer
Md. Ahshan Habib, MS in Agril. Botany	Scientific Officer

AGRONOMY & FARMING SYSTEMS DIVISION

A K M Rashadul Islam, Ph.D. (Agronomy)	Principal Scientific Officer & Head
Md. Ashraful Alam, Ph.D. (Soil Science)	Senior Scientific Officer
Himadri Prosad Roy, MS in Agronomy	Senior Scientific Officer
Md. Al Emran Hossain, MS in Agronomy	Scientific Officer
Tasfiqure Amin Apon, MS in Agronomy	Scientific Officer

SOILS & NUTRITION DIVISION

Md. Aminul Haque, Ph.D. (Soil Science)	Principal Scientific Officer & Head
Khandakar Mohiul Alam, Ph.D. (Soil Science)	Principal Scientific Officer
Md.Hasibur Rahman, MS in Soil Science	Principal Scientific Officer
Saiful Islam, MS in Agronomy	Senior Scientific Officer
Md. Abu Sayeed, MS in Entomology	Scientific Officer

ON-FARM RESEARCH DIVISION

Md. Munir Hossain, Ph.D. (Agronomy)	Principal Scientific Officer & Head
Md. Rashedul Islam, MS in Agril. Extn. Edu.	Senior Scientific Officer
Md. Rabiul Islam, MS in Agronomy	Scientific Officer
Shishir Rasul, MS in Agronomy	Scientific Officer

AGRICULTURAL ENGINEERING DIVISION

Md. Anisur Rahman, Ph.D. (Bio-Energy)	Principal Scientific Officer & Head
Sayed Shams Tabriz, Ph.D. (Conservation Agriculture)	Principal Scientific Officer
Md. Sanowar Hossen, B.Sc (Agril. Engg.), MS (FPM)	Senior Scientific Officer
Md. Mahabub Alam, (Dip. In Agril.)	Demonstrator

ENTOMOLOGY DIVISION

Md. Noor Alam, Ph.D. (Genetics & Plant Breeding)	Principal Scientific Officer & Head
Md. Nuray Alam Siddiquee, Ph.D. (Entomology)	Principal Scientific Officer
Md. Shafiqul Islam, Ph.D. (Entomology)	Senior Scientific Officer
Md. Elmur Reza, MS in Entomology	Senior Scientific Officer
Naznin Sultana, MS in Biotechnology	Scientific Officer

PATHOLOGY DIVISION

Md. Anisur Rahman, Ph.D. (Biotechnology)	Principal Scientific Officer & Head
Md.Imam Hossain, Ph.D. (Plant Pathology)	Senior Scientific Officer
Sharmin Sultana, MS in Horticulture	Scientific Officer
Md. Rabiul Islam, MS in plant pathology	Scientific Officer

TRAINING & TECHNOLOGY TRANSFER DIVISION

Md. Shariful Islam, Ph.D. (Crop Botany)	Senior Scientific Officer & Head
S M Rezaul Karim, MS in Agril. Extn. Edu.	Senior Scientific Officer
Quazi Srasthatya Prottasha, Masters of Fine Arts	Artist-Cum-Illustrator
Md. Asadujjaman Rasel, MS in Agronomy	Scientific Officer
Nusrat Jahan Upoma, M.S in Agril. Extension	Scientific Officer

AGRICULTURAL ECONOMICS DIVISION

Kuasha Mahmud, Ph.D. (Biotechnology)	Principal Scientific Officer & Head
Md. Kamruzzaman, Ph.D. (Agril. Economics)	Senior Scientific Officer

PLANNING & DEVELOPMENT DIVISION

K M Rezaul Karim, Ph.D. (Genetics & Breeding)	Principal Scientific Officer & Head
Md. Saium Hossain, MS in Agronomy	Senior Scientific Officer
Raiyan Meem Saiem, MS in Environmental Science	Scientific Officer
Lazia Rahman, MS in Horticulture	Scientific Officer

FARM DIVISION

Hasan Mohammad Tarique, Ph.D. (Mycoinsecticides Development)	Principal Scientific Officer & In-charge
Sanjit Mandal, MS in Entomology	Scientific Officer

ADMINISTRATION DIVISION

Md. Nuray Alam Siddiquee, Ph.D. (Entomology)	Principal Scientific Officer & Head
Md. Shafi Al Mamun, MS in (Entomology)	Senior Administrative Officer
Md. Aynul Hoque, M.S.S (Information Science & Library Management)	Librarian
Md. Tarikul Islam, BSS	Assistant Administrative Officer
Mst. Rowshan Ara Khatun, BA	Administrative Officer

ACCOUNTS DIVISION

Mohammad Abdullah Al Baki, M.Com.	Deputy Chief Accountant & Head
Md. Alamgir Kabir, B.Com.	Assistant Accounts Officer
Md. Zahurul Islam, M.Com. (Accounting)	Additional Accounts Officer

AUDIT CELL

Md. Ohiduzzaman Khan, M.S.S.	Deputy Director (Audit & Accounts) & Head

LIBRARY & PUBLICATION SECTION

Abu Zahid Md. Rajiul Ansary, M.S.S.	Publication Officer & Head

CONSTRUCTION SECTION

Md. Asadul Haque, B.Sc. (Civil Eng.)	Civil Engineer & Head

WORKSHOP SECTION

Sanjit Mandal, MS (Entomology)	Scientific Officer & Head (Add. Charge)

ICT CELL

Md. Munir Hossain, Ph.D. (Agronomy)	Principal Scientific Officer & Head

ELECTRIC CELL

Md. Rabiul Islam, Diploma in Electrical Engineer	Sub-Assistant Engineer (Elect.) & Head

PROCUREMENT SECTION

Md. Aynul Hoque, M.S.S (Information Science & Library Management)	Librarian & In-charge
Khandoker Kawsarul Haque, BA	Administrative Officer

GENERAL STORE SECTION

Jesmin Jahan, B.Ag. Ed.	Store Officer

MEDICAL SECTION

SECURITY SECTION

Md. Abdul Jabber, Diploma in Agriculture	Scientific Asst. & In-charge

SCHOOL SECTION

Md. Hasanuzzaman, M.Com. (Accounting), B.Ed.	Asst. Head Master & In- charge (Head Master)

RSRS, THAKURGAON

Md. Sohrab Hossain, Ph.D. (Agronomy)	Senior Scientific Officer & Station In-charge
Md. Mamunur Rashid, MS in Agronomy	Scientific Officer
Noushin Chowdhury, MS in Genetics and Plant Breeding	Scientific Officer
Md. Abu Sayem, (I. Com)	Asst. Accounts Officer
Md. Anoarul Haque, Diploma in Agriculture	Junior Officer
Md. Habibur Rahman, Diploma in Agriculture	Asst. Experimental Officer

RSRS, GAZIPUR & QUARANTINE STATION

Nilufar Islam, Ph.D.(Agronomy)	Principal Scientific Officer & Station In-charge
Atiya Sharmin Mitu, MS in Soil Science	Senior Scientific Officer
Md. Arif Hossain Saddam, MS in Horticulture	Scientific Officer
Farhana Haque, MS in Library & Information Science	Assistant Librarian

RSRS, SUBARNACHAR, NOAKHALI

Ranjit Chandra Kabiraj, Ph.D. (Soil Science)	Principal Scientific Officer & Station In-charge

SUB-STATION, RAJSHAHI

Mst. Kohinoor Begum, Ph.D. (Stress Physiology)	Principal Scientific Officer & Station In-charge
H. M. Al-Amin, MS in Agronomy	Senior Scientific Officer
Md. Serajul Islam, Diploma in Agriculture	Demonstrator

SUB-STATION, JOYPURHAT

Md. Shahidul Islam, MS in Soil Science	Senior Scientific Officer
Md. Mainul Hasan, MS in Crop Physiology & Ecology	Scientific Officer & Station In-charge

SUB-STATION, CHUADANGA

Tofael Ahmed, Ph.D. (Entomology), Post.Doc.	Principal Scientific Officer & Station In-charge
Md. Omar Khaiyam, MS in Plant Pathology	Senior Scientific Officer

SUB-STATION, JAMALPUR

A M Sajedur Rahman, MS in Crop Botany	Senior Scientific Officer
Tanjina Alam, MS in Crop Botany	Scientific Officer & Station In-charge

SUB-STATION, RAHMATPUR

Ratan Kumar Ganapati, Ph.D. (Crop Genetics & Breeding)	Senior Scientific Officer & Station In-charge
Md. Niaz Morshed, MS in Environmental Science	Senior Scientific Officer

SUB-STATION, SIRAJGANJ

Md. Ashfikar Rahman Doel, MS in Biotechnology	Scientific Officer & Station In-charge

SUB-STATION, CHUNARUGHAT

Ashim Chkraborty, MS in Environmental Science	Scientific Officer & Station In-charge

SUB-STATION, GAIBANDHA

Zahid Hasan Sabuj, MS in Genetics & Plant Breeding	Scientific Officer & Station In-charge

SUB-STATION, BANDARBAN

Md. Obydullah Sheikh, MS in Entomology	Scientific Officer & Station In-charge

PUBLICATIONS

01. আখের সাথে ১ম সাথীফসল বাঁধাকপি এবং ২য় সাথীফসল মুগডাল চাষ
02. আখের সাথে ১ম সাথীফসল মাসকালাই এবং ২য় সাথীফসল মুগডাল চাষ
03. আখের সাথে ১ম সাথীফসল খেসারি এবং ২য় সাথীফসল মুগডাল চাষ
04. গবেষণা সম্প্রসারণ কর্মশালা কার্যবিবরণী ২০২৪
05. Annual Research Programme 2024-2025
06. Annual Report 2023-2024

website: www.bsri.gov.bd