Annual Research Programme

2024-2025

Bangladesh Sugarcrop Research Institute

Ishwardi, Pabna

Annual Research Programme
2024-2025

Bangladesh Sugarcrop Research Institute
Ishwardi, Pabna

Compilation and Editing :
Dr. Kuasha Mahmud
Dr. Tofael Ahmed

Ornamented by : A Z M Rajiul Ansary

Cover Design : Quazi Srasthatya Prottasha

Publication No. : 306

May, 2025
Bangladesh Sugarcrop Research Institute
Ishwardi, Pabna

FOREWORD

Its a great pleasure and pride to present the Annual Research Programme 2024–2025 of the Bangladesh Sugarcrop Research Institute (BSRI). We are delighted to have successfully compiled and published this significant document, which holds critical importance not only for agricultural science but also for sustainable economic development, environmental conservation, and the goal of ensuring safe and sufficient sugar availability for consumers. This aligns with BSRI's vision and mission, contributing meaningfully to the agricultural sector and ultimately enhancing the Gross National Product (GNP) and Gross Domestic Product (GDP) of Bangladesh. As the only pioneering institution dedicated exclusively to sugarcrop research within the National Agricultural Research System (NARS) of Bangladesh, BSRI continues to play a pivotal role in addressing the country's long-standing sugar crisis. This is particularly vital in the context of decreasing arable land and a rapidly growing population. We remain committed to adopting forward-thinking strategies to strengthen our research efforts through innovation-developing modern, stress-tolerant sugarcrop varieties; advocating for hydroxide-and chemical-free sugar and gur production; and promoting eco-friendly, bio-organic solutions to combat plant diseases and pests.Our outreach initiatives ensure the effective dissemination of cutting-edge technologies to farmers, reinforcing our national vision of building a sustainable, secure and self-sufficient sugar industry. This research programme is thoughtfully designed based on the needs identified during the Research Extension Workshop 2024, aligning with national development priorities and current industry trends. The programme development process included collaboration with farmers, sugar mills, NGOs, SMEs, and other key stakeholders. Research priorities were identified through rigorous discussions across BSRI divisions and validated through the collective efforts of internal and external experts.The final structure of this programme is the outcome of three key workshops: the Research Extension Workshop, the Internal Research Review Workshop, and the External Research Review Workshop. We extend our gratitude to all scientists and expert reviewers from various universities and research institutes whose comments and suggestions greatly enriched this document. We are proud to work collaboratively with government bodies, universities, private sector partners, and farming communities to ensure that our research outcomes reach those who need them the most. Looking ahead, BSRI remains steadfast in its mission to accelerate agricultural innovation and development, promote sustainable best practices and contribute to the resilient and efficient production of quality sugar in Bangladesh. We draw inspiration from the dedication, creativity and perseverance of our scientific teams. Their commitment to excellence is the foundation of our continued progress. We invite readers to engage with this research programme, explore our findings, and join us in our efforts to foster a more productive, resilient and sustainable future for sugarcrop cultivation and production.

Finally, I extend my sincere appreciation to all scientists, officers and staff whose wholehearted cooperation made this publication possible. Special thanks go to our funding agency, the Ministry of Agriculture (MoA) and all stakeholders for their continued support. I also acknowledge those involved in the compilation and editing of this document. Together, let us continue to transform knowledge into impactful solutions and build a sustainable safe food production from sugarcrop.

May, 2025

Dr. Kabir Uddin Ahmed
Director General

CONTENTS

BREEDING DIVISION

Rationale

Sugarcane is a highly heterozygous and complex polyploid crop, making it challenging to predict its lifespan. The availability of limited number of germplasms significantly impacts the varietal development program, highlighting the need for effective collection and conservation efforts. The sugar industry is currently in a critical phase, facing numerous unavoidable challenges. As sugarcane cultivation shifts to marginal lands with problematic soils, it encounters various adverse conditions. Thus, continuous efforts are essential to develop superior sugarcane varieties that offer higher yields of cane, sugar and gur, while also exhibiting tolerance to drought, salinity, flooding, and waterlogging. The scarcity of flowering germplasm and the non-synchronization of flowering cycles present major obstacles to hybridization. This situation necessitates the implementation of pollen preservation techniques and photoperiodic treatments to enhance flowering. In addition to sugar and gur, the rising demand for chewing cane is increasingly important. Concurrently, breeder seed production for released varieties and the multiplication of nucleus seeds for promising clones are critical needs. Moreover, the varietal improvement of other sugar crops, such as date palm, palmyra palm and stevia, is also essential and requires significant attention. Comprehensive efforts in germplasm collection, characterization and utilization in the hybridization programs of these allied sugar crops are crucial for future advancements.

LIST OF EXPERIMENTS

PROGRAMME IN DETAILS

PROGRAMME AREA : VARIETAL IMPROVEMENT
1. 0 TITLE : HYBRIDIZATION FOR HIGH SUGAR, HIGH YIELD, STRESS TOLERANT, SHORT DURATION AND SELF DETRASH VARIETIES OF SUGARCANE
LOCATION : BSRI, Ishwardi, Pabna
INVESTIGATORS : M R Alam, M M Rahman, K M R Karim, H M Tarique, M M Ahmed, N A Munna and M A Rahman
NATURE OF STUDY : On-going
DURATION : 2014-
ESTIMATED COST(Tk) : 2,10,300/-

1.1 DEFINITION OF THE PROBLEM:

In crops, variety development is a continuous process. Hybridization followed by clonal selection is the principal procedure to develop sugarcane variety. Sugarcane variety with high cane and sugar producing ability is the prime demand of sugarcane variety. Considering this issue, crossing is made among targeted parents to produce large number of F_1 population. Subsequently better, progenies are selected for further evaluation.

1.2 OBJECTIVES:

1. Developing improved varieties of sugarcane in relation to higher cane (>100 t/ha) and sugar (pol% cane> 13) yield;
2. Selecting short duration (10 months) and lodging tolerant varietiy of sugarcane;
3. Selecting stress tolerant variety of sugarcane;
4. Selecting self-detrashing variety of sugarcane and
5. Selecting chewing variety of sugarcane.

1.3 METHODOLOGY:

After pollen viability test targeted flowering varieties/clones will be selected to set cross. The male parents will be removed two weeks after crossing. Hybrid seeds will be harvested, weighed and stored in deep-freeze. Later on, test sowing of the hybrid seeds will be performed in the glass-house in the month of July-August. On the basis of test sowing result, viable seeds will be sown cross wise. The seedlings attaining a height of 2"-3" will be transplanted in cell-u-pak tray in the seedling nursery bed for a height of 9"-12". Then each of them will be transplanted in the field in furrow at 50cm distance. At maturity, segregating population will be selected on the basis of different characteristics such as number of millable cane, height, thickness, crack, aerial root, solidness, leaf colour, disease and pest infestations. Then the selected clones will be planted in first line trial i. e. 1m × 4m test stage against one standard variety. Next year, selection will be made considering the same characteristics including field brix%. Only the good appearing clones showing equal or better field brix compare with the check variety will be selected for advancement. The selected clones will be planted in the second line trial at 4m × 4m test stage against one/two check variety. In the next year, the clones will be evaluated based on mentioned characteristics including juice analysis and estimated cane yield. The clones showing good chewing qualities will also be selected from this stage. Only the clones showing equal or better performance in comparison to the check variety will be selected for next trial.

TREATMENT : Based on synchronization of flowering, different crosses will be made with different targets considering the following parents.

A. High yield potential parents:

1. Isd 16	11. Co 642	21. I 507-85	31. I 103-96	41. I 163-01
2. Isd 28	12. Co 1148	22. I 19-86	32. I 108-96	42. I 12-02
3. Isd 32	13. CP 44-101	23. I 144-86	33. I 131-96	43. I 50-02
4. Isd 38	14. CP 69-1052	24. I 322-86	34. I 33-97	44. I 223-06
5. Isd 39	15. CP 85-1432	25. I 291-87	35. I 64-98	45. I 157-07
6. Isd 40	16. CPI 38-80	26. I 294-87	36. I 59-98	46. I 164-07
7. BSRI Akh 43	17. CPI 96-80	27. I 273-91	37. I 98-98	47. I 167-07
8. BSRI Akh 45	18. POJ 2878	28. I 216-92	38. I 36-00	48. I 290-08
9. BC_2	19. I 101-66	29. I 157-94	39. I 107-01	49. I 295-08
10. BC_5	20. I 33-78	30. I 14-96	40. I 108-01	50. I 73-09

B. High sucrose content parents:

1. BC_5	11. I 156-97	21. I 44-01	31. SC 5b
2. Co 635	12. I 162-97	22. I 68-01	32. SC 6b
3. Cp82-1172	13. I 98-98	23. I 77-01	33. NSM (TC)
4. CPI 38-80	14. I 486-99	24. I 95-01	34. I 21-05
5. I 134-70	15. I 21-00	25. I 140-01	35. I 23-05
6. I 144-86	16. I 36-00	26. I 55-02	36. I 74-05
7. I 1-97	17. I 92-00	27. I 64-02	37. Isd 40
8. I 33-97	18. I 133-00	28. I 98-02	38. BSRI Akh 43
9. I 128-97	19. I 17-01	29. I 100-02	39. BSRI Akh 45
10. Isd 38	20. I 23-01	30. I 193-02	40. BSRI Akh 48

C. Salinity tolerant parents:

1. Isd 24	7. BSRI Akh 43	13. I 121-09	19. I 26-02
2. Isd 28	8. BSRI Akh 45	14. I 144-86	20. Khailajhuri
3. Isd 32	9. BSRI Akh 46	15. I 204-08	
4. Isd 38	10. CPI 228-80	16. I 71-07	
5. Isd 39	11. Poj 2878	17. I 72-04	
6. Isd 40	12. I 108-08	18. I 433-99	

D. Drought tolerant parents:

1. I 137-96	11. I 446-99	21. I 57-78	31. I 142-01	40. Isd 36
2. I 255-06	12. I 48-07	22. Sc 4b	32. I 146-08	41. Isd 37
3. I 74-05	13. I 99-09	23. I 220-92	33. FR 97-45	42. Isd 38
4. BC5	14. Cp 5268	24. I 282-08	34. Co1158-T3	43. Isd 39
5. SC1g	15. SC11d	25. I 72-04	35. I 200-07	44. Isd 40
6. I 204-01	16. I 107-04	26. Co 642	36. Isd 20	45. BSRI Akh 45
7. SC8g	17. Cp 75-361	27. I 51-0 6	37. Isd 28	
8. IC2e	18. Sc 2d	28. I 322-86	38. Isd30	
9. I 91-79	19. I 293-08	29. I 21-05	39. Isd 32	
10. I 72-00	20. I 290-08	30. I 95-01	40 Isd 35	

E. Early maturing parents:

1. Isd 16	7. Isd 33	13. Sc 8d	19. I 61-07
2. Isd 21	8. Isd 35	14. I 136-00	20. I 140-01
3. Isd 22	9. Isd 39	15. 17-01	21. I 77-01
4. Isd 24	10. Isd 40	16. CP 50-70 TC	22. I 41-96
5. Isd 27	11. BSRI Akh 43	17. 82-1089 T1,T2,T6	
6. Isd 30	12. BSRI Akh 45	18. Isd 16 (4) TC	

F. Self-detrashing parents

1. CP 44-101	6. Co 642	11. IC 4d	16. SC 13d	21. I 145-09
2. I 162-04	7. CP 52-68	12. I 163-01	17. I 59-98	22. I 233-05
3. I 142-01	8. I 216-92	13. I 523-85	18. I 48-05	23. Isd 19
4. I 33-99	9. I 117-98	14. I 32-97	19. I 90-09	24. I 295-08
5. CPI 38-80	10. M 05-188	15. I 21-00	20. I 235-09	25. I 33-07

DESIGN: Augmented

DATA TO BE RECORDED:

1. Germination count (%)
2. No. of tillers/ha
3. No. of millable cane/ha
4. Cane height (m) and diameter (cm)
5. Field brix (%)
6. Pol% cane
7. Recoverable sucrose content (%)
8. Flowering record
9. Pollen viability (%)
10. Estimated cane yield (t/ha)

1.4 WORK ELEMENTS:

1. Flowering record
2. Determination of pollen fertility (%)
3. Parent selection
4. Cross setting
5. Fuzz collection
6. Recording seed weight (gm)
7. Seed storing
8. Seed sowing
9. Raising of seedling in nursery bed
10. Seedling transplanting in the field
11. Crosswise mortality count of seedling in the field
12. Evaluation and selection in original seedling
13. Plantation of clones in different test stages and yield trials
14. Recording of germination and tillering
15. Recording of pest and disease incidence
16. Evaluation of clones for different agronomical characters and sucrose content
17. Estimated yield data collection

1.5 TIME SCHEDULE:

Sl. No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	→	→	→													
2		→	→	→												
3		→	→	→												
4			→	→	→											
5				→	→	→										
6					→	→	→									
7					→	→	→	→	→	→	→					
8											→	→				
9													→	→	→	
10																→
11						→	→									
12				→	→											
13														→	→	
14							→	→	→	→						
15							→	→	→	→	→	→	→			
16			→	→	→	→	→	→	→							
17														→	→	

1.6 ECONOMIC IMPACT : Selected clones will help to develop varieties with higher cane, sugar and gur production.

1.7 EFFECT ON ENVIRONMENT : Friendly to environment.

1.8 UTILIZATION OF RESEARCH RESULTS : Selected clones will be planted in next stages for further screening for variety development.

2.0 TITLE : EVALUATION OF SUGARCANE CLONE *MODHUMALA* AS LOCATION SPECIFIC GUR VARIETIY

LOCATIONS : BSRI, Ishwardi, Chapai Nawabganj, Chunarughat, Shubornochor, Gazipur, Kurigram and Barishal

INVESTIGATORS : M R Alam, K M R Karim, M M Rahman, R K Ganopoti and M A Rahman

NATURE OF STUDY : On-going

DURATION : 2016-

ESTIMATED COST(TK) : Tk.1,88,000/-

2.1 DEFINITION OF THE PROBLEM:

Sugarcane is one of the economically important foods cum cash crop in Bangladesh. There is a good demand of juice as well as gur variety in the country. However, there is no location specific gur variety for the gur producing zones. At present, there are few local varieties cultivating in the gur zones. Thus, it is important to recommend the variety suitable for gur producing in that particular area.

2.2 OBJECTIVES:

1. To evaluate *Modhumala* clone for releasing as a variety with high recovery and quality gur characters.

2.3 METHODOLOGY:

Three sugarcane varieties/clone will be used as experimental materials. The experiment will be conducted at BSRI, Ishwardi, Chapainawabganj, Chunarughat, Shubornochor, Gazipur, Kurigram and Barishal. The trial will be set in each location separately following RCB design with 3 replications. The clone Modhumala will be planted in 6m X 8m plot using BSRI Akh 41 & BSRI Akh 46 as check. The clone will be evaluated on the basis of gur recovery/juice qualities. Management practices will be followed as and when necessary. If the clone Modhumala showed suitable will be released for commercial cultivation.

TREATMENTS:

1. Modhumala
2. BSRI Akh 41
3. BSRI Akh 46

DATA TO BE RECORDED:

1. Morphological character (colour, growth, erectness, etc.)
2. Cane qualities (softness, gur quality, qur recovery etc.)
3. Number of millable cane (MC)
4. Brix %
5. Sweetness (sugar %)
6. Yield (TCH)

2.4 WORK ELEMENTS:

1. Setting trials with selected materials
2. Detrashing of old leaves
3. Evaluation of the clones in different stages in respect of disease, pests and yield traits.

2.5 TIME SCHEDULE:

Sl. No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1			→	→												
2									→	→	→	→	→			
3											→	→	→	→	→	

2.6 ECONOMIC IMPACT:

Sugarcane cultivation with high quality gur variety will bring economic benefit to the farmers through income generation.

2.7 EFFECT OF ENVIRONMENT:

The investigation is friendly to environment and as such has no adverse impact on environment.

2.8 UTILIZATION OF RESEARCH RESULTS:

The improved gur variety of sugarcane will be used for commercial cultivation at different locations of Bangladesh as per suitability of environment.

3.0 TITLE : **COLLECTION, CHARACTERIZATION AND CONSERVATION OF INDIGENOUS AND EXOTIC GERMPLASM OF SUGAR CROPS**

LOCATIONS : BSRI, Ishwardi, Pabna and QS, Gazipur

INVESTIGATORS : M R Alam, M M Rahman, K M R Karim, H M Tarique, N A Munna, S N Asha and M A Rahman

NATURE OF STUDY : On-going

DURATION : 2001-

ESTIMATED COST (TK) : 1,73,000/-

3.1 DEFINITION OF THE PROBLEM:

Successful plant breeding programme depends on the collection, evaluation, conservation and utilization of germplasm. Therefore, it is needed to collect and conserve exotic and indigenous sugarcrops germplasm regularly.

Different sugar crops germplasm generally resembles each other in their appearance but they are morphologically different. Characterization of germplasm means the description of the materials for determining the magnitude of genetic diversity, variety identification, gap filling, studying the relationship of

species and in the establishment of core collection. It also provides an indication of the value of each germplasm accession and an important basis for gene bank management. It is precondition for taking any crossing programme. Without characterization no breeding programme can be successful. If characterization is done properly, breeders can proceed in right direction, i.e., it helps the breeders to take correct decision in crossing programme. On the other hand, a wrong to characterization leads the breeders in wrong direction. As a result, the whole programme goes in vain. Hence, in short, characterization and documentation is must for a successful breeding programme.

3.2 OBJECTIVES:

1. Collecting, characterizing and evaluating indigenous and exotic germplasm for using as parent ; materials and commercial varieties;
2. Assessing the genetic diversity and
3. Identifying and documenting the accessions.

3.3 METHODOLOGY:

At Quarantine Station, Joydebpur Imported germplasm from abroad are to be evaluated for three generations. In case of sugarcane germplasm after quarantine formalities, the materials are to be brought at BSRI and planted in 1m × 4m plot for further evaluation in the field condition. For local collection, the germplasm will be collected in the month of September-October from different parts of the country. Before collection, the sugar crops growing area of the country will be listed down. Later on, the collected area will be sealed out in the list to avoid the duplication of germplasm. The collected materials will be labeled with local name, location, date of collection, flowering habit, etc. The collected exotic and local germplasm will be planted at Ishwardi to multiply and to evaluate different characteristics. The sugarcane germplasm will be characterized in the month of September-December of next year. After characterization selected new sugarcane germplasm will be planted in a furrow of 3m long with 18 two-eyed setts. Thus, the germplasm will be conserved in the germplasm bank of BSRI. The germplasm showing promising for commercial cultivation will be multiplied for further evaluation and the flowering materials will be planted in breeding nursery to use in hybridization programme. This germplasm will be planted in a furrow of 10m long with 30 three-budded setts. Other sugar crops like date palm, palmyra palm, stevea will be planted in the field following standard distance.

For characterization, selected sugarcane germplasm will be planted in a separate plot during November-December. Characterization of the same will be done in IPGR descriptive manner so that the estimates of all the attributes will reflect the true value of the accessions. Morphological characterization will be based on the physical attributes of a plant. For this purpose, characterization data sheet will be used. The sugarcane germplasm will be characterized at 7-8 months and 10-12 months after planting. Data will be taken from 10 stalks in each accession.

TREATMENT : Not applicable

DATA TO BE RECORDED FOR SUGARCANE:

a) Data to be recorded at 7-8 months after planting:

1. Stool
2. Leaf blade
3. Leaf sheath
4. Auricle
5. Dewlap
6. Ligule
7. Stalk
8. Bud

b) Data to be recorded at 10-12 months after planting:

1. Lodging tendency
2. Stalk length
3. Internode length
4. Internode diameter
5. Solidness
6. Internode cross section
7. Internode cross section colour
8. Brix
9. Inflorescence data
10. Pollen fertility

DATA TO BE RECORDED FOR DATE PALM:

a) Morphology data
b) Flower and fruit data

3.4 WORK ELEMENT:

1. Plantation of collected germplasm
2. Germination count
3. Tiller count
4. Observation on reaction to pests and diseases In case of Sugarcane
5. Data recording after 7-8 months of plantation (e.g. shoot, leaf blade, bud etc.)
6. Determination of Brix (%) and chewing qualities
7. Data recording after 10-12 months of plantation (e.g. lodging tendency, stalk length, internode number etc.
8. Yield data at harvest

3.5 TIME SCHEDULE:

Sl. No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1			→	→												
2					→	→										
3						→	→	→								
4	All over the season															
5												→	→	→		
6														→	→	→
7															→	→
8														→	→	→

3.6 ECONOMIC IMPACT : Diverse parent materials will help for improving variety.

3.7 EFFECT OF ENVIRONMENT : Friendly to the environment.

3.8 UTILIZATION OF RESEARCH RESULTS:

Collected germplasm will be preserved in the germplasm bank of BSRI and flowering ones will be used in the hybridization programme. After a series of evaluations, the promising germplasm may be released as a variety. Characterization of germplasm (morphological characters) will act as a useful guide to overcome many confusions associated with the identification of sugar crops varieties that look very alike in the field. Therefore, the knowledge and the ability of extension workers and plant breeders to recognize variety(s) will be helpful for successful planning and hybridization programme, respectively.

4.0 TITLE : GENETIC ENHANCEMENT OF SUGARCANE (*Saccharum* sp. Hybrids) FOR RESISTANCE TO RED ROT DISEASE
LOCATIONS : BSRI, Ishwardi, Pabna
INVESTIGATORS : M A Rahman, N A Munna, M M Alam and M R Alam
NATURE OF STUDY : On going
DURATION : 2023-
ESTIMATED COST (TK) : 43,300/=

4.1 DEFINITION OF THE PROBLEM:

The genetic variability created through interspecific hybridization and back crossing between Saccharum officinarum and *Saccharum spontaneum* have sustained the sugarcane improvement activities for more than half-a-century (Babu *et al.*, 2009). Further improvement within this population essentially depends on the utilization of variability available for stalk yield and quality traits. Proper exploitation of this variability in a complex polyploid crop like sugarcane is a complicated process. Breeding for higher yield and quality requires basic information on the extent of genetic variation in a population and its response to selection.

Total genetic recombination present in the modern varieties is limited. Because of the small number of clones/species used in primary crosses, genetic base of modern sugarcane varieties has been reported to be narrow and is thought to be the reason for the present slow progress in sugarcane breeding (Arceneaux, 1965 and D'Hont *et al.*, 1995). Thus, the sugarcane breeders must explore new possibilities to increase genetic variability by identifying and effecting crosses between the diverse parents.

Red rot caused by *Colletotrichum falcatum* went. is the most serious disease of sugarcane in Bangladesh. Breeding for red rot resistance has emerged as an important issue of varietal evolution. Crosses will be made using parents from interspecific origins involving diverse forms of *S. officinarum* and *S. spontaneum* that are so far unutilized in the sugarcane breeding programme.

4.2 OBJECTIVES:

1. Developing red rot resistant clones through interspecific hybridization and
2. Selecting progenies resistant to red rot disease.

4.3 METHODOLOGY:

Selected clones of *S. spontaneum* will be used as pollen parent and *S. officinarum* as pistil parent. Clones of *S. spontaneum* such as S12, S14, S38 etc. will be selected as pollen parent and clones of *S. officinarum* such as Col 33, Co 630, US 72-189 etc. as pistil parent. The hybridity of F_1 seedlings will be checked based on morphological characters compared with both parents. F_1 seedlings will be selected based on agronomic character, disease, pest infestation, and brix percent. Next year F_1 seedlings will be backcrossed with *S. officinarum.* All the progenies along with their corresponding parents will be subjected to screening against red rot disease.

DATA TO BE RECORDED:

1. Stalk length
2. Stalk diameter
3. Internode length
4. Number of millable canes
5. Brix percent
6. Red rot reaction
7. Stem borer infestation

4.4 WORK ELEMENT:

1. Determination of pollen fertility
2. Cross setting / back crossing
3. Fuzz collection
4. Fuzz drying and preservation
5. Fuzz sowing
6. Seedling raising in nursery bed
7. Seedling transplanting in the field
8. Clone selection

4.5 TIME SCHEDULE:

Sl.	2024				2025											
No.	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1		→	→	→												
2		→	→	→												
3						→	→	→								
4							→	→	→	→						
5										→	→	→	→			
6													→	→		
7															→	→
8																→

4.6 ECONOMIC IMPACT: Red rot resistant parents will be helpful to develop red rot resistant cane variety.

4.7 EFFECT ON ENVIRONMENT: Friendly to environment

4.8 UTILIZATION OF RESEARCH RESULTS: Selected clones from interspecific hybridization will be planted in next stages for further screening.

5.0 TITLE	**:**	**PRESERVATION OF SUGARCANE POLLEN AND EVALUATION OF POLLEN VIABILITY FOR CROSS SYNCHRONIZATION**
LOCATION	**:**	BSRI, Ishwardi, Pabna
INVESTIGATORS	**:**	N A Munna, M M Rahman, M M Alam, S N Asha and M A Rahman
NATURE OF STUDY	**:**	On going
DURATION	**:**	2022-2025
ESTIMATED COST(Tk)	**:**	32,600/-

5.1 DEFINITION OF THE PROBLEM:

Genetic improvement of sugarcane through bi-parental crosses is being limited due to a lack of flower synchronization between parents. For this reason, floral synchronization is essential while crossing sugarcane. The main methodologies that are being practiced to overcome this problem are: Stepwise planting of accesses, photoperiod control, and application of inducers. However, these operations have shown low efficiency and/or high handling costs. In that case, an alternative method that can help to carry out asynchronous crosses between sugarcane plants with non-coincidental flowering is the conservation of sugarcane pollen. Likewise, there is little information in the literature regarding the survivability of pollen and the length of time pollen remains viable when subjected to low-temperature conservation. Considering this issue, the conservation methodology and feasibility assessment of sugarcane pollen with the objective of making crossroads between asynchronous sugarcane varieties will be performed.

5.2 OBJECTIVES:

1. Viability assessment of stored sugarcane pollen for cross synchronization;
2. Optimizing pollination technique and identifying potential storability of sugarcane pollen and
3. Determining compatibility upon crossing with preserved pollen.

5.3 METHODOLOGY:

Twelve sugarcane clones of three genotypes will be selected, including both wild genotypes like *Saccharum spontaneum* and *Erianthus arundinaceus* and cultivated genotypes *Saccharum officinarum*.

a) Pollen collection

The flowering season is the preferred period for carrying out pollen collection. To collect pollen, the inflorescences will be harvested in the morning, preferably between 7 and 8 am to prevent dehydration from exposure to the sun and high temperatures. For collection of pollen, inflorescences whose anthers will mature 1/3 of the panicle and releasing pollen naturally in air will be chosen. The stems of the inflorescences will be cut with a minimum length of 100 cm, and immediately sent to the laboratory. For favoring anthesis in the central or basal portion of these panicles, they will be kept in nutrient solution for a period of up to 24 hours. Pollen collection will be done immediately after pollen dehiscence. Before storing, the pollen grains will be packed in 100 mL glass stopper flasks, which will be kept open in glass desiccators with 1 kg of silica gel blue at 4°C for 1 h period for dehydration.

b) Storage of pollen:

The collected pollen will be stored in filled glass or plastic bottles having screw cap in a maximum of 1/4 of its volume for greater air circulation. Afterwards, the bottles will be closed and stored at 3°C (37.4°F) and -18°C (O° F) temperature. Finally, samples of pollen grains will be obtained from mature anthers that will be deposited and opened on a histological slide.

c) Viability:

The pollen viability will be analyzed by means of cytological labeling with 2% lugol solution (1 g of iodine, 2 g of potassium iodide and 100 ml of distilled water.

The count of stained and non-stained pollen grains stained allows estimating the percentage of viable pollen through the formula:

$$\text{Pollen viability (\%)} = \frac{\text{Number of stained pollen grains}}{\text{Number of total pollen grains}} \times 100$$

d) Crossing with stored pollen:

Crossing will be carried out with preserved pollen. The bottle containing preserved pollen will be taken out from the freezer and kept in the shade and at room temperature (24°C) for fifteen minutes, to thaw, before pollination of panicles with the respective parents. Pollination will be done with the aid of a brush or or by spraying with a concentration by pouring the pollen into a bag of paper with the panicles. After cross setting the fuzz will be collected and stored for further germination test.

TREATMENTS:

A) Pollen source

1. *Saccharum officinarum*
2. *Saccharum spontaneum*
3. *Erianthus arundinaceus*

B) Preservation tecnique

1. 3°C temperature
2. -20°C temperature
3. Ambient condition at room temperature

C) Pollination technique

1. Dusting
2. Spraying

DESIGN: RCB

DATA TO BE RECORDED:

1. Flowering time
2. Pollen viability (%) at 30 days interval
3. No. of crosses
4. Fuzz produced/cross (gm)

5.4 WORK ELEMENT:

1. Collection of sugarcane pollen
2. Recording pollen collection date
3. Dehydration of pollen in pre-storage
4. Preservation of pollen in different preservation units
5. Recording pollen storage date
6. Assessment of the stored pollen viability
7. Recording pollen viability at 60 days interval
8. Cross setting using viable preserved pollen
9. Recording cross no. /variety
10. Recording the number of crosses/Variety

5.5 TIME SCHEDULE:

Sl. No.	2024					2025						
	A	S	O	N	D	J	F	M	A	M	J	J
1		→	→									
2		→	→									
3		→	→									
4		→	→									
5				→	→							
6				→	→	→	→					
7				→	→	→	→					
8					→	→	→					
9						→	→	→	→			
10						→	→	→	→	→	→	→

5.6 ECONOMIC IMPACT:

Pollen preservation and crossing with preserved pollen will increase the scope of hybridization and thereby will help to develop improved variety of sugarcane.

5.7 EFFECT ON ENVIRONMENT:

Environment will not be affected as the experiment will be conducted in controlled condition.

5.8 UTILIZATION OF RESEARCH RESULTS:

Stored pollen will be utilized in hybridization for improved variety development.

6.0 TITLE : VARIETAL IMPROVEMENT OF SUGARCANE THROUGH INDUCED MUTATION

LOCATION : BSRI, Ishwardi, Pabna

INVESTIGATORS : M A Rahman, M M Rahman, M R Alam, H M Tarique, N A Munna, S N Asha and K M R Karim

NATURE OF STUDY : On-going

DURATION : 2005-

ESTIMATED COST (TK) : 28,300/=

6.1 DEFINITION OF THE PROBLEM:

Radiation is an important tool for producing mutant variety. Many workers reported that it is possible to produce red rot resistant mutant variety of sugarcane by irradiating of setts, callus and fuzz with gamma rays. Jagathesan (1973) conducted yield trial with irradiated material and reported some mutants to have early high sucrose and resistance to red rot. T.S. Khairwal *et al.* (1984) developed red rot resistant mutant by gamma rays and EMS. In Bangladesh, red rot is a serious disease of cane for which many outstanding varieties are being degenerated. Besides, there are some abiotic stress tolerant varieties with low sucrose content. To overcome these problems irradiation may be the alternate breeding approach.

6.2 OBJECTIVES:

1. Developing sugarcane variety having high sucrose content and
2. Developing sugarcane varieties tolerant to red rot and smut diseases.

6.3 METHODOLOGY:

Irradiation and selection of sugarcane mutants in different generations (MV_1, MV_2, MV_3, MV_4 & MV_5).

Development of sugarcane mutant through gamma irradiation

The fuzz of different crosses will be treated with gamma rays at variable (8.77-17.54Gy) doses from Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh. After germination, when the seedlings become strong enough they will be transplanted in the field as MV_1 generation at a distance of 70 cm from one another. Before transplanting, a basal fertilizer dose will be applied and normal cultural practices will be done. Twelve months after planting the good-looking clones will be selected for further evaluation for MV_2 and successive generations.

TREATMENT:

Fuzz of five crosses will be irradiated with different doses of gamma rays (8.77-17.54Gy).

DATA TO BE RECORDED:

1. Naturally red rot resistant mutant (M V_1, MV_2, MV_3 , MV_4 & MV_5 generation)
2. No. of tillers after 150 days
3. Morphological abnormalities, if any
4. Date of flowering
5. Disease symptoms, if any
6. Resistant mutant after inoculation of red rot pathogen
7. Field brix (%)

6.4 WORK ELEMENT:

1. Selection and plantation of mutants
2. Germination count at 90 days
3. Tiller count at 150 days
4. Record of morphological abnormalities
5. Red rot inoculation
6. Recording disease symptoms, if any
7. Flowering record
8. Field brix record and chemical analysis
9. Selection of desirable mutants

6.5 TIME SCHEDULE:

Sl. No.	2024				2025										
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1		→													
2				→											
3							→	→							
4							→	→							
5										→	→				
6												→			
7													→	→	
8														→	→
9														→	→

6.6 ECONOMIC IMPACT:

It is expected to develop a better mutant from each of the irradiated genotypes having high yield and sugar with red rot resistant and non-flowering habit which will improve the economic condition of the farmers as well as of the country.

6.7 EFFECT OF ENVIRONMENT: Friendly to environment.

6.8 UTILIZATION OF RESEARCH RESULTS:

Seed canes of the newly developed variety(s) will be distributed to mills and non-mill zones for commercial cultivation with a view to increasing cane, sugar and gur production.

7.0 TITLE : PHOTOPERIODIC REGULATION OF FLOWERING IN SUGARCANE
LOCATION : BSRI, Ishwardi, Pabna.
INVESTIGATORS : H M Tarique, M M Alam, N A Munna, S N Asha and M A Rahman
NATURE OF STUDY : On-going
DURATION : 1997-
ESTIMATED COST (TK) : 67,300/-

7.1 DEFINITION OF THE PROBLEM:

Flowering is directly related with the hybridization process. At BSRI, about 1159 sugarcane germplasm are being maintained in the germplasm bank of which nearly 75% germplasm do not flower at all. Moreover, among the flowering ones, some are flowering early and some are late. Hence, the induction of flower in non-flowering germplasm and synchronization of the flowering germplasm for successful hybridization programme deserve continuous study.

7.2 OBJECTIVES:

1. Inducing flower at early in mid and late flowering genotypes;
2. Inducing flower at late in early flowering genotypes;
3. Inducing flower in sparse flowering genotypes and
4. Synchronizing the flowering time of different genotypes.

7.3 METHODOLOGY:

Selected germplasm will be given photoperiodic treatment. All the germplasm will be planted in drum having 20" height and 16" diameter in the last week of November. Before plantation the drums will be filled up with a media composed of soil, pressmud and sawdust (3:2:1). Recommended doses of fertilizers and insecticides will be applied. Cultural practices will be done as per requirement. All the germplasm in drum will be placed on rail cart in the last week of April and will be given photoperiodic treatment as follows:

a) ADVANCEMENT OF FLOWERING IN MID AND LATE FLOWERING VARIETIES/ CLONES:

A number of 32 germplasm (14 mid-flowering and 18 late-flowering groups) will be given a constant photoperiodic treatment of 12.45 hrs for 30 days from starting. After 30 days treatment, day length will be reduced @ 1 min. per day for mid-flowering group and @ 45 second per day for late flowering group until it reaches to 11.30 hrs photoperiodic length. The 11.30 hrs photoperiodic treatment will be continued until natural day length reaches 11.30 hrs. The photoperiodic treatment will be started at 3rd week of May for mid-flowering group, and 1st and 3rd week of June for late flowering group.

b) DELAYING FLOWERING OF EARLY FLOWERING VARIETIES/ CLONES:

A number of 12 germplasm will be given photoperiodic treatment of 12.30 hrs constant treatment for 30 days in two chambers. The treatment will be started in the first week of August. After 30 days treatment, day length will be reduced 1.5 and 2.0 minutes per day in two chambers separately until they reach 11.30 hrs photoperiodic length. The 11.30 hrs photoperiodic treatment will be continued until natural day length reaches 11.30 hrs.

c) INDUCTION OF FLOWER IN SPARSE FLOWERING VARIETIES/ CLONES:

Under this programme, 9 germplasm (sparse-flowering) will be given a constant photoperiodic treatment of 13.00 hrs for 30 days from starting. After 30 days, day length will be reduced @ 1min. per day until it reaches to 11.30 hrs photoperiodic day length. And this 11.30 hrs photoperiodic treatment will be continued until natural day length reaches to 11.30 hrs. Later on, flowering dates of different germplasm will be recorded and through synchronization hybridization work will be done. Treatments will be started from the first week of May.

TREATMENTS:

1. Control
2. 11.30 hrs day length
3. 12.30 hrs day length
4. 12.45 hrs day length
5. 13.00 hrs day length
6. 13.50 hrs day length
7. 0.45 minute reduction/day
8. 1 minute reduction/day

DESIGN : RCBD

DATA TO BE RECORDED:

1. Flowerable stalk/stool
2. Flowering stalk/stool
3. Pollen viability (%)
4. Flowering time
5. No. of crosses
6. Fuzz produced/cross (gm)

7.4 WORK ELEMENT:

1. Germplasm plantation in drum
2. Starting photoperiodic treatment in time
3. Increment of day length of photoperiodic treatment
4. Reduction of day length of photoperiodic treatment
5. Recording flower initiation date
6. Recording flower emergence date
7. Pollen fertility test (%)
8. Recording the number of flowerable stalks/variety
9. Recording the number of flowering stalks/variety
10. Recording the number of crosses/variety

7.5 TIME SCHEDULE:

Sl. No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1			→													
2						→										
3										→						
4											→	→	→			
5													→	→		
6													→	→		
7														→	→	
8														→	→	→
9														→	→	→
10															→	→

7.6 ECONOMIC IMPACT:

Photoperiodic treatment will increase the scope of hybridization and thereby will help the development of improved variety of sugarcane.

7.7 EFFECT ON ENVIRONMENT:

Environment will not be affected as the experiment will be conducted in controlled condition.

7.8 UTILIZATION OF RESEARCH RESULTS:

The effective photoperiod length will be used to induce flower in sparse and non-flowering germplasm and also to synchronize the flowering time of different flowering germplasm for effective crossing thereby widening the scope of hybridization.

8.0 TITLE : INVESTIGATING THE FLOWERING BEHAVIOUR AND BREEDING POTENTIAL OF SUGARCANE GERMPLASM
LOCATIONS : BSRI, Ishwardi, Pabna
INVESTIGATORS : N A Munna, M R Alam, K M Karim, S N Asha and M A Rahman
NATURE OF STUDY : New
DURATION : 2024-
ESTIMATED COST (TK : 21,000/-

8.1 DEFINITION OF THE PROBLEM:

Effective genetic improvement of crops relies on the proper functioning of reproductive parts. Sugarcane presents unique challenges due to its high heterozygosity and complex polyploid genetic structure. Notably, there is considerable variation in the flowering habits of wild and cultivated sugarcane species. Again, a significant obstacle in sugarcane breeding is the induction and synchronization of flowering and crossing of sugarcane like other cross depends on fully functional floral organs. Flowering of sugarcane genotypes is important for the breeding program, but flowering is highly affected by environmental conditions. Flowering in

sugarcane involves stages like initiation, flagging, emergence, and pollen shedding. Each stage requires specific physiological and environmental conditions including day length, humidity, and temperature. Deviations from these conditions can inhibit flowering. In the germplasm, some clones flower rarely, while others flower profusely or produce inflorescences that do not emerge. Sugarcane plants also show varying pollen viability each year, making it essential to understand flowering behavior for effective breeding management. Therefore, this study has been undertaken to study the flowering habits of the wild and cultivated species, specifically examining how the environment affects flowering patterns, regularity, timing, intensity, and pollen viability, thereby enhancing breeding efficiency and promoting sustainable sugarcane production in regions with variable climates.

8.2 Objectives:

1. Identification of flowering patterns of sugarcane germplasm;
2. Assessing the breeding potential of sugarcane germplasm and
3. Using the potential germplasm in crossing program for developing variety.

8.3 METHODOLOGY:

This study will examine breeding potential using 200 parental clones and 10 wild sugarcane clones. Flowering data will be collected through key developmental stages. The Elongation Stage will be measured by counting the days from mid-October to the start of flag leaf formation. The Flag Leaf Stage will be measured by counting the days from the beginning of flag leaf formation to full flag leaf emergence. The full Emergence Stage will be tracked by counting the days from tip emergence to the full extension of the inflorescence. Finally, the Percentage of Flowering will be determined by dividing the number of flowering stalks by the total number of stalks and multiplying by 100.

b) Weather data:

Temperature, day length, and relative humidity are the key environmental variables influencing the timing of sugarcane flowering and pollen viability. To address the fact, daily averages of minimum and maximum temperature, day length, and relative humidity will be recorded during flower development phases.

c) Data of Flowering propensity:

Data on flowering propensity will be collected from the clones, focusing on the number of flowered canes and the total number of canes. Each clone's flowering performance will be evaluated and scored on a 1–5 scale to categorize their propensity: very low (≤10% flowered canes), low (11–30%), medium (31–60%), high (61–80%), and very high (>80%). This scoring system will facilitate a systematic comparison of flowering potential across different clones.

d) Pollen functionality and Germination Assessment of the flower

To evaluate pollen viability, anthers from matured but unopened spikelets will be squashed in a 10% iodine solution. The resulting slides will be examined under a light microscope to determine the percentage of viable pollen. Varieties with less than 10% viable pollen will be treated as female parents while those with more than 10% viable pollen will be treated as male. For pollen tube germination assessment, an in vitro germination medium will be prepared, consisting of one liter of water, 300 mg calcium nitrate, 100 mg boric acid, 100 mg magnesium sulfate, and 300 g sucrose. This medium will be autoclaved, stored in small flasks, and used as needed. Pollens will be collected in the early morning, sieved, and cultured in individual petri dishes per genotype. The cultures will be maintained at 25°C and 95% relative humidity for 30 minutes. The percentage of germination will be calculated based on the total number of pollen grains.

After pollen viability test targeted flowering clones will be selected to set the desired cross. The resultant fuzz will be collected and stored under optimal conditions for future germination testing.

TREATMENT: Not applicable

DATA TO BE RECORDED:

1. Days to Elongation stage
2. Days to Inflorescence tip emergence

3. Days to Inflorescence full emergence
4. Date of flowering initiation
5. Date of flowering
6. % Pollen viability
7. % Pollen tube germination
8. Frequency of male flowers
9. Frequency of female flowers
10. Flowering Propensity
11. Record temperature, rainfall, and photoperiod at flowering time
12. Flower size, shape, and number of florets
13. Flowering time
14. Length of the flowering period
15. Assess the type and structure of flowers produced (e.g. spikelets, panicles).

8.4 WORK ELEMENT:

1. Documentation of breeding germplasm
2. Flowering record
3. Record temperature, Relative humidity, and photoperiod at flowering time
4. Laboratory determination for pollen viability %
5. Laboratory determination for pollen tube germination%
6. Assessment of the type of flower produced
7. Cross setting
8. Fuzz collection
9. Assess the seed set for each cross

8.5 TIME SCHEDULE:

Sl. No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1		→														
2		→	→	→	→											
3		→	→	→												
4												→	→	→		
5														→	→	→
6															→	→
7														→	→	→

8.6 ECONOMIC IMPACT:

Better understanding of sugarcane flowering will help in better hybridization program which in turn will improve the breeding program and ultimately the higher cane and sugar production of the country through development of improve variety of sugarcane.

8.7 EFFECTS OF ENVIRONMENT: Friendly to the environment.

8.8 UTILIZATION OF RESEARCH RESULTS:

The selected flowering germplasm will be used in hybridization for successful breeding program.

9.0 TITLE : **EVALUATION OF PROMISING CLONES UNDER DIFFERENT YIELD TRIALS AT VARYING AGRO- CLIMATIC CONDITIONS**

LOCATIONS : BSRI, Ishwardi; RSRS, Gazipur; RSRS, Thakurgaon, Rajshahi; Carew & Co. and Joypurhat

INVESTIGATORS :

BSRI, HQ	M A Rahman
Carew & Co.	(Station-in-Charge) and H M Tarique
JSM	M S Islam (Station-in-Charge) and M M Alam
RJSM	(Station-in-Charge) and M R Alam
RSRS, Thakurgaon	M S Hossain (Station-in-Charge) and M M Alam
RSRS, Gazipur	(Station-in-Charge) and N A Munna

NATURE OF STUDY : On-going

DURATION : 2010-

ESTIMATED COST (TK) : 3,30,519/-

9.1 DEFINITION OF THE PROBLEM:

Environment has a tremendous influence on the manifestation of a variety. A variety may not be suitable for all locations. Considering the fact, the trial has been designed to conduct at different agro-ecological conditions for suitability study of selected clones.

9.2 OBJECTIVES:

1. Determining the performance of the clones under varying agro-climatic conditions;
2. Selecting location specific variety and
3. Determining the ratooning potential of the clones.

9.3 METHODOLOGY:

The clones selected from second line trial (4m x 4m stage) will be planted in Preliminary Yield Trial (PYT) at two locations with three replications against one/two check varieties. The plot size will be maintained 4m × 4m. In the same year, the materials will be given to the Pathology Division for screening against red rot disease through artificial inoculation.

Chemical analysis of the clones will be performed at BSRI. Based on different agronomical characters such as germination, tiller, pol % cane, milable cane, yield and disease reaction, the promising clones will be selected for the Advanced Yield Trial (AYT). Only the clones showing equal or better performance with the check varieties will be advanced to AYT. In this trial, the clones will be planted in 6m × 5m plot with four replications at two locations against one/two check variety(s). Simultaneously, the pathology division will also plant the selected clones for pathological test as before. Based on agronomical characters, yield, pol % cane and disease status report, the superior clones will be selected for Zonal Yield Trial (ZYT)-I. The clones showing equal or better performance compare to the check varieties will be selected only. In ZYT-I, the clones will be planted in 6m × 10m plot with four replications against the check varieties.

The selected clones will be supplied to the pathology, entomology, agronomy and physiology divisions to evaluate the performance in their respective fields. Based on yield, pol % cane, disease and pest infestation only the superior clones compare with the check varieties will be advanced to the Zonal Yield Trial (ZYT)-II. In trial (ZYT-I), clones will be kept as ratoon at two locations to observe their ratooning potentiality. Maintaining the similar plot size with four replications and same check the clones will be planted at five locations in ZYT-II, and the clones will be maintained as ratoon for second year to see their ratooning ability. Selected clones having high sucrose content and resistance against diseases will be advanced to proposed variety trial (PVT) at seven locations for further evaluation keeping the same plot size and replication as in ZYT-I and II. The promising clones under PVT may be evaluated by the members of the Field Evaluation Team of Seed Certification Agency (SCA). Based on maturity, the clones will be categorized as early, mid and late maturing. Upon approval by National Seed Board (NSB), the clone(s) will be released as variety for cultivating all over the country or in specific location.

DESIGN : RCB

DATA TO BE RECORDED:

1. Germination count (%)
2. No. of tillers/ha
3. No. of millable cane/ha
4. Cane height (m) and diameter (cm)
5. Field brix (%)
6. Recoverable sucrose content (%)
7. Cane yield/ha

9.4 WORK ELEMENTS:

1. Plantation of clones in different test stages and yield trials
2. Recording of germination and tillering
3. Recording of pest and disease incidence
6. Evaluation of clones for different agronomical characters and sucrose content
7. Harvesting and yield data collection

9.5 TIME SCHEDULE:

Sl. No.	2024				2025												2026	
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1			→															
2						→			→									
3							→						→					
4														→			→	
5																→	→	

9.6 ECONOMIC IMPACT:

Newly developed varieties will help in increasing cane and sugar yield and thereby will generate high income of farmers.

9.7 EFFECT ON ENVIRONMENT: Friendly to environment.

9.8 UTILIZATION OF RESEARCH RESULTS:

Seed canes of the developed variety(s) will be distributed to mills and non-mill zones for commercial cultivation to increase the sugar and gur production of the country. The newly developed variety(s) will be distributed to the model farmers of the mills and non-mill zones for commercial cultivation. Hence, newly developed variety(s) will be utilized for higher cane, sugar and gur production of the country.

10.0 TITLE : BREEDER SEED MULTIPLICATION OF PROMISING CLONES/VARIETIES OF SUGARCANE
LOCATIONS : BSRI, Ishwardi, Pabna
INVESTIGATORS : M A Rahman, M R Alam, H M Tarique and M Alam
NATURE OF STUDY : On-going
DURATION : 1980-
ESTIMATED COST (TK) : 28,300/=

10.1 DEFINITION OF THE PROBLEM:

In sugarcane, advanced clones are required to be evaluated by the Breeder, Entomologist, Pathologist, Agronomist and Soil chemist in their respective field. Advanced clones are used for setting up of different experiments and are also supplied to different sugar mills for nucleus seed programme. To meet up the demand, it is required to multiply the advanced clones/seed materials in successive generations.

10.2 OBJECTIVES:

1. Producing breeder seeds of potential varieties and clones;
2. Maintaining purity of existing varieties and
3. Distributing quality seeds to different stakeholders.

10.3 METHODOLOGY:

The selected clones from PYT, AYT, ZYT-I, ZYT-II ZYT- III and released varieties (as breeder seed) will be multiplied at BSRI, Ishwardi and RSRS, Thakurgaon farm. Normal cultural practices will be done as per requirement. Recommended dose of fertilizers and insecticides will be applied. The Pathologist and Entomologist of BSRI will inspect and clean the multiplied seed cane at different times.

10.4 WORK ELEMENT:

1. Clonal selection from different yield trials
2. MHAT of clones under ZYT-II and released varieties
3. Clonal plantation
4. Inspection of seed plot by the Pathologist and Entomologist
5. Recording the number of affected stools roughed out
6. Distribution of seed cane

10.5 TIME SCHEDULE:

Sl. No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1		→	→													
2		→	→													
3			→	→												
4							→	→	→	→	→	→	→	→	→	
5							→	→	→	→	→	→	→	→	→	
6															→	→

10.6 ECONOMIC IMPACT:

Use of clean seed will minimize the disease and pest infestation. As a result, cane and sugar yield will be increased which in turn will improve the economic condition of the farmers as well as of the country.

10.7 EFFECT OF ENVIRONMENT: Friendly to environment.

10.8 UTILIZATION OF RESEARCH RESULTS:

The multiplied seed canes will be distributed to different divisions for testing in their respective field and will be used for setting up of different yield trials at BSRI as well as in sugar mills farm. Clean seed canes will be distributed to different sugar mills for planting in nucleus seed plot. Besides, clean seed canes of newly released varieties will be produced at BSRI for distribution to mills and non-mill zones.

11.0 TITLE : CHARACTERIZATION OF STEVIA GERMPLASM
LOCATIONS : BSRI, Ishwardi, Pabna
INVESTIGATORS : S N Asha, M M Alam, N A Munna, K M R Karim and M A Rahman
NATURE OF STUDY : On-going (Modified)
DURATION : 2019-
ESTIMATED COST (TK) : 18,000/-

11.1 DEFINITION OF THE PROBLEM:

Stevia rebaudiana, a non-caloric natural sweetener is currently the available substitute to sugar. It has emerged as a promising sweetener due to its natural sweetness and potential health benefits. It is becoming popular in Bangladesh day by day, due to its zero-calorie sweetening agent. Studies for the selection and improvement of adapted genotypes are considered important for stevia cultivation in the country. Therefore,

stevia breeding programs to obtain new cultivars with desirable and stable chemical profiles may improve the quality of raw materials for the industry. The genetic variability of spontaneous populations can be identified and used in breeding programs to increase the production and quality of steviol glycosides.

11.2 OBJECTIVES:

1. Evaluating the collected accessions of stevia and characterizing their genetic divergence and
2. Evaluating biomass accumulation and physiological indices for assessing its breeding potential.

11.3 METHODOLOGY:

The BSRI stevia accessions will be used for morphology study. The polybag seedling will be prepared from stem cutting and then transplanted in earthen pot. Irrigation, fertilizer application, weeding, staking, and other necessary intercultural operations will be practiced as and when required. Diseases and pest infestation will be recorded throughout the growing period. Morphological characterization will be done after one month of transplantation following 20 days interval. Harvesting will be done at two splits, after 114 days of transplanting (first cut) at 5cm above the base and after 84 days of first harvest (second cut), when 5% of the plants shows flowering.

DATA TO BE RECORDED:

1. Plant height (cm)
2. No of branches/plant (primary, secondary, tertiary)
3. No of leaves
4. Leaf stem ratio
5. Leaf shape
6. Leaf size
7. Juvenile period (days)
8. No of corymbs
9. Flowering time
10. Leaf yield (green leaves)
11. Leaf dry weight (g)

11.4 WORK ELEMENT:

1. Seedling raising of collected stevia germplasm
2. Plantation in earthen pot
3. Morphological data collection
4. 1st cut and data collection (At 114 DAT)
5. 2nd cut and data collection (After 84 days of 1st cut)
6. Data analysis and reporting

11.5 TIME SCHEDULE:

Sl. No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	→	→														
2		→	→	→												
3					→	→	→	→	→							
4									→	→						
5											→	→	→			
6														→	→	

11.6 ECONOMIC IMPACT:

Diverse parent materials will help for improving variety which in turn will improve the economic condition of the farmers as well as of the country.

11.7 EFFECT OF ENVIRONMENT: Friendly to environment.

11.8 UTILIZATION OF RESEARCH RESULTS: Collected germplasm will be preserved in the germplasm bank of BSRI and flowering ones will be used for future hybridization programme of stevia. The promising germplasm will be released as variety for commercial cultivation.

12.0 TITLE : IMPROVEMENT OF DATE PALM USING ARTIFICIAL POLLINATION
LOCATION : BSRI, Ishwardi, Pabna
INVESTIGATORS : M R Alam, M M Rahman, M M Ahmed, M M Alam, S Mandal and M A Rahman
NATURE OF STUDY : On-going
DURATION : 2019-
ESTIMATED COST(Tk) : 12,500/-

12.1 DEFINITION OF THE PROBLEM :

Crop's variety development is a continuous process. Hybridization followed by selection is the principal procedure to develop variety. Local date palm (*Phoenix sylvestris*) is well adapted in Bangladesh and use only juice production though it has huge fruit bearing capacity. The fruit or pulp layer of local date palm is not as thick as Arabian date palm (*Phoenix dactylifera*). So, it has no market demand. But in our country both the date palm juice and fruit of Arabian date palm (Khejur) have high demand. To meet up the market demand and get benefit from local and Arabian date palm, artificial hybridization will be made among targeted parents to produce fruit and juice bearing progenies.

12.2 OBJECTIVES:

1. Improving local date palm for quality juice and fruit yield

12.3 METHODOLOGY:

Date palm sexes are borne by separate individuals. The unisexual flowers are pistillate (female) and staminate (male) in character. The male palm produces the pollen and the female palm produces the fruit. The flower stalks are produced from the axils of the leaves. The inflorescence consists of a long stout spathe which, on bursting, exposes many thickly crowded floral branchlets which are stout and short in male, and long and slender in female. The male flowers are borne single and are waxy white, while the female flowers are borne in clusters of three and are yellowish green in colour. Parentage of local and improve (Arabian) date palm for this experiment will be selected from BSRI date palm garden in the month of February-March 2025 at the flowering period. In case of differing in flowering time of male and female plant, then pollen from male inflorescences will be collected and preserved in the laboratory for using artificial pollination. On the other hand, pollen from male inflorescences of improve date will be applied to female flowers of local date and vice versa (*Phoenix sylvestris* × *Phoenix dactylifera and Phoenix dactylifera* × *Phoenix sylvestris*) followed by bagging to protect out crossing. Artificial pollination will be performed by dusting pollen to the selected female flowers. Fruit setting and fruits characters will be recorded and analyzed. Better ones will be used to develop F_1 progeny and planted at BSRI date palm garden for further evaluation.

TREATMENT: a) Improved date palm b) Local date palm

DESIGN : RCB

DATA TO BE RECORDED:

1. Flowering time
2. No. of pollinated inflorescence
3. No. of fruit set/ inflorescence
4. Fruit size and shape
5. Thickness of pulp layer
6. Collection of juice/plant
7. Brix% in juice
8. Fruit yield

12.4 WORK ELEMENTS:

1. Parent selection
2. Flowering record
3. Pollen collection
4. Determination of pollen fertility (%)
5. Artificial pollination
6. Bagging of inflorescence
7. Recording fruit weight
8. Juice collection
9. True to type seedling production

12.5 TIME SCHEDULE:

Sl. No.	2024	2025											
	D	J	F	M	A	M	J	J	A	S	O	N	D
1	→	→	→										
2	→	→	→	→									
3	→	→	→	→									
4	→	→	→	→									
5		→	→	→									
6		→	→	→									
7					→	→	→	→					
8											→	→	→
9	→	→	→	→	→	→	→	→	→	→	→	→	→

12.6 ECONOMIC IMPACT:

Improve genotypes will help to produce juice and quality fruit from same plant which will meet up the demand of the farmers as well as of the country.

12.7 EFFECT ON ENVIRONMENT: Friendly to environment.

12.8 UTILIZATION OF RESEARCH RESULTS:

The research result (variety) will be used for higher production of juice and quality fruit through commercial cultivation.

13.0 TITLE : CHARACTERIZATION AND DOCUMENTATION OF LOCAL AND EXOTIC DATE PALM

LOCATIONS : BSRI, Ishwardi, Pabna

INVESTIGATORS : M M Alam, M R Alam, M M Ahmed, S N Asha and M A Rahman

NATURE OF STUDY : On going

DURATION : 2022-2027

ESTIMATED COST (TK) : 10,000/-

13.1 DEFINITION OF THE PROBLEM:

Different date palm germplasm generally resemble each other in their appearance but they are morphologically different. Characterization of germplasm means the description of the materials for determining the magnitude of genetic diversity, variety identification, studying the relationship of species and in the establishment of core collection. It also provides an indication of the value of each germplasm accession and an important basis for gene bank management. It is prerequisite for crossing programme. Without characterization successful breeding programme is not possible. If characterization is done properly, breeders can proceed in right direction, it helps the breeders to take correct decision in cross making. As there is no previous record of date palm characterization in Bangladesh, therefore characterization and documentation of date palm (*Phoenix sylvestris & Phoenix dactylifera*) has been under taken to execute successful breeding programme.

13.2 OBJECTIVES:

1. Assessing the genetic diversity;
2. Registering the accession and avoiding duplication;
3. Establishing the relationship between the species and
4. Establishing the core collection.

13.3 METHODOLOGY:

Under this programme, local and exotic germplasm of date palm garden will be considered for characterization. Morphological characterization will be based on the physical attributes of a plant. The germplasm will be characterized at different time at different growth stage. Healthy date palm plant will be selected for recording data. In case of leaf data, well developed 5 mature leaf data will be collected. From each plant first 5 early blooming flower will be considered for data collection. After the flower gets matured data of 5 early emerging fruits will be collected and in case of seed, 10 mature healthy ripening fruits will be considered for data collection.

TREATMENT: Local and exotic date palm collection of BSRI.

DATA TO BE RECORDED:

a) Data to be recorded (Morphological data):

1. Leaf length(cm)
2. Petiole length(cm)
3. Leaf blade length(cm)
4. Spine length(cm)
5. Spine area length(cm)
6. No. of spine per leaf
7. Spine rachis angle(°)
8. collection of juice per plant(litre)
9. Brix(%) of juice

b) Data to be recorded (flower and fruit data):

1. Flowering time
2. No. of inflorescence per plant
3. No. of fruit set
4. Spathe length (cm)
5. Peduncle length (cm)
6. Peduncle thickness (cm)
7. Days to fruit maturity
8. Days to fruit ripening
9. Fruit per plant
10 .Fruit colour of the maturity
11. Fruit length (cm)
12. Fruit width (cm)
13. Fruit weight(gm)
14. Fruit volume
15. Fruit shape
16. Fruit apex
17. Flavour
18. Flesh thickness
19. Flesh colour
20. Fruit density (w/v)

c) Data to be recorded (seed data):

1. Seed length(cm)
2. Seed width(cm)
3. Seed weight(gm)
4. Seed volume(cm^3)
5. Seed colour
6. Seed surface
7. Seed weight percentage of fruit weight
8. Seed volume percentage of fruit volume

13.4 WORK ELEMENT:

1. Collection of Morphological data (e.g. Leaf length, Petiole length, Spine length, No. of spine per leaf etc.)
2. Collection of flowering data
3. Collection of fruit and seed data
4. Data processing and analysis

13.5 TIME SCHEDULE:

Sl. No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
2					→	→	→									
3							→	→	→	→	→	→				
4					→	→	→	→	→	→	→	→	→	→	→	→

13.6 ECONOMIC IMPACT:

An indication of the potential value or utility of each germplasm accession will be an important basis for gene bank management and subsequent use.

13.7 EFFECT OF ENVIRONMENT: Friendly to environment.

13.8 UTILIZATION OF RESEARCH RESULTS:

Characterization of germplasm will act as useful guide to overcome many confusion associated with identification of date palm varieties which look very alike in the field. Therefore, the knowledge and the ability of extension workers and plant breeders to recognize varieties will help for successful planning and hybridization programme, respectively.

14.0 TITLE : SELECTION OF PALMYRA PLAM GERMPLASM BASED ON JUICE YIELD AND QUALITY

LOCATIONS : BSRI, Ishwardi, Pabna

INVESTIGATORS : H M Tarique, M M Rahman, M R Alam, M M Ahmed, M S Arefin, M K Begum and M A Rahman

NATURE OF STUDY : On-going

DURATION : 2023-

ESTIMATED COST (TK) : Tk. 77,500.00

14.1 DEFINITION OF THE PROBLEM:

Palmyra plam plants belongs to Palmae family which spontaneously grows throughout Bangladesh. This plant is used for different purposes, but popular for their sweet juice and gur. This plant plays a significant role in improving the environment, because it can be cultivated along the sides of roads, railway lines, embankments, farmland ails and it can aid the meat sugar and gur requirement of the country.

Bangladesh is suffering from the shortage of sugar and goor production. In both cases sugarcane is only the main source of raw material. A secure supply of raw material of sweetener plants is the prerequisite for achieving self-sufficiency and sustainability in this sector. Gur production from Palmyra plam may be alternative source to minimize sugar and gur deficiencies of country. Therefore, characterization of germplasm of Palmyra plam in case of juice yield and quality is very essential for future research programme for development of improved variety.

14.2 OBJECTIVES:

1. Identifying palmyra palm genotypes based on juice yield and quality and
2. Selecting parents for hybridization program.

14.3 METHODOLOGY:

Sap or juice is the most important product of palmyra palm. Palm sap or juice will be collected from Palmyra palm Germplasm Center of Bangladesh Sugarcrop Research Institute, Ishwardi, Pabna. The tapping technique of palm juice involves the messaging of the interior of the developing inflorescences by means of a hand and wooden mallet or tong, thereby stimulating sap flow. Sap is collected by cutting the outer end at the head of the inflorescences. Sap is collected three times a day from each inflorescence, normally in morning, noon and evening. Three to five inflorescences are tied together and inserted into a suitable container for juice

collection, usually using an earthen pitcher. The inflorescence generally emerged in the last week of March. After emergence of palm inflorescence, it will be processed in the month of mid April.

TREATMENT: Not applicable

DATA TO BE RECORDED:

i) Juice secretion/day/plant/season.
ii) Chemical analysis of juice (Brix %, Pol %, Purity %, Reducing Sugar %)

14.4 WORK ELEMENT:

1. Preparation for juice collection
2. Juice collection (tapping)
3. Characterization for juice yield and quality parameter of selected genotypes
4. Data processing and documentation

14.5 TIME SCHEDULE:

Sl.	2024				2025											
No.	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1							→	→	→							
2								→	→	→						
3								→	→	→						
4								→	→	→	→	→				

14.6 ECONOMIC IMPACT:

A potential variety will improve the economic condition of the farmers as well as of the country.

14.7 EFFECT OF ENVIRONMENT: Friendly to environment.

14.8 UTILIZATION OF RESEARCH RESULTS:

The promising germplasm will be released as variety, after a series of evaluation, for commercial cultivation.

BIOTECHNOLOGY DIVISION

Rationale

Biotechnology is the integration of natural sciences and organisms, cells, parts thereof, and molecular analogues for products and services. Biotechnological techniques such as tissue culture, genetic transformation and molecular marker studies could be used as important tools for sugar crops; sugarcane, sugar beet, stevia, date palm, and palmyra palm improvement. Sugarcane is often cited as the model crop in which cultivar improvement has been obtained through tissue culture. It has some important advantages as a target for genetic transformation such as excellent regeneration system, and routinely multiplied and maintained by vegetative propagation. Marker studies could be useful for variety identification and development of MAS (Marker Assisted Selection) method for accurate, rapid and early selection of sugar crops variety independent of environmental factors.

Development of superior sugarcane cultivar through conventional breeding takes about 10-12 years in Bangladesh. An elite variety might completely be abandoned because of a single deficiency often being vulnerable to biotic or abiotic stress under climatic change. Traditional breeding approaches to rectify such a deficiency in an existing cultivar are difficult because of its genetic complexity. Consequently, date palm, palmyra palm, sugar beet and stevia as alternate sweeteners are receiving research importance as alternate source of sugar. Therefore, biotechnological research may offer viable options for sugarcane improvement as well as alternate sweeteners.

Keep in mind of climatic change and need based demand “Research Program of 2024-2025” has been undertaken with major emphasis on:

- Characterization and documentation of sugar crops using molecular markers.
- Genetic transformation of desitable genes in sugarcane.
- Micropropagation for multiplication of sugar crops.
- Development of somaclones of stevia through tissue culture techniques and subsequent molecular diversity analysis.
- CRISPR/Cas9 based genome editing for improvement of stevia.

LIST OF EXPERIMENTS

1.0 Title : Characterization and documentation of sugar crops using molecular markers
2.0 Title : Genetic enhancement of sugarcane containing desirable characters through tissue culture techniques
3.0 Title : Genetic transformation of desirable genes in sugarcane
4.0 Title : Micropropagation for multiplication of sugar crops
5.0 Title : Development of somaclones of stevia through tissue culture techniques and subsequent molecular diversity analysis
6.0 Title : CRISPR/CAS9 based genome editing for improvement of stevia

PROGRAMME IN DETAILS

PROGRAMME AREA	:	**BIOTECHNOLOGY AND FRONTIER RESEARCH**
1.0 TITLE	:	**CHARACTERIZATION AND DOCUMENTATION OF SUGAR CROPS USING MOLECULAR MARKERS**
LOCATION (S)	:	BSRI Lab
INVESTIGATORS	:	N Islam, A K Ghose, M A Azim and M R R Rajib
NATURE OF THE STUDY	:	On-Going
PROJECTED COMPLETION	:	Continuous
ESTIMATED COST (TK.)	:	Tk. 12,50,200.00

1.1 DEFINITION OF THE PROBLEM:

Molecular characterization of sugar crop varieties and germplasm is a very important component in any crop improvement programme. The traditional method of characterization and identification of sugar crops varieties or germplasm is based on agronomic and morphological traits. However, such traits are highly affected by the environment. Interest in molecular characterization and identification of crop varieties and collected germplasm is increasing because molecular markers are accurate, abundant and less affected by the environment. Identification of varieties using molecular markers through DNA fingerprinting is indispensable for variety protection. Characterization of varieties and existing germplasms using molecular markers would be directed for hybridization and selection of varieties to achieve target breeding.

Commercial sugar crop varieties are characterized by a narrow genetic base and breeding programme throughout the world has limited genetic diversity. Potential for maximum gain in the breeding programme is only realized when a broad genetic base is present. To determine the extent of diversity present in the sugar crop germplasm pool, proper evaluation and accurate characterization of the materials would be done using molecular markers.

1.2 OBJECTIVES:

1. Identification of sugar crop varieties, active germplasm and developed somaclones through DNA fingerprinting;
2. Determination of genetic diversities among the sugar crop varieties, active germplasm, and somaclones;
3. Tagging of marker against identified character; and
4. Developing Marker Assisted Selection (MAS) method for different sugar crops.

1.3 METHODOLOGY:

1. The BSRI-bred sugar crop varieties, collected germplasm, developed somaclones would be used as experimental materials.
2. DNA extraction and purification will be followed by the modified mini prep CTAB method. Three individual DNA samples from a cultivar or germplasm in equal volume and concentration will be pooled to form the bulked sample.
3. SSRs and ESTs primers will be used in PCR amplification.
4. Amplified DNA will be run in agarose gel by electrophoresis to separate allele specific bands.
5. Electrophoresesed gel will be documented for DNA fingerprinting using gel documentation system.
6. Documented electrophoreses gel will be scored on the basis of presence or absence of allele specific bands. Data will be analyzed to determine the relationships among all varieties, germplasm collection, and developed somaclones and cluster analysis will be carried out using computer software.

It may be mentioned that, the method might need to be modified depending on responses and observations of the experiments.

1.4 WORK ELEMENTS:

1. Samples collection
2. DNA extraction, quality determination and quantification
3. PCR amplification
4. Gel electrophoresis
5. Documentation/Imaging
6. Data collection and analysis

1.5 TIME SCHEDULE:

Sl No	2025												2026	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1	→	→	→	→	→	→	→	→	→	→	→	→	→	→
2	→	→	→	→	→	→	→	→	→	→	→	→	→	→
3	→	→	→	→	→	→	→	→	→	→	→	→	→	→
4	→	→	→	→	→	→	→	→	→	→	→	→	→	→
5	→	→	→	→	→	→	→	→	→	→	→	→	→	→
6	→	→	→	→	→	→	→	→	→	→	→	→	→	→

1.6 ECONOMIC IMPACT:

Breeding program would be formulated based on molecular characterization. Time and cost for variety election will be reduced.

1.7 EFFECT ON ENVIRONMENT:

This experiment is environment friendly and there would have no adverse impact on environment.

1.8 UTILIZATION OF RESEARCH RESULTS:

Results of this investigation will be utilized for variety identification, documentation and protection. Breeding programme would be formulated based on molecular characterization of active germplasm collection. Marker Assisted Selection (MAS) method for different sugar crops would be developed.

PROGRAM AREA : **BIOTECHNOLOGY AND FRONTIER RESEARCH**
2.0 TITLE : **GENETIC ENHANCEMENT OF SUGARCANE CONTAINING DESIRABLE CHARACTERS THROUGH TISSUE CULTURE TECHNIQUES**
LOCATION(S) : BSRI Lab.
INVESTIGATORS : A K Ghose, M A Azim, M R R Rajib and N Islam
NATURE OF THE STUDY : On going
PROJECTED COMPLETION : Continuous
ESTIMATED COST (TK) : Tk. 2,09,989.00

2.1 DEFINITION OF THE PROBLEM:

Genetic enhancement of sugarcane for sustainable productivity with desirable characters under changing climate is demanding due research attention as existing gene pool became exhaustive use of conventional breeding system. Tissue culture might be an option for the same. It has been proposed that the primary application of tissue culture in crop improvement is to take an acceptable commercial cultivar that is deficient in one or a few characters, produce somaclones of that cultivar through tissue culture, and select variants with the desired change. Sugarcane is often cited as the model crop in which cultivar improvement has been obtained through tissue culture. The role of tissue culture in commercial cultivar development is an important consideration that remains to be resolved at the present time.

Desirable characters for sugarcane include high sucrose content, disease resistance, tolerance to biotic and abiotic stresses, profuse tillering, and ratooning potentiality, which are all crucial for maximizing yield and improving sugarcane production. Since traditional plant breeding methods have been slow to yield substantial improvements in desirable characters, the alternative approach of utilizing plant tissue culture

techniques has received increased attention. An added advantage in generation of plants through tissue culture is the regenerated plants are clones of commercial varieties those have deficit in one or a few characters, thereby simplify subsequent testing. The induction of genetic variability for desirable characters in sugarcane would further facilitate its cultivation under unfavorable condition. Sodium chloride (NaCl), hydroxy proline (HYP), polyethylene glycol (PEG), and mutagenic agents would be used to select sugarcane with desirable characters.

2.2 OBJECTIVES:

1. Development of sugarcane somaclones under selection pressure using NaCl, hydroxy proline, polyethylene glycol, and mutagenic agents and
2. Evaluation and selection of sugarcane somaclones with desirable traits.

2.3 METHODOLOGY:

1. BSRI released sugarcane varieties and Modhumala will be used as experimental materials.
2. Somaclones from different varieties will be produced through callus culture.
3. For callus initiation explants will be inoculated on MS + 2, 4-D (at different concentrations) + 10% coconut water.
4. Callus will be sub-cultured on the medium containing NaCl (50, 100, 150, 200 and 250 mM), HYP (0.5, 1.0, 1.5, 2.0 and 2.5 mM), EMS (0.01M, 0.02M, 0.03M) and PEG (5.0, 7.5, 10.0, 12.5 and 15.0%). On every concentration the callus will be maintained for 2-3 weeks.
5. The tolerant callus will be tested for retention of tolerance by sub-culture first on media without selecting agents, followed by selecting agents containing media.
6. Shoot will be regenerated on shooting media (MS + different concentrations of BAP + different concentrations of Kn) with and without selecting agents.
7. For root initiation regenerated shoots will be sub-cultured on the medium MS + NAA (different concentrations of) with and without selecting agents.
8. After hardening, plants will be tested under induced salinity and drought under pot as well as natural drought conditions in the field.

It may be mentioned that the method might need to be modified depending on responses and observations of the experiments.

2.4 WORK ELEMENTS:

1. Explants collection and sterilization
2. Media preparation
3. Inoculation and incubation of explants
4. Sub-culture
5. Observation and data collection in in vitro conditions
6. Observation and data collection in ex vitro conditions

2.5 TIME SCHEDULE:

Sl No	2025												2026	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1														→
2														→
3														→
4														→
5														→
6														→

2.6 ECONOMIC IMPACT: It is expected to develop sugarcane varieties with desirable characters.

2.7 EFFECT ON ENVIRONMENT: This experiment is environment friendly and there would have no adverse impact on environment.

2.8 UTILIZATION OF RESEARCH RESULTS:

Results of this experiment will be used to develop sugarcane varieties with desirable characters within a shorter period of time.

PROGRAM AREA : **BIOTECHNOLOGY AND FRONTIER RESEARCH**
3.0 TITLE : **GENETIC TRANSFORMATION OF DESIRABLE GENES IN SUGARCANE**
LOCATION(S) : BSRI Lab.
INVESTIGATORS : M A Azim, A K Ghose, M R R Rajib and N Islam
NATURE OF THE STUDY : On going
PROJECTED COMPLETION : Continuous
ESTIMATED COST (TK) : Tk. 2,55,200.00

3.1 DEFINITION OF THE PROBLEM:

Plant genetic transformation mediated by *Agrobacterium tumefaciens*, a soil born phytopathogenic bacterium, has become the most useful method for the induction of foreign genes into plant cells and the subsequent regeneration of transgenic plants. *A. tumefaciens* has the exceptional ability to transfer a particular DNA segment of the plasmid into the nucleus of the infected cells where it is then stably integrated into the host genome and transcribed expressing the desirable trait. *Agrobacterium*-mediated transformation is advantageous in comparison with other methods of genetic transformation in plants. Efficient method for *Agrobacterium*-mediated transformation and recovery of transgenic plants has been reported in sugarcane (Arencibia *et al.*, 1998). In BSRI, hybridization is the only method being practiced for varietal development, which has proved to be much less effective now a days since similar or same parentage is being used in crossing programme. As such no break-through could be expected in varietal development in future. *Agrobacterium*-mediated transformation method might be a prospective method to develop sugarcane varieties having built-in potential with desired characters. Therefore, the present programme on *Agrobacterium*-mediated transformation has been undertaken to transfer desirable genes and their expression for development of transgenic sugarcane in Bangladesh.

3.2 OBJECTIVES:

1. Collection and maintenance of Agrobacterium strains with desirable gene(s);
2. Transformation of desired gene (s) in sugarcane;
3. Confirmation of transformation and evaluation the expression of targeted gene (s) in sugarcane; and
4. Transgenic sugarcane development.

3.3 METHODOLOGY:

1. Luria-Bertani (LB) broth medium contained 1% Bacto peptone, 0.5% Bacto-yeast extracts and 1% NaCl will be used for routine *Agrobacterium* culture.
2. Sugarcane varieties such as Isd 16, Isd 38, Isd 39, Isd 40, BSRI Akh 44, BSRI Akh 45 and BSRI Akh 46 will be used as experimental materials. Excised basal innermost area of spindle leaf as explant will be cultured on MS-M1 medium (MS medium containing 100 mg/l myo-inositol, 500 mg/l casein hydrolysate, 2 mg/l 2,4-D, 3% sucrose and 0.6% agar) and MS-M2 (MS medium containing 7.5 mg/l NAA, 3% sucrose and 0.6% agar) for callus initiation and shoot development respectively.
3. For transformation, Agrobacterium strains ($P^{CAMBIA1301}$ containing plasmid with OsPDH45+OsGlyI+OsGlyII genes for salt and drought tolerance) will be cultured in LB medium supplemented with 50 mg/l hygromycin, at 100 rpm under 37°C for 24-48 hours. Then the bacterial cells will be suspended in MS-M1 liquid medium and will be used for infection of callus produced on MS-M1 medium and leaf segments.
4. Callus (21-28 days after initiation on MS-M1 medium in the dark at 25°C) will be sub-cultured on fresh MS-M1 medium for 7-14 days. Then the callus (3-5 mm in diameter) and separated leaf segments will be immersed in the *Agrobacterium* suspension for 60, 90 and 120 minutes for infection. Infected callus will be cultured on solid MS-M1 medium and leaf segments on MS-M2 for co-cultivation. Co-cultivation will be made in the dark at 28-30°C for 3-14 days.

5. All the media for co-cultivation and *Agrobacterium* suspension culture will be supplemented with 30 mg/l acetosyringone.
6. The co-cultivated materials will be washed two times with liquid MS-M1 and MS-M2 media supplemented with 500 mg/l cefotaxime according to Agrobacterium strains. Then washed materials will be transferred to MS-M1 and MS-M2 solid media containing 50 hygromycin according to bacterial strains and maintained 14-21 days for selection. After selection, the cultures will be sub-cultured regularly on regeneration media (MS-M2 + hygromycin 50 mg/l for leaf segments and MS-M3 containing MS + BAP 2mg/l + Kn 1mg/l + hygromycin 50 mg/l for callus) at an interval of 2-3 weeks.
7. Optimum inhibitory concentration of kanamycin will be determined using 50, 75, 100 mg/l concentrations of kanamycin in routine media.
8. After co-cultivation and selection, the expression of GUS will be analyzed histochemically in callus tissues and leaf segments as well as shoots from resistant callus and leaf segments.
9. On the other hand shoots from resistant callus and leaf segments will be cultured on the regeneration medium under fluorescent light with 16 h photo period.
10. Regenerated shoots will be cultured on rooting medium MS-M4 (MS basal medium supplemented with 5.0 mg/l NAA or IBA) containing 50 mg/l hygromycin.
11. To identify and confirm the stable incorporation of introduced genes and its expression in the transformed plants two different assays viz. GUS assay (to identify putative transformed shoots) and genetic analysis using PCR will be carried out.
12. After PCR confirmation transferred plants will be tested against salt and drought stresses using *in vitro* methods and will be maintained under in vitro contained conditions.

It may be mentioned that the methods and media might need to be changed depending on plasmid construct, responses and observations.

3.4 WORK ELEMENTS:

1. Collection of *Agrobacterium* strains
2. Culture and maintenance of *Agrobacterium* strains
3. Sugarcane explants collection and preparation
4. Media preparation and sterilization
5. Infection of sugarcane explants with *Agrobacterium*
6. Co-cultivation of *Agrobacterium* and sugarcane explants
7. Sub-culture in regeneration media
8. Detection of transformation and expression

3.5 TIME SCHEDULE:

Sl No	2025												2026	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1	→													→
2	→													→
3	→													→
4	→													→
5	→													→
6	→													→
7	→													→
8	→													→

3.6 ECONOMIC IMPACT:

It is expected to produce high yielding salinity and drought tolerant sugarcane varieties. In future receiving higher yield through cultivation of resistant variety, growers would be economically benefited.

3.7 EFFECT ON ENVIRONMENT:

This investigation will be conducted under contained condition therefore, would have no adverse impact on environment.

3.8 UTILIZATION OF RESEACH RESULTS:

Method of genetic transformation of sugarcane will be optimized. Findings of this investigation will be used for genetic transformation of sugarcane with desired gene (s) as well as the developed method will be used in conducting CRISPR/Cas9 based genome editing for improvement of different sugarcrops.

PROGRAM AREA : BIOTECHNOLOGY AND FRONTIER RESEARCH
4.0 TITLE : MICROPROPAGATION FOR MULTIPLICATION OF SUGAR CROPS
LOCATIONS : BSRI Lab. Pot and Field
INVESTIGATORS : M A Azim, A K Ghose, M R R Rajib and N Islam
NATURE OF THE STUDY : On going
PROJECTED COMPLETION : Continuous
ESTIMATED COST (TK.) : Tk. 1,50,000.00

4.1 DEFINITION OF THE PROBLEM:

In Bangladesh, the demand of sugar is increasing day by day but the area under production of sugar crops is decreasing. BSRI released high yielding, disease free sugarcane varieties may cultivate in the limited area and tissue culture derived sugarcane plantlets with superior characters will be the best solution. Among the considerations, the main candidature is long duration of this crop to cultivate by the farmers. Sugar beet (*Beta vulgaris*) have been introduced in Bangladesh which is the source of almost 40% of the world sucrose and it is a temperate crop, but can be cultivated successfully in tropical and sub-tropical regions. It is a cross-pollinating, highly heterogeneous crop and has a self-incompatibility system thus, micropropagation, *i.e.* vegetative multiplication under *in vitro* conditions can be widely used for sugar beet propagation. It is possible to multiply sugar beet from all its vegetative and generative organs such as hypocotyls, cotyledons, epicotyls, leaf, leaf stalk and dormant shoots (*Annonymous*, 2006) which can be utilized to eliminate the problem of the true seed production in our country and help to enhance the cultivation of sugar beet in Bangladesh.

Date palm and palmyra palm is economically important plants and produce juice and goor; an alternate source of sugar which can meet up the substantial demand of high shortage sugar in the country. Arabian date palm and palmyra palm fruits are sweet and used as food. True to type propagating materials are need for cultivation of Arabian date palm and palmyra palm. Propagation of these plants through seeds is not a viable proposition because of very low percentage of germination and heterozygous nature of seed grown plants.

Therefore, the present investigation has been undertaken to produce vegetative seed production of sugar beet and the propagation of date palm and palmyra palm through tissue culture technique.

4.2 OBJECTIVES:

1. Identifying the suitable sources of explants for micropropagation of sugarcane, sugar beet, Arabian date palm and palmyra palm;
2. Finding out the suitable media for micropropagation;
3. Developing tissue culture protocols and
4. Hardening plantlets for transplantation.

4.3 METHODOLOGY:

1. Hypocotyls, cotyledons, epicotyls, leaf, leaf stalk, dormant shoots, and offshoots will be used as explants for micropropagation of sugarcane, sugar beet, Arabian date palm and palmyra palm and cultured on MS medium supplemented with different concentrations and combinations of auxins and cytokinins.
2. The explants will be cut into small pieces (about 1cm long) and then will be treated with 1% savlon for 5-6 minutes with constant shaking and washed thoroughly with distilled water.
3. Then the explants will be taken under laminar airflow cabinet. Surface sterilization will be done with a 0.1% mercuric chloride solution containing two-three drops of tween-80 for five minutes under aseptic condition. Surface sterilized explants will be washed four times with sterilized distilled water.
4. Then explants will be inoculated aseptically for shooting on MS medium with different concentrations and combinations of growth regulators. Shoots will be cultured on rooting media for root production.
5. Rooted plantlets will be hardened and transplanted in the soil.

4.4 WORK ELEMENTS:

1. Explants collection and sterilization of sugarcane, sugar beet, Arabian date palm and palmyra palm
2. Media preparation
3. Inoculation and incubation of explants
4. Sub-culture
5. Observation and data collection under in vitro conditions
6. Hardening of plantlets
7. Transplantation of plantlets in the field
8. Observation and data collection in ex vitro and field conditions

4.5 TIME SCHEDULE:

Sl No	2025												2026	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1	→	→	→	→	→	→	→	→	→	→	→	→	→	→
2	→	→	→	→	→	→	→	→	→	→	→	→	→	→
3	→	→	→	→	→	→	→	→	→	→	→	→	→	→
4	→	→	→	→	→	→	→	→	→	→	→	→	→	→
5	→	→	→	→	→	→	→	→	→	→	→	→	→	→
6	→	→	→	→	→	→	→	→	→	→	→	→	→	→
7	→	→												
8	→	→	→	→	→	→	→	→	→	→	→	→	→	→

4.6 ECONOMIC IMPACT:

Sugarcane, sugar beet, Arabian date palm and palmyra palm plantlets will be produced through micropropagation which will save the seed cost and provide disease free quality seed. Farmers would get higher economic benefit out of the results of this experiment.

4.7 EFFECT ON ENVIRONMENT:

This experiment is environment friendly and there would have no adverse impact on environment.

4.8 UTILIZATION OF RESEARCH RESULTS:

Results of this investigation will be utilized as alternate source for sugarcane, sugar beet, Arabian date palm and palmyra palm plantlets production. In Bangladesh, tissue culture techniques being developed and integrated with conventional breeding programmes are playing a significant role in the agricultural improvement, and adaptation of sugarcane, sugar beet, Arabian date palm and palmyra palm. Farmers will be economically benefited from the results of this experiment.

PROGRAMME AREA : BIOTECHNOLOGY AND FRONTIER RESEARCH
5.0 TITLE : DEVELOPMENT OF SOMACLONES OF STEVIA THROUGH TISSUE CULTURE TECHNIQUES AND SUBSEQUENT MOLECULAR DIVERSITY ANALYSIS
LOCATION(S) : BSRI Lab. Pot and Field.
INVESTIGATORS : N Islam, A K Ghose, M A Azim and M R R Rajib
NATURE OF THE STUDY : On-going
PROJECTED COMPLETION : Continuous
ESTIMATED COST (TK.) : Tk. 7,50,000.00

5.1 DEFINITION OF THE PROBLEM:

Stevia is economically important medicinal plant that contains stevioside in the leaves. Stevia leaves are alternate source of sugar which can meet up the substantial demand of high shortage sugar in the country. Stevia used as medicinal purpose in case of diabetic patient. Micropropagation is a method of plant propagation which starts from very small parts of plant (shoot tip, meristem) in germ free environment. Micropropagation technology could be used as an effective tool for a rapid and cheaper means of propagation of stevia due the limited source of planting materials such as newly released high yielding varieties.

Micropropagation might be used for rapid multiplication and high quality plantlets production in stevia. Besides, it is needed to develop non flowering stevia plant or changes flowering behavior as well as stevioside content per plant in Bangladesh.

Therefore, to increase the yield of stevia utilizing micropropagated high quality plantlets and to determine the extent of diversity present in the stevia germplasm pool and accurate characterization of the materials done by using molecular markers the experiment has been undertaken.

5.2 OBJECTIVES:

1. Identification of suitable sources of explants;
2. Finding out the suitable media;
3. Production of plantlets and
4. Developing desirable non-flowering stevia plantlets and molecular diversity analysis.

5.3 METHODOLOGY:

1. Shoot tip and meristematic buds of stevia will be cultured on MS medium supplemented with different concentrations and combinations of cytokinins and auxins for shoot and root production.
2. The explants will be cut into small pieces (about 1cm long) and then will be treated with 1% savlon for 5-6 minutes with constant shaking and washed thoroughly with distilled water.
3. Then the explants will be taken under laminar airflow cabinet. Surface sterilization will be done with a 0.1% mercuric chloride solution containing two-three drops of tween-80 for five minutes under aseptic condition. Surface sterilized explants will be washed four times with sterilized distilled water.
4. Then explants will be inoculated aseptically for shooting on MS medium with different concentrations and combinations of growth regulators. Shoots will be cultured on rooting media for root production.
5. Rooted plantlets will be hardened and transplanted in the soil.
6. DNA extraction and purification will be followed by the modified mini prep CTAB method. Three individual DNA samples from a somaclone in equal volume and concentration will be pooled to form the bulked sample.
7. SSRs and ESTs primers will be used in PCR amplification.
8. Amplified DNA will be run in agarose gel by electrophoresis to separate allele specific bands.
9. Electrophoresesed gel will be documented for DNA fingerprinting using gel documentation system.
10. Documented electrophoreses gel will be scored on the basis of presence or absence of allele specific bands. Data will be analyzed to determine the relationships among all varieties, germplasm collection, and developed somaclones and cluster analysis will be carried out using computer software.

It may be mentioned that the method might need to be modified depending on responses and observations of the experiments.

5.4 WORK ELEMENTS:

1. Explants collection and sterilization of stevia
2. Media preparation
3. Inoculation and incubation of explants
4. Sub-culture
5. Observation and data collection from in vitro conditions
6. Hardening of plantlets
7. Transplantation of plantlets in the field
8. Observation and data collection from ex vitro and field conditions
9. Samples collection
10. DNA extraction, quality determination, and quantification
11. PCR amplification
12. Gel electrophoresis
13. Documentation/Imaging
14. Data collection and analysis

5.5 TIME SCHEDULE:

Sl No	2025												2026	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
2.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
3.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
4.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
5.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
6.	→	→	→	→										
7.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
8.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
9.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
10.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
11.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
12.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
13.	→	→	→	→	→	→	→	→	→	→	→	→	→	→
14.	→	→	→	→	→	→	→	→	→	→	→	→	→	→

5.6 ECONOMIC IMPACT:

Stevia cultivation in Bangladesh has the potentiality to boost up the economy by providing farmer's with a high value crop suited for meeting up the partial demand of sugar production.

5.7 EFFECT ON ENVIRONMENT:

This experiment would have no adverse impact on environment.

5.8 UTILIZATION OF RESEARCH RESULTS:

Results of this experiment will be used to develop stevia varieties having desirable characters within a shorter period of time. Farmers will be economically benefited by increasing the cultivation of superior stevia varieties.

PROGRAMME AREA : BIOTECHNOLOGY AND FRONTIER RESEARCH
6.0 TITLE : CRISPR/CAS9 BASED GENOME EDITING FOR IMPROVEMENT OF STEVIA
LOCATION(S) : BSRI Lab. Pot and Field.
INVESTIGATORS : A K Ghose, M A Azim, M R R Rajib and N Islam
NATURE OF THE STUDY : New
PROJECTED COMPLETION : Continuous
ESTIMATED COST (TK.) : Tk. 15,50,000.00

6.1 DEFINITION OF THE PROBLEM:

In BSRI, hybridization is the only method being practiced for varietal improvement of different sugar crops, especially stevia which has proved to be much less effective now a day since similar or same parentage is being used in crossing programme. As such no break-through could be expected in varietal development in future. The "Clustered Regularly Interspaced Short Palindromic Repeats" (CRISPR)/Cas9 based genome editing might be a prospective method to develop sugar crop varieties having superior quality and built-in potential against biotic and abiotic stresses.

The "Clustered Regularly Interspaced Short Palindromic Repeats" (CRISPR)/Cas9 system with Cas9 endonuclease offers a powerful targeted genetic modification apparatus for gene functional studies and ultimately heritable trait improvement. CRISPR/Cas9 system has been recently proven to be a versatile tool for genome editing and also can recruit various modifying enzymes and transcriptional activators to the targeted genomic site through fusion with Cas9. Artificial transcriptional activators provide a useful means for gene activation by administering a transcription activation domain (TAD) to a particular gene promoter at the native genomic locus via a programmable DNA-binding module. Recruitment of these regulators to promoters

adjacent to transcription start site (TSS) through the CRISPR/Cas9 system can modify the level of expression of the targeted genes. Although the modifications caused by the CRISPR/Cas9 systems are similar to naturally occurring mutations, the employment of transgenic systems during the creation of specific varieties needs to follow GMO laws in nations that rely on process-based regulations.

Therefore, the present programme on the genome editing of stevia through CRISPR/Cas9 technique has been undertaken to develop high quality stevia varieties in Bangladesh.

6.2 OBJECTIVES:

1. Identification and characterization of target gene (s) responsible for desired character through bioinformatic analysis;
2. Designing of specific and efficient single guide RNAs (sgRNAs) targeting desired gene (s);
3. Transformation, expression, isolation, and purification of CAS9 protein;
4. Establishing the protoplast isolation protocol;
5. Optimization of PEG mediated transfection of protoplast with ribonucleoprotein (RNP) and
6. Evaluation of the expression of desired edited gene (s).

6.3 METHODOLOGY:

1. The BSRI-bred variety of stevia would be used as experimental materials.
2. DNA extraction and purification will be followed by the modified mini prep CTAB method.
3. PCR amplification of the target gene (s) by using target specific primers and sequencing of the gene.
4. Specific and efficient single guide RNAs (sgRNAs) will be designed by different online tools.
5. PCR assembly and in vitro transcription of sgRNAs.
6. Designing and synthesis of CAS9 protein
7. Transformation, expression, isolation, purification, and visualization of CAS9 protein by SDS-PAGE gel electrophoresis.
8. Protoplast isolation from leaves by different combinations and concentrations of enzymes.
9. Transfection of isolated protoplast with different ribonucleoproteins (RNPs) through PEG method.
10. Total RNA isolation from transfected protoplasts and evaluation of the expression level of targeted gene (s) responsible for the desired character (s).

It may be mentioned that the method might need to be modified depending on responses and observations of the experiments.

6.4 WORK ELEMENTS:

1. Plant samples collection
2. DNA extraction, PCR amplification, and sequencing of the targeted gene (s)
3. Single guide RNAs (sgRNAs) designing, synthesis and in vitro transcription
4. Designing, synthesis, transformation, expression, isolation, purification, and visualization of CAS9 protein
5. Protoplast isolation
6. Evaluation of the efficacy of different enzyme solutions in protoplast isolation
7. Transfection of protoplasts with Different ribonucleoproteins (RNPs)
8. Evaluation of the expression level of targeted gene (s) responsible for the desired character (s).
9. Transfected protoplast culture
10. Data collection and analysis

6.5 TIME SCHEDULE:

Sl No	2025												2026	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1	→	→	→	→	→	→	→	→	→	→	→	→	→	→
2	→	→	→	→	→	→	→	→	→	→	→	→	→	→
3	→	→	→	→	→	→	→	→	→	→	→	→	→	→
4	→	→	→	→	→	→	→	→	→	→	→	→	→	→
5	→	→	→	→	→	→	→	→	→	→	→	→	→	→
6	→	→	→	→	→	→	→	→	→	→	→	→	→	→
7	→	→	→	→	→	→	→	→	→	→	→	→	→	→
8	→	→	→	→	→	→	→	→	→	→	→	→	→	→
9	→	→	→	→	→	→	→	→	→	→	→	→	→	→
10	→	→	→	→	→	→	→	→	→	→	→	→	→	→

6.6 ECONOMIC IMPACT:

Improved stevia varieties would be developed within shorter period of time. Cost and time required for variety development will be reduced.

6.7 EFFECT ON ENVIRONMENT:

This experiment is environment friendly and there would have no adverse impact on environment.

6.8 UTILIZATION OF RESEARCH RESULTS:

Results of this investigation will be utilized for varietal development of stevia. Based on the results of this experiment, further research program can be developed for specific trait of any sugar crops.

PHYSIOLOGY & SUGAR CHEMISTRY DIVISION

Rationale

In Bangladesh, Sugarcane cultivation is being gradually pushed to low-lying Char and marginal lands prone to water-logging, flood, drought and salinity stresses due to increasing demand of cereals and vegetables for the fast growing population. Of the total sugarcane production in the country only 23-27% cane is utilized for sugar production and about 53-57% usually utilized for goor manufacturing. Besides, Date palm and Palmyra palm are potential plants for goor/syrup production in the country to reduce gap between demands of sugar/*gur* and production. Therefore, screening experiments against water-logging, flood, drought and salinity stresses as well as *gur* manufacturing have been proposed. For maximizing sugarcane yield, proposed research programme has been undertaken through physiological management. Programme of cane and juice quality due to water-logging and flood have been undertaken. Trials on preservation techniques of sugarcane juice and juice collection and date palm syrup production and preservation have been proposed to explore the maximum economic return from Date palm and Palmyra palm as an alternate crop for quality *gur*/syrup production. Studies on sugarcane germination under low temperature has been proposed since majority plantation is done during November to following January in north and south west parts of Bangladesh when ambient temperature remains below 20°C which affects germination.

The another alternate sweetening agent stevia plant cultivation has been included in the current programme for the extraction of stevioside in different growth stage. For the observation of maturity behavior and goor quality of different clones under ZYT I, II and III test stages, a study has been undertaken. The maturity status and goor quality with chemical analysis will be determined through this study. In the manufacturing of goor, various chemicals hazardous to human health are used by commercial goor makers. In order to recommend a safe and environment friendly products for goor clarificants, experimentation with plants extracts clarificants like Wild Okra has been used. Research has also been undertaken to find out effectiveness of various packing devices for semi solid/ solid/granular goor and Date palm syrup preservation and suitability for super market.

LIST OF EXPERIMENTS

PHYSIOLOGY SECTION
PROGRAMME AREA : VARIETAL IMPROVEMENT

1.0 TITLE : Screening of sugarcane genotypes under ZYT-I, II & III against stress condition (a. Water logging, b. Flood, c. Drought and d. Salinity)

PROGRAMME AREA : CROPS AND SOIL MANAGEMENT

2.0 TITLE : Germination Potentiality of Advanced Sugarcane Clones under Low Temperature Stress Condition

3.0 TITLE : Determination of stevioside at different growth stage of stevia

SUGAR CHEMISTRY SECTION
PROGRAMME AREA : VARIETAL IMPROVEMENT

4.0 TITLE : Screening Sugarcane Clones Based on Maturity Behavior and *Gur* Quality

PROGRAMME AREA : SUGAR AND *GUR* PROCESSING

5.0 TITLE : Studies on Preservation Techniques of Sugarcane Juice

6.0 TITLE : Optimization study of storage time on liquid palmyra palm gur to develop *tal misri*

PROGRAMME IN DETAILS

PHYSIOLOGY SECTION

PROGRAMME AREA : SUGARCANE VARIETAL IMPROVEMENT

1.0 TITLE : SCREENING OF SUGARCANE GENOTYPES UNDER ZYT-I, II & III AGAINST STRESS CONDITION (A. Water logging, B. Flood, C. Drought and D. Salinity)

A. FOR WATER LOGGING STRESS

LOCATIONS : BSRI (Concrete tank & Field), Pabna (Ishurdi), and Natore (Lalpur)

INVESTIGATORS : M S Islam, S Arefin, F H Shanta and M A Habib

NATURE OF STUDY : On going

DURATION : Continuous

ESTIMATED COST (TK) : 1,50,000.00

1.1 DEFINITION OF THE PROBLEM:

In Bangladesh, one of the important reasons of low yield of sugarcane is water-logging problem. Due to higher demand of vegetables and cereal crops, sugarcane is gradually pushed into marginal and low lying areas and sugarcane varieties being cultivated do not have proven capabilities to grow under water-logging stress condition. As a result higher yield cannot be achieved. In this trial, sugarcane clones will be screened out having proven capabilities to grow under water-logging stress condition.

1.1.2 OBJECTIVES:

i) Selecting sugarcane clones with superior tolerance to water-logging;
ii) Finding out morphological and physiological basis for water-logging tolerance to sugarcane and
iii) Identifying parents to use in further crossing programme to develop water-logging tolerant varieties.

1.1.3 METHODOLOGY:

The BSRI bred clones as well as those collected from selected areas of Bangladesh will be included in the study to be accomplished in the following phases:

I. Testing under artificial/induced water-logging.
II. Field-testing.

I. ARTIFICIAL WATER-LOGGING TESTING IN THE YARD:

In this case, the test clones/varieties will be grown in pots, and subjecting them to standing water in a concrete water tank. Sugarcane clones of ZYT I, II, III and other selected clones will be compared with water-logging stress tolerant commercial varieties. Another set of pots will be maintained as control.

II. FIELD TESTING :

Sugarcane clones of ZYT I, II, III and other selected clones will be tested under field condition at BSRI farm as well as farmer's field at BSRI (Pot & Field), Ishurdi (Pabna), and Gaibandha.Screening of clones/varieties will be done through field testing in water-logging prone areas in order to obtain more information on their yielding potential under field water-logging stress condition at BSRI farm as well as at farmer's field under farmer's management level.

PROCEDURE:

A randomized complete block design with at least three replications will be followed for the field experiment. Normal cultural practices for sugarcane cultivation including land preparation, planting, fertilizer application, and weed control etcwill be maintained. The experimental plants will be kept under 30-90 cm deep standing water at least 60-90 days continuously.

1.1.4 WORK ELEMENTS:

I. Artificial water-logging testing trial:

i) Planting of single-budded setts to plastic pots.
ii) Placement of pots to water tank &water-logging stress treatment starts.
iii) Primordial water roots (PWR) recording at an interval of 15 days.

iv) Analysis of root characters.
v) Dissolve oxygen determination.
vi) Chlorophyll level determination.
vii) Measurement of stem elongation rate at an interval of 15 days.
viii) Grading of clones under stress condition.
ix) Green and dry leaves count at an interval of 15 days during stress period
x) Determination of fibre per cent cane.
xi) Determination of Brix per cent cane.
xii) Final data collection at harvest (volume, fresh and dry weight of water roots.

II. Field testing trial (BSRI farm):

i) Land preparation.
ii) Planting of 2-budded setts to main field.
iii) Irrigation.
iv) Weeding/Mulching.
v) 1sttop dressing of urea and MP fertilizer.
vi) 2 nd top dressing of urea, MP fertilizer/ Furadan application.
vii) Tiller count (March, April, May, June).
viii) Earthing up.
ix) Tying of cane.
x) Imposition of water-logging stress.
xi) Grading of stressed sugarcane clones at an interval of 15 days.
xii) Green and dry leaves count at an interval of 15 days during stress period.
xiii) Millable cane count.
xiv) Chlorophyll level determination.
xv) Determination of Brix per cent cane.
xvi) Yield data collection at harvest.

III. Farmer's field testing trials [Pabna, and Natore].

i) Land selection.
ii) Land preparation.
iii) Planting date fixation.
iv) Planting of 2-budded setts to main field.
v) Field visit for irrigation supervision/advice.
vi) Field visit for weeding supervision/advice.
vii) 1st top dressing supervision.
viii) 2nd top dressing of fertilizer/Furadan application supervision.
ix) Tiller recording (March, April, May and June).
x) Earthing up supervision.
xi) Grading of selected sugarcane clones at an interval of 15 days starting
xii) from 1st August until last November.
xiii) Green and dry leaves count at an interval of 15 days during water-
xiv) logging stress period.
xv) Final yield/millable canes records.

1.1.5 TIME SCHEDULE:

	2024			2025												2026
Sl. No.	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
I. Artificial water-logging trial:																
1		→	→													
2											→	→				
3											→	→	→	→		
4											→	→	→	→		
5											→	→	→	→		
6											→	→	→	→		
7											→	→	→			
8											→	→	→	→		
9											→	→	→	→		
10														→	→	→
11															→	→
II. Field testing trial (BSRI Farm):																
1	→															
2		→														
3		→	→		→	→	→									
4				→	→	→	→									
5					→	→										
6							→	→								
7						→	→	→								
8							→	→	→							
9									→	→	→					
10									→	→						
11											→	→	→	→	→	
12											→	→	→	→	→	→
13															→	→
14										→	→	→	→			
15															→	→
III. Farmer's field testing trials:																
1	→	→														
2			→	→												
3			→	→												
4			→	→												
5				→	→											
6				→	→	→	→									
7						→	→									
8									→	→						
9						→	→	→	→							
10							→	→	→							
11									→	→	→	→	→	→		
12											→	→	→	→		
13																→

1.1.6 DATA TO BE COLLECTED:

i) Volume of primordial water roots.
ii) Fresh weight of primordial water roots.
iii) Dry weight of primordial water roots.
iv) No. of green leaves per plant at an interval of 15 d.
v) No. of dry leaves per plant at an interval of 15 d.
vi) Stem elongation rate.
vii) Chlorophyll level.
viii) Grading of cane at an interval of 15d.
ix) Millable cane and Cane yield at harvest
x) Juice quality at harvest.

1.1.7 ECONOMIC IMPACT:

It is expected to get water-logging tolerant variety which would expand the scope of sugarcane cultivation to low-lying water-logging prone marginal land and sugarcane growers would get higher economic benefit out of results of this experiment.

1.1.8 EFFECT ON ENVIRONMENT:

It is environment friendly and there would not be any adverse effects on environment due to implementation of this experiment.

1.1.9 UTILIZATION OF RESEARCH RESULTS:

The expected results (tolerant variety) of water-logging stress experiment will be disseminated to potential user i.e. farmers through demonstration and training of extension personnel and farmers of water-logging stress prone areas.

B. FOR FLOOD STRESS

LOCATIONS : BSRI (concrete tank), Sirajganj and Natore (Lalpur)
INVESTIGATORS : M S Islam, M S Arefin, F H Shanta and M A Habib
NATURE OF STUDY : On going
DURATION : Continuous
ESTIMATED COST (TK) : 1,00,000.00

1.2.1 DEFINITION OF THE PROBLEM:

It is assumed that there is about 0.2 million hectare of Charland suitable for sugarcane cultivation and sugarcane is gradually pushed into flood prone Charland due to higher demand of cereals and vegetables. Sugarcane developed for high and medium high land do not grow well in these Charlands. Therefore, this experiment is undertaken to develop flood tolerant varieties.

1.2.2 OBJECTIVES:

i) Selecting clones with superior tolerance to flood stress;
ii) Finding out morphological and physiological basis for flood tolerance to sugarcane and
iii) Identifying parents to use in further crossing programme to develop flood tolerant varieties.

1.2.3 METHODOLOGY:

The BSRI bred clones as well as those collected from selected areas of Bangladesh will be included in the study to be conducted in the following phases:

I. Testing under induced flood stress condition.
II. Field-testing.

I. TESTING UNDER INDUCED FLOOD STRESS CONDITION: In this case, the test clones/varieties will be grown in Plastic pots and subjecting them to artificially made running water in a concrete water tank. Sugarcane clones of ZYT-I, II, III and other selected clones will be compared with known flood stress tolerant commercial varieties. A separate set of those clones will be maintained as check.

II. FIELD TESTING :

Sugarcane clones of ZYT-I, II, III and other selected clones/varieties will be tested under farmers field condition at Ishurdi (Pabna) and Lalpur (Natore).Screening of clones/varieties will be done through field testing in flood prone areas in order to obtain more information on their yielding potential under field flood stress condition.

PROCEDURE :

A randomized complete block design with at least three replications will be followed for the field experiment. Normal cultural practices for sugarcane including land preparation, planting, fertilizer application, weed control etc will be maintained. The experimental plants will be kept under standing water at least 60-90 days continuously.

1.2.4 WORK ELEMENTS:

I. Artificial Flood Stress testing trial:

i) Planting of single budded setts to plastic pots.
ii) Placement of pots to water tank & flood stress treatment starts.
iii) Primordial water roots (PWR) recording at an interval of 7 days.
iv) Analysis of root characters.
v) Dissolve oxygen determination
vi) Green and dry leaves count at an interval of 15 days.
vii) Grading of clones under stress condition.
viii) Determination of fibre per cent.
ix) Chlorophyll level determination
x) Final data collection at harvest.

II. Field testing trial (Farmer's field): Sirajganj and Natore

i) Land preparation.
ii) Planting of 3-budded setts to main field.
iii) Irrigation supervision.
iv) Weeding/ Mulching suppression.
v) 1st top dressing of urea and MP fertilizer application supervision.
vi) 2nd top dressing of urea and MP application supervision.
vii) Tiller count.
viii) Earthing up.
ix) Tying of cane.
x) Green and dry leaves count at an interval of 15 days.
xi) Grading of stressed sugarcane clones at an interval of 15 days.
xii) Millable cane count.
xiii) Final data collection at harvest.

1.2.5 TIME SCHEDULE :

Sl No.	2024					2025											
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
I. Artificial flood trial:																	
1				→													
2												→					
3												→	→	→			
4												→	→	→	→		
5												→	→	→	→		
6												→	→	→	→		
7												→	→	→	→		
8														→	→		
9												→	→	→	→	→	
10																→	
II. Farmer's field testing trial																	
1			→	→													
2				→													
3				→	→	→	→										
4					→	→	→	→									
5						→	→										
6										→							
7								→	→	→	→						
8										→	→						
9													→				
10												→	→	→			
11													→	→	→	→	
12																→	
13																	→

1.2.6 DATA TO BE COLLECTED:

i) Record of primordial water roots (PWR) initiation at an interval of 7 d.
ii) Fresh weight of PWR.
iii) Volume of PWR.
iv) Dry weight of PWR.
v) No. of green leaves per plant at an interval of 15 d.
vi) No. of dry leaves per plant at an interval of 15 d.
vii) Stem elongation rate.
viii) Chlorophyll level.
ix) Grading of cane at an interval of 15 d.
x) Millable canes and Cane yield at harvest.
xi) Juice quality at harvest.

1.2.7 ECONOMIC IMPACT:

It is expected to get flood tolerant variety which would expand the scope of cultivation of sugarcane to flood prone areas, and sugarcane growers of these areas would get higher economic benefit out of this experiment.

1.2.8 EFFECT ON ENVIRONMENT:

This experiment is environment friendly and there would not be any adverse effects on environment due to implementation of this experiment.

1.2.9 UTILIZATION OF RESEARCH RESULTS:

The expected outcome (flood tolerant variety) of flood stress experiment will be disseminated to potential users through demonstration and training of extension personnel, and farmers of flood stress prone areas.

C. FOR DROUGHT STRESS

LOCATION : BSRI (PVC pipe), RSRS (Thakurgaon) and Godagari (Rajshahi).
INVESTIGATORS : M S Islam, M S Arefin, F H Shanta and M A Habib
NATURE OF STUDY : On going
DURATION : Continuous
ESTIMATED COST (TK) : 1,50,000.00

1.3.1 DEFINITION OF THE PROBLEM:

In drought prone areas of Bangladesh, yield of sugarcane is low due to lack of drought tolerant varieties. To extend sugarcane cultivation in marginal land and drought prone areas development/screening of drought tolerant varieties are important. Therefore, in this trial sugarcane clones will be screened out having capabilities to grow under drought stress condition.

1.3.2 OBJECTIVES:

i) Selecting sugarcane clones with superior tolerance to drought stress;
ii) Finding out morphological and physiological basis for drought tolerance to sugarcane and
iii) Identifying parents to use in further crossing programme to develop drought tolerant varieties.

1.3.3 METHODOLOGY:

The BSRI bred clones as well as locally collected clones will be included in the study to be carried out in the following phase:

I. Testing under induced drought stress condition.
II. Field-testing.

I. TESTING UNDER INDUCED DROUGHT STRESS CONDITION:

In this case, the test clones/varieties will be grown in PVC pipe and subjecting them to artificially made drought stress by using PEG (Polyethylene Glycol 6000). Sugarcane clones of ZYT-I, II, III and other selected clones will be compared with known drought stress tolerant commercial varieties. A separate set of those clones will be maintained as check.

II. FIELD TESTING:

BSRI bred sugarcane clones of ZYT-I, II, III and other selected clones/varieties will be tested under field condition. Screening of clones/varieties will be done subjecting them to field testing in drought prone areas (Barind tract, Rajshahi and RSRS, Thakurgaon) in order to obtain more information on their yielding potential under field drought stress condition.

PROCEDURE: Single-budded setts of different test clones will be planted into 60x10cm PVC pipes each containing 6 Kg soil. Normal intercultural operations including watering, fertilization, weeding etcwill be done. Four months after planting PEG or Manitolosmoticawill be applied to 50% PVC pipes containing plants. The remaining 50% plant will serve as control. In case of field testing two budded setts will be planted to normal drought prone areas such as Godagari (Rajshahi) and RSRS (Thakurgaon) in the month of late October.

1.3.4 WORK ELEMENTS:

I. Induced drought testing trial (BSRI):

i) Planting of single-budded setts to PVC pipe.
ii) Application of water to PVC pipe as and when required.
iii) Application of PEG/Manitol to PVC pipes to create drought stress.
iv) Grading/tolerance rating at an interval of 15 days.
v) Green and dry leaves count.
vi) Leaf area index determination in June and September.
vii) Determination of Chlorophyll ‘a’ and Chlorophyll ‘b’.
viii) Determination of Proline content in stress period.

ix) Determination of Stomatal conductance in drought period.
x) Determination of Sucrose percent of juice in September.
xi) Data collection at harvest (Weight of root, root volume, fresh and dry weight of roots).

II. Field testing trial (RSRS Thakurgaon):

i) Planting of 2-budded setts to main field.
ii) Irrigation.
iii) Weeding/ Mulching.
iv) 1st top dressing of urea and MP fertilizer.
v) 2nd top dressing of urea.
vi) Grading of sugarcane at an interval of 15 days.
vii) Green and dry leaves count.
viii) Tiller count.
ix) Earthing up and tying of canes.
x) Yield data collection at harvest.

III. Farmer's field testing trial (Godagari, Rajshahi):

i) Selection of farmers/ land for setting up proposed trial.
ii) Monitoring of land preparation and fixation of planting date.
iii) Planting of 2-budded setts to main field.
iv) Field visit for irrigation, weeding & mulching.
v) 1st top dressing supervision.
vi) 2nd top dressing supervision.
vii) Tiller recording (March, April, May) and earthing up.
viii) Green and dry leaves count.
ix) Grading of selected sugarcane clones during drought stress period.
x) Millable cane count in the month of October and November.
xi) Final yield records at harvest.

1.3.5 TIME SCHEDULE:

Sl No.	2024					2025											
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
I. Artificial drought trial (BSRI yard):																	
1				→													
2				→	→	→	→										
3								→	→								
4								→	→								
5									→	→	→						
6											→			→			
7									→	→	→						
8									→	→	→						
9									→	→	→						
10														→			
11														→	→		
II. Field testing trial (RSRS, Thakurgaon)																	
1				→													
2				→	→	→											
3				→	→	→											
4							→	→									
5								→	→								
6										→	→						
7								→	→	→	→						
8								→	→	→	→						
9										→	→	→					
10									→	→	→	→				→	→
III. Farmer's field testing trial (Rajshahi)																	
1			→														
2				→													
3				→													
4					→	→	→	→									
5							→										
6									→								
7								→	→	→							
8							→	→	→	→							
9							→	→	→	→							
10															→	→	
11																→	→

1.3.6 DATA TO BE COLLECTED:

i) Tiller count in the month of March, April, May & June.
ii) No. of green leaves record at an interval of 30 d.
iii) No. of dry leaves record at an interval of 30 d.
iv) Grading of cane in the month of February and March.
v) Roots production.
vi) Chlorophyll 'a' and chlorophyll 'b'.
vii) Proline content.
viii) Leaf area index.
ix) Millable canes and Cane yield at harvest.
x) Cane quality at harvest.

1.3.7 ECONOMIC IMPACT:

It is expected to get drought tolerant variety which would expand the scope of cultivation of sugarcane to drought prone areas, and sugarcane growers would get higher economic benefit out of results of this experiment.

1.3.8 EFFECT ON ENVIRONMENT:

It is environment friendly and there would not be any adverse effects on environment due to implementation of this experiment.

1.3.9 UTILIZATION OF RESEARCH RESULTS:

It is expected to obtain drought tolerant sugarcane varieties from this trial. The drought tolerant varieties will be disseminated to potential users of this technology in sugar mills and non-mill zones through demonstration and training of extension personnel and farmers of drought stress prone areas.

D. FOR SALINITY STRESS

LOCATION : BSRI (Concrete tank) and Shatkhira (Ashasuni).
INVESTIGATORS : M S Islam, S Arefin, F H Shanta and M A Habib
NATURE OF STUDY : On going
DURATION : Continuous
ESTIMATED COST (TK) : 3,60,000.00

1.4.1 DEFINITION OF THE PROBLEM:

Southern part of Bangladesh is salinity stress prone and cultivation of sugarcane crop is hazardous. To increase productivity of crop plants in saline area is an important task for the scientists. Selection of crop variety tolerant to salinity will help to increase productivity as a whole in saline area. Considering the future productivity potential of saline areas, it will be important to conduct experiments to select BSRI bred sugarcane varieties/clones tolerant to salinity stress.

1.4.2 OBJECTIVES:

i) Selecting sugarcane clones with superior tolerance to salinity;
ii) Identifying morphological and physiological characters of salinity tolerance and
iii) Identifying parents to use in further crossing programme to develop salinity tolerant varieties.

1.4.3 METHODOLOGY:

The BSRI bred clones as well as locally collected clones will be included in the study to be carried out in the following phases:

I. Testing under induced salinity stress condition.
II. Field-testing.

I. TESTING UNDER INDUCED SALINITY STRESS CONDITION:

In this case, the test clones /varieties will be grown in plastic pot and subjecting them to artificially made salinity stress .Sugarcane clones of ZYT I, II, III and other selected clones will be compared with known salinity stress tolerant commercial varieties. A separate set of those clones will be maintained as check.

II. FIELD TESTING:

A field experiment will be set up at Shatkhira known saline areas with BSRI bred advanced clones of ZYT I, II and III. Two budded sugarcane setts will be planted in furrow. The experiment will be laid out in RCB with at least three replications. Size of unit plot will be 10 m x 5 m with one meter row spacing. Normal intercultural practices including land preparation, planting, fertilizer &furadan application, weed control etcwill be done as and where required.

PROCEDURE:

Soils of plastic pots will be treated with different levels of salt concentration (8 dSm-1, 10 dSm-1). Single-budded setts of different test clones will be planted into plastic pots. Normal intercultural operations including watering, fertilization, weeding etcwill be done. Salt will be applied to 50% pots containing plants. The remaining 50% plant will serve as control. In case of field testing two budded setts will be planted to normal salinity prone areas such as Shatkhira in the month of late October.

1.4.4 WORK ELEMENTS:

I. Induced salinity testing trial:

i) Application of salt to pot to create salinity stress.
ii) Planting of single-budded setts to pot.
iii) Application of water to pot as and when required
iv) Grading/tolerance rating at an interval of 15 days.
v) Green and dry leaves count.
vi) Observation of anatomical changes.
vii) Leaf area index determination in June and September
viii) Determination of Chlorophyll 'a' and Chlorophyll 'b'.
ix) Determination of Proline content in growth period.
x) Determination of Sucrose percent of juice in September.

II. Field testing trial (Shatkhira):

i) Land selection.
ii) Monitoring of land preparation & planting date fixation.
iii) Planting.
iv) Supervision of irrigation, mulching, weeding and insect control.
v) First top dressing of urea and MP.
vi) Second top dressing of urea and MP.
vii) Leaf and soil sample collection.
viii) Evaluate growth performance during grand growth period (grading of sugarcane).
ix) Tiller count (March, April, May and June).
x) Yield of cane, millable cane and cane quality at harvest.

1.4.5 TIME SCHEDULE:

	2024							2025						
Sl. No.	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	→													
2				→	→									
3					→									
4				→	→									
5					→	→								
6						→								
7						→	→	→						
8						→	→	→						
9								→	→	→				
10						→	→	→						
11						→	→	→						
12						→	→	→						
13												→	→	→
14														→

1.4.6 DATA TO BE COLLECTED:

i) Observation of anatomical changes of sugarcane root under different salinity levels.
ii) Proline and CSI determination under different salinity levels.
iii) Pre planting soil sample collection and analysis.
iv) Tiller count in the months of March, April, May and June.
v) Grading during salinity stress period.
vi) Soil sample collection at maximum soil salinity period.
vii) Brix reading in the months of September, October, November and December.
viii) Millable canes and Cane yield at harvest.

1.4.7 ECONOMIC IMPACT:

It is expected to get salinity tolerant variety which would expand the scope of cultivation of sugarcane to salinity prone marginal land, and sugarcane growers would get higher economic benefit out of results of this experiment.

1.4.8 EFFECT ON ENVIRONMENT:

It is environment friendly and there would not be any adverse effects on environment due to implementation of this experiment.

1.4.9 UTILIZATION OF RESEARCH RESULTS:

Present study will help to get the response of BSRI bred advanced clones under saline condition. Replacement of presently cultivated local variety by BSRI bred salt tolerant high yielding varieties will hopefully increase sugarcane production in salinity affected marginal lands and will bring economic benefits to farmers.

PROGRAMME AREA	**:**	**CROPS AND SOIL MANAGEMENT**
2.0 TITLE	**:**	**GERMINATION POTENTIALITY OF ADVANCED SUGARCANE CLONES UNDER LOW TEMPERATURE STRESS CONDITION**
LOCATION	**:**	BSRI yard and RSRS (Thakurgaon)
INVESTIGATORS	**:**	M A Habib, M S Islam, S Arefin and F H Shanta
NATURE OF STUDY	**:**	On-going
DURATION	**:**	Continuous
ESTIMATED COST (TK)	**:**	30,000.00

2.1 DEFINATION OF THE PROBLEM:

Sugarcane plantation time is generally September-November, when ambient temperature remains above 20ºC. But, sometimes, sugarcane is planted in December and January when the ambient temperature prevails below 20ºC. It is reported that sugarcane field remains vacant due to poor and uneven germination when it is planted in December-January. This poor germination is obtained due to lower ambient temperature and moisture stress during this dry season. Thus, this study has been undertaken to evaluate germination behaviour of BSRI bred advanced clones under lower ambient temperature.

2.2 OBJECTIVES:

Evaluating BSRI bred advanced sugarcane clones having inbuilt potential to germinate under lower ambient temperature.

2.3 METHODOLOGY:

A set of 3- budded 50 setts of each BSRI bred sugarcane clone under ZYT-III will be planted in the soil bed at an interval of 15 days starting from 1st November and continued up to end of February. Water will be applied regularly to keep field condition. Emergence of shoots will be recorded at an interval of 3 days.

2.4 WORK ELEMENTS:

i) Land preparation to set up proposed trial (Soil bed).
ii) Preparation of 3-budded setts and planting.
iii) Irrigation and weeding as and when required.

iv) Germination record at an interval of 3 days after emergence of 1st shoot.
v) Temperature record.

2.5 TIME SCHEDULE:

Sl. No.	2024				2025			
	1 Nov	15 Nov	1 Dec	15 Dec	1 Jan	15 Jan	1 Feb	15 Feb
1	→	→	→	→	→	→	→	→
2	→	→	→	→	→	→	→	→
3	→	→	→	→	→	→	→	→
4	→	→	→	→	→	→	→	→
5	→	→	→	→	→	→	→	→

2.6 DATA TO BE COLLECTED:

i) Germination record at an interval of 3 d.
ii) The highest germination record.
iii) No of days required to achieve the highest germination per cent.
iv) Temperature record.

2.7 ECONOMIC IMPACT:

It is expected to get cold tolerant variety that would help growers to do planting even during low temperature without gappy germination resulting higher yield of sugarcane.

2.8 EFFECT ON ENVIRONMENT:

This trial is environment friendly and there would have no adverse impact on environment.

2.9 UTILIZATION OF RESEARCH RESULTS:

This study will bring direct benefit to the sugarcane growers. They would be able re-schedule their planting time to avoid gappy and uneven germination in the field.

3.0 TITLE : **DETERMINATION OF STEVIOSIDE AT DIFFERENT GROWTH STAGE OF STEVIA**
LOCATION : BSRI Farm and Physiology and Sugar Chemistry Lab
INVESTIGATORS : M S Islam, M S Arefin, F H shanta and M A Habib
NATURE OF STUDY : NEW
DURATION : 2025-2028
ESTIMATED COST (TK) : 2,00,000/-

3.1 DEFINITION OF THE PROBLEM:

Stevia (*Stevia rebaudiana* Bert.) belongs to the family of compositae. The dry leaves of this plant are 30 times sweeter than sugar, with zero calories whereas pure extract stevioside (diterpene glycosides) in non caloric and 300 times sweeter than sugar. The stevia dried leaves powder is used in the tea cup well as other food as calorie-free sweetener. It is completely natural, safe for human health and beneficial to diabetic patients. International demands are only for high quality stevia leaves having at least 9% stevioside content. There is no buyer for stevia leaves having less then 8% stevioside. Stevioside, a compound extracted from stevia leaves, is a sweetener that stands out among the natural sweeteners. This extract is a white powder composed of stevioside and its anomers, the rebaudiosides, which are responsible for the sweetness of the compound (Higginbotham, 1983; Parpinello *et al.*, 2001). The leaves of stevia are the source of sweet glycosides. It is mainly used as a sweetener and flavor enhancer in the food and beverage industry. The chemical compound obtained from stevia is considered to be the best alternative source of sugar especially for diabetes patients. Climatic factors and agronomical practices affect the quality and quantity of yield. The concentration of stevioside in the leaves is higher when the stevia plants are grown under long days and when these plants are harvested just prior to flowering. Time of harvesting depends on land type, type of stevia and growing season.

3.2 OBJECTIVES:

i. To extract the stevioside in different time of growth stage of stevia.
ii. To analyze the quality as well as the amount of stevioside in different growth stage of stevia.
iii. To determine the amount of fresh and dry leaf.

3.3 METHODOLOGY:

The field study will be conducted at BSRI farm and in the laboratory of physiology and sugar chemistry division.

Plot Size : 2m × 2m
Replications : 03
Design : RCB
Stevia variety : BSRI Stevia 1
Date of planting : March, 2025
Gross area : 0.05 ha

3.4 DATA TO BE COLLECTED:

i) Plant height (cm)
ii) Number of leaves plant^{-1}
iii) Leaf area plant^{-1} (cm)
iv) Fresh leaf yield plant^{-1} (g)
v) Dry leaf yield plant^{-1} (g)
vii) Nutritional value of stevioside

3.5 WORK ELEMENTS:

i) Land preparation.
ii) Plantation of settlings.
iii) Irrigation.
iv) Weeding/ Mulching.
v) Sample collection
vi) Leaf yield (Kg ha^{-1}).
viii) Fresh leaf yield plant^{-1} (g)
ix) Dry leaf yield plant^{-1} (g)
x) Extraction of stevioside

3.6 TIME SCHEDULE:

Sl.No	2025									
	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov
i.	---									
ii.		---								
iii.		---	---	---						
iv.			---	---						
v.			---	---	---	---	---	---	---	
vi.			---	---	---	---	---	---	---	
vii.								---	---	---
viii							----	-		
ix							----	-		
x				-----	------	------	-----	------	-------	

3.7 ECONOMIC IMPACT:

It is expected that stevia growers would get higher economic benefit out of the results of this experiment.

3.8 EFFECT ON ENVIRONMENT:

This experiment is environment friendly and there would have no adverse effects on environment.

3.9 UTILIZATION OF RESEARCH RESULTS:

It is expected that the research results will be helpful for stevia growers. The results will also be helpful for getting higher economic benefit to the growers.

SUGAR CHEMISTRY SECTION

PROGRAMME AREA	**:**	**SUGARCANE VARIETAL IMPROVEMENT**
4.0 TITLE	**:**	**SCREENING SUGARCANE CLONES BASED ON MATURITY BEHAVIOUR AND GUR QUALITY**
LOCATIONS	**:**	BSRI Farm & laboratory of physiology & sugar chemistry division
INVESTIGATORS	**:**	M S Arefin, M S Islam, F H Shanta & M A Habib
NATURE OF STUDY	**:**	On-going
DURATION	**:**	Continuous
ESTIMATED COST (TK)	**:**	1,20,000.00

4.1 DEFINITION OF THE PROBLEM:

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.

4.2 OBJECTIVES:

i) Determining maturity behaviour of sugarcane varieties/clones and find out peak maturity period;
ii) Screening sugarcane clones suitable for gur production and
iii) Determining the quality of gur after preparation.

4.3 METHODOLOGY:

Selected sugarcane clones under ZYT-I, II & III test stages will be planted at BSRI farm in the month of October/November 2023. Similar 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. The chemical analyses of all the clones will be done once in a month with three replications. On basis of chemical analyses, the clones will be grouped as early, medium and late maturing potential. The clones showing pol % cane 10.5% and above in mid October with 0.5% reducing sugars content will be grouped as early maturity potential and the same value obtained in November and December will be grouped as mid and late maturing potential clones. *Gur* will be prepared from the same clones in the month of October, December and February by open pan boiling method without adding chemical clarificants. The physical and chemical properties of prepared *gur* will be determined within 7(seven) days of its preparation to screen suitable clones for superior quality *gur* production.

4.4 WORK ELEMENTS:

i) Land preparation.
ii) Plantation.
iii) Irrigation.
iv) Intercultural operations.
v) Top dressing of fertilizers and insecticide (Urea, MOP and Furadan).
vi) Brix survey.
vii) Chemical analysis of sugarcane.
viii) *Gur* preparation.
ix) Determination of physico-chemical properties of *gur*.

4.5 TIME SCHEDULE:

Sl. No.	2024			2025												2026		
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
i	---																	
ii	---	---																
iii		---	---	---	---	---												
iv			---	---	---	---	---											
v						---		---										
vi											---	---						
vii												---	---	---	---	---	---	---
viii													---		---		---	
ix													---		---		---	

4.6 DATA TO BE COLLECTED:

i) Brix (%), pol in juice, pol in cane, Purity (%), Reducing Sugars (%), Fibre (%) of juice.
ii) Gur recovery.
iii) Physico-chemical properties of gur.

4.7 ECONOMIC IMPACT:

It is expected to identify the clones having different maturity behaviour to widen the scope of crushing period. If early, mid and late maturing clones could be identified, sugar mills and gur makers will be benefited through introduction of maturity based crushing schedule. The millers and gur makers will get higher economic benefit.

4.8 EFFECT ON ENVIRONMENT:

This investigation is environment friendly and there would have no adverse impact on environment.

4.9 UTILIZATION OF RESEARCH RESULTS:

i) Sugar mills/*gur* makers will be benefited for introducing maturity based crushing programme for higher sugar and *gur* recovery.
ii) Research results will fulfill a part of NSB requirement for releasing sugarcane variety.
iii) Sugarcane varieties/clones grouped as early, medium and late maturing potential will be helpful for cane breeders in crossing and hybridization programme.
iv) *Gur* manufacturers will be benefited through utilization of expected research results. *Gur* makers will be able to manufacture superior quality of gur avoiding hazardous chemicals for human health.
v) It is expected that the results will be helpful for future crossing and hybridization programme in sugarcane variety development.

PROGRAMME AREA : SUGAR AND *GUR* PROCESSING
5.0 TITLE : STUDIES ON PRESERVATION TECHNIQUE OF SUGARCANE JUICE
LOCATIONS : Physiology and Sugar Chemistry Laboratory
INVESTIGATORS : M S Arefin, M S Islam, F H Shanta & M A Habib
NATURE OF STUDY : On-going
DURATION : 2023-2025
ESTIMATED COST (TK) : 1,50,000.00

5.1 DEFINITION OF THE PROBLEM:

Sugarcane is a long duration crop of high and medium high land. On an average, sugarcane is grown in 0.18 million hectares of which 50% is located in the sugar mills zones, where sugarcane is mostly used for sugar production and remaining 50% that of non-mill zone is mostly utilized for '*gur*' production. At present total annual production of sugarcane in Bangladesh is around 7.0-7.5 million tons, 23-27% of which utilize for sugar production; 53-57% use for '*gur*' production and remaining 14-24% for seed, chewing and drinking juice purpose. Sugarcane juice is available almost all over 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 flavour of 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 discolouration of sugarcane juice which can be improved by heat inactivation of enzyme. Addition of citric acid or ascorbic acid to juice also gave good pleasant dull orange colour to juice. Addition of lemon and ginger followed by pasteurization and preservation with sulphurdioxide also reduced physico-chemical changes during storage of ready-to-serve bottled sugarcane juice. In view of above information, the present investigation was envisaged to optimise the process of manufacture and preservation for ready-to-serve bottled sugarcane juice up to consumer acceptability. This technique may be a barrier to prevent deterioration of sugarcane juice during preservation period. So, this study is undertaken to find out suitable sugarcane juice preservation technique for consumption, preservation and marketing throughout the year.

5.2 OBJECTIVES:

i) Optimizing the techniques for preservation of ready-to-serve bottled sugarcane juice of consumer acceptability and
ii) Observing shelf life of preserved sugarcane juice.

5.3 METHODOLOGY:

Treatments:

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

For juice collection, mature sugarcanes will be collected from BSRI farm and carrying in goor house of Physiology and Sugar Chemistry Division. Canes were cleaned, washed and crushed by hand driven brash crusher to obtain maximum possible juice. Juice was filtered through a four layered markin cloth. Juice yields were recorded and juice were subjected to physico-chemical and sensory evaluation

5.4 DATA TO BE COLLECTED:

The following data will be taken from sugarcane juice after preservation at 7 days interval:

i) Brix (%)
ii) Pol % juice
iii) Pol % cane
iv) Purity%
v) RS%
vi) Microbial load before and after preservation of sugarcane juice

5.5 WORK ELEMENTS:

i) Collection of bottles
ii) Cane collection and crushing
iii) Bottling.
iv) Chemical analyses of juice at the time of preservation
iv) Chemical analyses of juice and microbial load after preservation

5.6 TIME SCHEDULE:

Sl. No.	2024			2025									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
i	---	---											
ii		---									---		
iii		---	---	---							---		
iv		---	---	---							---		
v		---	---	---	---	---	---				---	---	---

5.7 UTILIZATION OF RESEARCH RESULTS:

Sugarcane juice will be available to the consumers throughout the year and traders will be benefited for higher market price.

5.8 EFFECT ON ENVIRONMENT:

This experiment is environment friendly and there would have no adverse effect on environment.

5.9 UTILIZATION OF RESEARCH RESULTS:

The research findings will be helpful to preserve sugarcane juice and marketed throughout the year and will be attractive to the consumers. This will be popular to the elite people of the city.

PROGRAMME AREA : SUGAR AND *GUR* PROCESSING

6.0 TITLE : OPTIMIZATION STUDY OF STORAGE TIME ON LIQUID PALMYRA PALM *GUR* TO DEVELOP *TAL MISRI*

LOCATION : BSRI Farm and Physiology and Sugar Chemistry Lab

INVESTIGATORS : M S Arefin, F H shanta, M S Islam and M A Habib

NATURE OF STUDY : NEW

DURATION : 2025-2028

ESTIMATED COST (TK) : 1,00,000/-

6.1 DEFINITION OF THE PROBLEM:

The Palmyra is a tropical palm tree that grows indigenously in Bangladesh, India, Sri Lanka, Malaysia, Indonesia and many parts of East Africa. Cultivation requires little labour in planning the nuts and protecting them from cattle till they grow above reach. The growth of tree is very slow and it takes from 15 to 30 years to bear. The palmyra palm is a large tree growing up to 30m high and the trunk may have a circumference of over 1.5 meters at the base. The trunk is black in colour and looks like cylinders. It is also corrugated by the semicircular scars of fallen leaves. The tree can be easily recognized by its gigantic fan shaped leaves. There may be 25-40 fresh leaves and they are leathery, gray green, fan-shaped, 1-3 meters wide and folded along the midrib and they spring at the top in a clump. They are usually very tough and have thick stalks. There are two kinds of the palmyra – the male and the female. The male and female flowers are held by two different trees, never in one. Both male and female trees produce spikes of flowers but only the female plant bears fruits. However both trees are used for tap toddy. The flowers are small and appear in densely clustered spikes, developing into large, brown, roundish fruits. The male flowers are smaller than the female flowers. Though growing of this important palm has an immense potential, no determined effort has been made to bring the palm under cultivation. Palmyra referred as tree of life with nearly 800 uses including food, beverage, fiber, fodder, medicinal and timber. Among the various edible uses of the palm, the sweet sap tapped from the inflorescence for making palm sugar is of prime importance. The endosperm of the young fruit, like tender coconut, is a delicacy in summer. The petiole fiber and leaf blade are used to make products such as brushes and handicrafts. The tree serves as a source of raw material for several cottage industries. (Vengaiah PC *et al*, 2017). There are many health benefits of palm jaggery. It improves digestion, boosts the production of digestive enzymes, and facilitates bowel movement. It also boosts immunity and is rich in zinc and potassium, which help the body fight against several diseases. It also helps prevent anemia. Palm jaggery is a good source of iron that allows the body to maintain hemoglobin levels. Corresponding author. E-mail address: sac007s@gmail.com (S.K. Sonawane). On the other hand, Palm candy or “Tal misri” is a commonly prepared

confectionary product made from a combination of palm jaggery, water, and various other forms of sugars, cane sugar being the most widely used one (Borse *et al.*, 2007; Lasekan & Abbas, 2010). It is a crystalline translucent sweet candy. As a product, it has significant economic importance and is consumed extensively in many states of India. Like palm jaggery, palm candies are a good source of ascorbic acid, nicotinic acid, riboflavin, and several minerals. It also has a reasonably high percentage of carbohydrates and protein. Palm candy is produced by boiling a mixture of store-bought neera in a galvanized iron pan until it reaches its striking point. It is crystalline, sweet, and translucent. Palm candy confers several health benefits upon its regular consumption. It is said to aid in treating chickenpox, digestive problems, coughs, and colds. Palm candy is also thought to be advantageous throughout pregnancy (Lata & Kamala, 1966; Devdas *et al.*, 1969; Uzochukwu *et al.*, 1997).

6.2 OBJECTIVES:

1. To determine the perfect time to form *tal misri* from semi liquid palmyra palm *gur*;
2. To optimize the total protocol of making *tal misri* and
3. To identify the physicochemical properties of *tal misri*.

6.3 METHODOLOGY:

Liquid *gur* will be prepared from the freshly collected palmyra palm juice by tapping into the inflorescence of the palm tree using lime-added collection pots by open pan boiling method without adding chemical clarificants. After attaining a certain brix content (Final brix must be within 80 to 82 %) the semi liquid *gur* will be transferred into a earthen pot. After cooling, this earthen pot is placed into a cool place (in cold storage) for a certain period of time. It will take 3 to 4 months to 01 year to form *tal misri*.

Treatments:

T_1 = Stored for 3 months
T_2 = Stored for 4 months
T_3 = Stored for 5 months
T_4 = Stored for 6 months
T_5 = Stored for 7 months
T_6 = Stored for 8 months
T_7 = Stored for 9 months
T_8 = Stored for 10 months
T_9 = Stored for 12 months

6.4 WORK ELEMENTS:

i) Removing the dry leaves of palmyra palm tree .
ii) Messaging the inflorescence part continuously for 07 days within 15 days of initiation of inflorescences.
iii) Cutting the end part of inflorescences for 0.2 to 0.3 mm in every morning and afternoon.
iv) Then tapping into some inflorescences of palmyra palm tree using lime-added collection pots.
v) Repeatation of above mentioned process for collecting juice..
vi) Liquid gur will be prepared by open pan boiling method and double filtration without adding chemical clarificants
vii) Storage of freshly prepared liquid *gur* in a dry and cool place.
viii) Formation of *tal misri*.
ix) Determination of physico-chemical properties of *tal misri*.

6.5 TIME SCHEDULE:

Sl. No.	2025												2026		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
i			----												
ii			----												
iii				----	-----	----									
iv				----	-----	----									
v				----	-----	----									
vi				----	-----	----	----								
vii				----	-----	----	----	----	----	----	----	----	----	----	----
viii				----	-----	----	----	----	----	----	----	----	----	----	----
ix															-----

6.6 DATA TO BE COLLECTED:

i) Brix (%), pol (%) in juice, Reducing Sugars (%),.
ii) Optimum time formation of *tal misri*.
iii) Amount of prepared *tal misri* in every treatment
iv) Determination of physico-chemical properties nutritional value of *tal misri*

6.7 ECONOMIC IMPACT:

It is expected that people will get pure *tal misri*. It has multilateral health benefits. Sometimes infants and babies are fed *tal misri*. The producers will get higher economic benefit.

6.8 EFFECT ON ENVIRONMENT:

This investigation is environment friendly and there would have no adverse impact on environment.

6.9 UTILIZATION OF RESEARCH RESULTS:

i) The producers will be benefited for introducing pure *tal misri*.
ii) Research results will fulfill a research part of sugarcrop mandate part.
iii) *Tal misri* can supersede with white sugar and it is useful to health.
iv) *Tal misri* manufacturers will be benefited through utilization of expected research results. *Tal misri* makers will be able to manufacture superior quality of *tal misri* avoiding hazardous chemicals for human health.

AGRONOMY & FARMING SYSTEMS DIVISION

Rationale

Agronomy & Farming Systems Division undertakes research works to develop technologies related to improved agronomic practices of different sugarcrops. Another objective of the division is to develop sugarcane based sustainable cropping systems through inclusion of a number of crops grown as intercrops in sequence to get higher economic benefit from sugarcane field, thus enriching BSRI technology bank. Apropos to previous year's activities, research program for 2024-2025. The proposed research programs have been designed to address different agronomic problems in sugarcane cultivation, agronomic evaluation of BSRI developed sugarcane clones, intercropping of oil crops with sugarcane, optimizing pit diameter and number of setts, weed management practices in sugarcane, effect of gibberellic acid on sugarbeet yield and quality. It also includes spacing and fertilizer management of stevia. Seven experiments are designed to set-up during 2024-2025 cropping year which will be conducted at BSRI Farm and some other locations of Bangladesh.

LIST OF EXPERIMENTS

PROGRAMME AREA : VARIETAL IMPROVEMENT

1.0 Title : Performance of BSRI Developed Advanced Sugarcane Clones at Different Planting Dates

PROGRAMME AREA : CROP AND SOIL MANAGEMENT

2.0 Title : Location Based Sequential Intercropping with Sugarcane

3.0 Title : Optimizing Pit Diameter and Number of Setts per Pit for Profitable Sugarcane Production

4.0 Title : Evaluation of New Herbicides for Weed Management in Sugarcane

5.0 Title : Effect of Spacing and Fertilizer Levels on Growth and Productivity of Stevia

6.0 Title : Effects of Gibberellic Acid on Growth and Quality of Sugarbeet

PROGRAMME IN DETAILS

PROGRAMME AREA : **VARIETAL IMPROVEMENT**
1.0 TITLE : **PERFORMANCE OF BSRI DEVELOPED ADVANCED SUGARCANE CLONES AT DIFFERENT PLANTING DATES**
LOCATION : BSRI Farm
INVESTIGATORS : A K M R Islam, T A Apon, M A E Hossain, H P Roy and M A T Sohel
NATURE OF STUDY : On-going with new clones
DURATION : 2024-2025
ESTIMATED COST (Tk.) : 80,000.00

1.1 DEFINITION OF THE PROBLEM

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. The experiment is aimed to help the breeders to release high yielding and high sugar content cane varieties for commercial cultivation with package of cultural practices especially date of planting which influences the overall performance of the variety.

1.2 OBJECTIVES

i. To study the comparative performance of different promising clones;
ii. To find out the optimum date of planting for advanced promising clones of sugarcane and
iii. To generate agronomic information to meet up the requirement of National Seed Board.

1.3 METHODOLOGY

Promising sugarcane clones developed by Breeding Division will be planted in different dates under conventional system. Recommended rate of fertilizers will be applied and cultural practices will be done.

Treatments

Factor A: Promising Clones

A_1: I 94-16
A_2: I 49-17
A_3: I 75-18
A_4: I 141-18
A_5: BSRI Akh 46 (Check)

Factor B: Planting Dates

B_1: 15 December, 2024
B_2: 15 January, 2025
B_3: 15 February, 2025

Planting Method : Conventional (two budded sett)
Plot size : 6m×4m
Design : RCB
Replication : 3
Fertilizer dose : As per recommendation
Irrigation and cultural practices : As and when required

Data to be collected

1. Germination (%)
2. Tiller population ($\times 10^3$ ha^{-1}) at 90, 120 and 150 DAP
3. Millable cane ($\times 10^3$ ha^{-1}) at harvest
4. Unit stalk weight (kg), height (m), girth (cm), internodes (no.) at harvest
5. Cane yield (tha^{-1})
6. Pol (%) cane
7. Weather data

1.4 WORK ELEMENTS

1. Seed collection and sett preparation
2. Land selection and preparation
3. Basal fertilization and planting
4. Weeding and mulching
5. Irrigation
6. Fertilizer top dressing
7. Insect and pest management
8. Earthing-up & tying
9. Harvesting of cane
10. Data tabulation, analysis and reporting

1.5 TIME SCHEDULE

Activity No.	Months																	
	2024				2025												2025	
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1.	→		→		→													
2.	→	→		→		→												
3.		→		→		→												
4.			→	→	→	→	→	→	→									
5.		→	→	→	→	→	→	→	→									
6.					→	→	→	→	→	→	→							
7.			→	→	→	→	→	→	→	→	→	→						
8.												→	→					
9.														→	→	→	→	
10.																	→	

1.6 ECONOMIC IMPACT

The farmers/users of the varieties/clones of sugarcane will be able to obtain better economic return by replacing the old degenerated varieties with the new one.

1.7 EFFECTS ON ENVIRONMENT: No adverse effect on environment.

1.8 UTILIZATION OF RESEARCH RESULTS

- ❖ The results of this study will provide sufficient data and information about the promising clones for submission to the National Seed Board (NSB) for evaluation.
- ❖ The farmers may be benefited through growing the better-performed varieties (after release) in stipulated time on the basis of results of this experiment.

PROGRAMME AREA : CROP AND SOIL MANAGEMENT
2.0 TITLE : LOCATION BASED SEQUENTIAL INTERCROPPING WITH SUGARCANE
LOCATION : BSRI Farm and Chunarughat
INVESTIGATORS : M A E Hossain, T A Apon, H P Roy, M A T Sohel and A K M R Islam
NATURE OF STUDY : On-going
DURATION : 2022-25
ESTIMATED COST (TK.) : 30,000.00

2.1 DEFINITION OF THE PROBLEM

Sugarcane is planted by keeping adequate space in between two rows. This space remains vacant until full sugarcane canopy development and short duration crops can be grown in the vacant space without affecting much yield of sugarcane. Intercropping is an excellent technique to increase total yield, higher monetary return, and greater resource utilization and fulfill the diversified need of the farmers.

Nowadays farmer producing one or two intercrop in sugarcane field. Sequential Intercropping is growing of two or more crops in a sequence on the same field in a year. The succeeding crop is sown/planted after the preceding crop has been harvested. To increase the production of oil crops, Mustard and Sesame intercropped with sugarcane sequentially. This experiment has been undertaken with the following objectives:

2.2 OBJECTIVES

i. To identify the suitable variety of mustard for intercropping with sugarcane and
ii. To select the suitable combination of oil crops with sugarcane.

2.3 METHODOLOGY

Treatments:

T_1 : Sugarcane Only
T_2 : Sugarcane + Mustard (BARI Sarisha-9) - Sesame (BARI Til-4)
T_3 : Sugarcane + Mustard (BARI Sarisha-14) - Sesame (BARI Til-4)
T_4 : Sugarcane + Mustard (BARI Sarisha-17) - Sesame (BARI Til-4)
T_5 : Sugarcane + Mustard (BARI Sarisha-18) - Sesame (BARI Til-4)
T_6 : Sugarcane + Mustard (BARI Sarisha-20) - Sesame (BARI Til-4)
T_7 : Sugarcane + Mustard (Binasarisha-9) - Sesame (BARI Til-4)
T_8 : Sugarcane + Mustard (Binasarisha-11) - Sesame (BARI Til-4)

Replications	: 3
Design	: RCB
Plot size	: 6m x 6m
Planting material	: Soil Bed Settling
Cane Variety	: BSRI Akh 45
Date of planting	: December, 2024

Data to be collected

For sugarcane

1. Germination (%)/Establishment (%)
2. Tiller population ($\times 10^3$ ha^{-1}) at 90, 120, 150 and 180 DAT
3. Millable cane ($\times 10^3$ ha^{-1}) at harvest
4. Unit stalk weight (kg), height (m), girth (cm), internode (no.)
5. Cane yield (tha^{-1}) at harvest
6. Pol (%) cane at harvest
7. Economic analysis (BCR, LER).

For intercrop

1. Plant height (m)
2. Plant population ($\times 10^3$ ha^{-1})
3. Intercrop yield (tha^{-1}) at harvest
4. Economic analysis: BCR

2.4 WORK ELEMENTS

1. Seed collections
2. Land preparation
3. Basal fertilization
4. Cane plantation
5. Irrigation
6. Weeding and mulching
7. Fertilizer top dressing
8. Insect and pest control
9. Harvesting of cane
10. Data collection
11. Data tabulation, analysis and reporting

2.5 TIME SCHEDULE

Activity No.	MONTHS																		
	2023					2024												2025	
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1	→																		
2			→																
3				→															
4				→															
5						→			→										
6						→				→									
7							→			→									
8							→							→					
9															→				
10						→											→		
11																		→	

2.6 ECONOMIC IMPACT: Positive economic impact is expected.

2.7 EFFECTS ON ENVIRONMENT: Friendly to soil and environment.

2.8 UTILIZATION OF RESEARCH RESULTS:

It will help to maximize the production of oil crops and increase the yield of Sugarcane.

PROGRAMME AREA : CROP AND SOIL MANAGEMENT

3.0 TITLE : OPTIMIZING PIT DIAMETER AND NUMBER OF SETTS PER PIT FOR PROFITABLE SUGARCANE PRODUCTION

LOCATION(S) : BSRI Farm

INVESTIGATOR(S) : T A Apon, M A E Hossain, H P Roy, M A T Sohel, and A K M R Islam

NATURE OF STUDY : New

DURATION : 2024-2027

3.1 DEFINITION OF THE PROBLEM

Sugarcane is one of the most productive plant species known in terms of dry matter production as it potentially produces from 41 to 65 t of dry matter ha^{-1} $year^{-1}$. Limited horizontal expansion of sugarcane area due to industrialization of cultivable lands, the vertical growth by adopting effective crop management techniques is the option left. Among many reasons for low cane yield at farmer's field, use of conventional methods of planting associated with low plant population is considered to be of primary importance. The superior performance of the crop depends upon establishment methods as it is directly influenced by amount of harvestable solar radiation and crop stand. Recently a new technology of planting sugarcane in ditches and pits of variable size has been developed, which has not only explored the possibility of increasing plant population per unit area, but also making efficient utilization of water and applied nutrients which produces higher proportion of thick and heavy primary shoot, contributing more to final population and the yield. By considering the above-mentioned facts the experiment has been undertaken to optimize the size of the pit and number setts per pit to obtain maximum yield per unit land.

3.2 OBJECTIVE(S)

i. To identify the optimum pit diameter along with number of setts per pit and
ii. To maximize the cane yield per unit of land.

3.3 METHODOLOGY

Treatments:

Pit Diameter

P_1 : 60 cm
P_2 : 90 cm
P_3 : 120 cm
P_4 : 150 cm

Number of Two-budded Setts Per Pit

S_1 : 5
S_2 : 10
S_3 : 15

Design : RCB
Replication : 3
Cane Variety : BSRI Akh 46
Date of planting : December, 2024

Data to be collected

1. Germination (%)
2. Tiller population ($\times 10^3$ ha^{-1}) at 120, 150 and 180 DAP
3. Millable cane ($\times 10^3$ ha^{-1}) stalks at harvest
4. Unit stalk weight (kg), height (m), girth (cm), internode (no.)
5. Cane yield (tha^{-1}) at harvest
6. Pol (%) cane at harvest
7. Different economic indices (GMV, BCR etc.)

3.4 WORK ELEMENTS

1. Sett collection
2. Land selection and preparation
3. Basal fertilization and planting
4. Weeding and mulching
5. Irrigation
6. Fertilizer top dressing
7. Insect and pest management
8. Earthing-up & tying
9. Harvesting of cane
10. Data tabulation, analysis and reporting

3.5 TIME SHEDULE

Activity No.	Months																
	2024					2025											
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1			→	→													
2				→	→												
3				→	→												
4				→	→	→	→										
5				→	→	→	→	→	→	→							
6						→	→		→	→							
7				→	→	→	→	→	→	→	→	→	→	→			
8									→	→							
9															→	→	
10					→	→	→	→	→	→	→	→	→	→	→	→	→

3.6 ECONOMIC IMPACT: Positive economic impact is expected.

3.7 EFFECTS ON ENVIRONMENT: Friendly to soil and environment.

3.8 UTILIZATION OF RESEARCH RESULTS:

It will help to minimize the cost of production and increase the yield of cane per unit area of land.

PROGRAMME AREA : **CROP AND SOIL MANAGEMENT**

4.0 TITLE : **EVALUATION OF NEW HERBICIDES FOR WEED MANAGEMENT IN SUGARCANE**

LOCATION : BSRI Farm and RSRS Thakurgaon

INVESTIGATORS : H P Roy, T A Apon, M A E Hossain, M A T Sohel and A K M R Islam

NATURE OF STUDY : On-going with new herbicides

DURATION : 2024-2025

ESTIMATED COST (Tk.) : 30,000.00

4.1 DEFINITION OF THE PROBLEM

Weeds are unwanted plant populations which interfere with the utilization of land and water resources. Of the total annual loss of agricultural produce from various pests, weeds account for 45%, insects 30%, diseases 20%, and other pests 5%. Weed is one of the most important single factors for sugarcane production, upto 14.1 to 71.7% yield reduction in sugarcane occur due to weed infestation (Mani *et al.*, 1968). Hand weeding (manually) is the most common weed control practice but expensive and laborious in many cases. Therefore, the only manual weed control now is considered not to be effective for weed control in cane field. In the developed countries, herbicide is successfully used for efficient weed control. But herbicides are not widely used in Bangladesh. A very few works have been done on the use of herbicides in cane field in Bangladesh, even no effective herbicides are recommended for cane field yet. Therefore, in the present study, an attempt has been initiated to find out efficacy of different herbicides for controlling various weeds of sugarcane field for higher yield and economic benefit.

4.2 OBJECTIVES

i. To study the performance of herbicides for controlling weeds of sugarcane and
ii. To find out the weed control efficiency of herbicides as compared to control.

4.3 METHODOLOGY

Treatments:

T_1 : Control (no weeding)
T_2 : Hand weeding
T_3 : AKARI 55 SC (Atrazine 50% + Mesotrione 5%)@ 2 L ha^{-1}
T_4 : Athena 55 SC (Atrazine 50% + Mesotrione 5%) @ 2 L ha^{-1}
T_5 : Glusinat 20 SL (Glufosinate Ammonium 20%) @ 3.0 L ha^{-1}
T_6 : Cinder 30 SL (Glufosinate Ammonium 30%) @ 2.5 L ha^{-1}
T_7 : Robot 55 SC (Atrazine 50% + Mesotrione 5%) @ 2 L ha^{-1}
T_8 : Fairquat 37.4 SL (Diquat dibromide)@ 2 Lha^{-1}
T_9: Penachlor 40 SE (Pretilachlor 38.5% + Penoxsulam 1.5%) @ 2.5 L ha^{-1}
T_{10} : Rolar 75 WDG (Halosulfuron-methyl 75% W/W) @45-75 g ha^{-1}
T_{11} : Rajclean 10 WP (Pyrazosulfuron-ethyl 10%) @ 150 g ha^{-1}
T_{12} : Bensaf Gold 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{13} : D-SET 30 SL (Glufosinate Ammonium 30%)@ 3 L ha^{-1}
T_{14}: Tenx 55 SC (Atrazine 50% + Mesotrione 5%)@ 3 L ha^{-1}
T_{15}: TARON 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{16} : Maya Agun 55 SC (Atrazine 50% + Mesotrione 5%) @ 3.5 L ha^{-1}
T_{17}: Diamond 20SL (Diquat 200g/L) 100g ha^{-1}
T_{18} : Cover 55SC (Atrazine 50% + Mesotrione 5%) @ 2 L ha^{-1}
T_{19} : Limisan 55SC (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{20} : Safalsan 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{21} : Utisan 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{22} : Atrameso 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{23} : PCI-Quat 20 SL (Diquat Dibromide)@ 2 kg ha^{-1}
T_{24} : Jholok 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{25} : Matzine 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{26} : Total mine 72 SL (2,4-D Amine salt 72%) 500 L ha^{-1}
T_{27} : Nirtisan 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{28} : Agro Herb 55 SC (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{29} : R-Quat-Methyl 20SL (Di Quat Dibromide) @2 L ha^{-1}
T_{30} : Easiquat 20 SL (Diquat Dibromide 20%) @2 L ha^{-1}
T_{31} : Nibuchlor 40 SC (Pretilachlor 38% + Prnoxsulam 1.5%) @ 1.3 L ha^{-1}
T_{32} : Impisan (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{33} : Prestige (Atrazine 50% + Mesotrione 5%) @ 2.5 L ha^{-1}
T_{34} : Arrow 55 SC (Atrazine 50% + Mesotrione 5%) @ 2 L ha^{-1}
T_{35} : Byzine 26 OD (Atrazine 25% + Topramezone 1%) @ 3 L ha^{-1}
T_{36} :Nicon 24 OD (Atrazine 25% + Nicosulfuron 4%) @ 2 L ha^{-1}
T_{37} :Take off 55 SC (Atrazine 50% + Mesotrione 5%) @ 2 L ha^{-1}

Planting material : Two budded setts
Plot size : 6m × 6m
Replications : 3
Design : RCB
Cane Variety : BSRI Akh 43
Time of planting : December, 2024
Fertilizer dose : As per BSRI recommendation
Herbicides application : As per treatments

Data to be collected

For sugarcane

1. Germination (%)
2. Tiller population (10^3 ha^{-1}) at 90, 120 and 150 DAT
3. Millable cane (10^3 ha^{-1})
4. Unit stalk weight (kg), stalk height (m), stalk girth (cm), internodes/cane (no.) at harvest
5. Cane yield (tha^{-1})
6. Pol (%) cane
7. Economic analysis

For weeds

1. Weed species found on experimental plots
2. Mean weed intensity (m^{-2}) at 30, 60, 90 and 120 DAT
3. Dry weight of weeds (gm^{-2}) at 30, 60, 90 and 120 DAT
4. Weed control efficiency (%)

4.4 WORK ELEMENTS

1. Land preparation
2. Pre emergence herbicides application
3. Basal fertilization, planting of cane and irrigation
4. Post emergence herbicides application
5. Irrigation
6. Fertilizer top dressing
7. Insect and pest management
8. Harvesting of cane
9. Biometry of harvested cane
10. Data collection, tabulation, analysis and reporting

4.5 TIME SCHEDULE

Activity No.	Months																
	2024					2025											
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1		→															
2			→														
3				→													
4						→											
5				—	—	—	—	—	—	→							
6								—	—	→							
7							—	—	—	—	—	—	→				
8																—	→
9																	→
10				—	—	—	—	—	—	—	—	—	—	—	—	—	→

4.6 ECONOMIC IMPACT: Positive economic impact is expected.

4.7 EFFECTS ON ENVIRONMENT: No much adverse effect on environment.

4.8 UTILIZATION OF RESEARCH RESULTS:

Expected results of the experiment will encourage farmers to apply herbicides in sugarcane field for controlling the weeds economically.

PROGRAMME AREA : CROP AND SOIL MANAGEMENT

5.0 TITLE : EFFECT OF SPACING AND FERTILIZER LEVELS ON GROWTH AND PRODUCTIVITY OF STEVIA

LOCATION : BSRI

INVESTIGATORS : A K M R Islam, T A Apon, M A E Hossain, H P Roy and M A T Sohel

NATURE OF STUDY : New

DURATION : 2024-2027

ESTIMATED COST : 50,000.00 (TK.)

5.1 DEFINITION OF THE PROBLEM

Stevia (*Stevia rebaudiana*) is being domesticated and cultivated in many countries like Japan, China, Taiwan, Korea, Mexico, USA, Thailand, Malaysia, Indonesia, Australia, Tanzania, Canada, Abkhazia, and Russia because of the sweetness of the leaf extract, having sweetener power 300 times greater than cane sugar. Industrial crops should not be grown as pure crops as food crops requirement is also increasing. Considering the need for higher food production, stevia needs to be introduced as a sugar crop. Industrial monocultures may pose potential hazards of continuous cropping including suppression of soil fertility, productivity and sparing food crops as well as market glut. By considering the above-mentioned facts, the current study is undertaken with the following objectives:

5.2 OBJECTIVES

i. To find out the effect of spacing and fertilizer on leaf yield of stevia and
ii. To determine the optimum spacing and fertilizer dose of stevia.

5.3 METHODOLOGY

Treatments:

Spacing Fertilizer Dose per Hectare

S_1 : 50×50 cm	F_1 : 100:30:40 Kg NPK
S_2 : 50×40 cm	F_2 : 110:40:50 Kg NPK
S_3 : 40×40 cm	F_3 : 120:50:60 Kg NPK
S_4 : 40×35 cm	

Replications	: 3
Design	: RCB
Plot size	: 4m x 4m
Planting material	: Stevia seedlings
Date of planting	: February, 2025

Data to be collected

Establishment % of seedling

1. Plant population (m^{-2})
2. Leaf yield (kg ha^{-1})
3. Unit leaf weight (g), plant height (cm), individual plant weight (g), individual plant leaf weight (g)
4. Fresh biomass
5. Total antioxidant activity (µmolg^{-1} fresh leaf)
6. Total phenolic compound

5.4 WORK ELEMENTS

1. Seed collections
2. Land preparation
3. Basal fertilization
4. Stevia plantation
5. Irrigation
6. Weeding and mulching
7. Fertilizer top dressing
8. Insect and pest control
9. Harvesting of cane
10. Data collection
11. Data tabulation, analysis and reporting

5.5 TIME SCHEDULE

Activity No.	MONTHS																		
	2024					2025												2026	
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1			→																
2			→																
3				→															
4				→															
5			→	→	→														
6						→	→	→	→	→	→								
7							→	→	→	→	→								
8						→	→	→	→	→	→	→	→	→					
9														→	→				
10					→	→	→	→	→	→	→	→	→	→	→	→	→		
11																		→	→

5.6 ECONOMIC IMPACT: Positive economic impact is expected.

5.7 EFFECTS ON ENVIRONMENT: Friendly to soil and environment.

5.8 UTILIZATION OF RESEARCH RESULTS:

The experiment will determine the optimal spacing and fertilizer levels for maximizing stevia leaf yield while assessing their effects on plant growth, productivity, and soil health. It will provide insights into the most efficient agronomic practices for sustainable stevia cultivation.

PROGRAMME AREA : CROP AND SOIL MANAGEMENT

6.0 TITLE : EFFECTS OF GIBBERELLIC ACID ON GROWTH AND QUALITY OF SUGARBEET

LOCATION : BSRI Farm

INVESTIGATORS : T A Apon, M A E Hossain, H P Roy, M A T Sohel and A K M R Islam

NATURE OF STUDY : New

DURATION : 2024-2027

ESTIMATED COST (TK) : 30,000.00/-

6.1 DEFINITION OF THE PROBLEM

Gibberellic acid (GA_3) is a plant hormone known to influence growth, development and flowering. It has been widely used in agriculture to enhance crop yield and quality. Sugarbeet, an important crop for sugar production, is sensitive to hormonal treatments. Different sugarbeet varieties exhibit varying responses to external stimuli, including plant hormones. By considering the above-mentioned facts this research aims to fulfill the following objectives:

6.2 OBJECTIVES

i. To investigate the interaction effect of GA_3 and different sugarbeet varieties on growth and quality parameters and

ii. To optimize GA_3 application strategies for specific varieties to maximize yield and sugar content.

6.3 METHODOLOGY

Treatments:

Foliar spraying of GA_3		**Variety**	
S_1	: 75 mgL^{-1}	V_1	: KWS Allanya
S_2	: 150 mgL^{-1}	V_2	: KWS Desideria
S_3	: 225 mgL^{-1}	V_3	: SesVanderhave
S_4	: 0 mgL^{-1}		

Plot size	: 4m × 4m
Design	: RCB
Replication	: 3
Sowing date	: 15 December, 2024
Frequency of GA_3 spraying	: 30, 60 and 90 DAS
Irrigation and cultural practices	: As and when required

Data to be collected

1. Germination (%)
2. SPAD value
3. Plant height (cm)
4. Beet length (cm)
5. Beet diameter (cm)
6. Shoot fresh weight ($gplant^{-1}$)
7. Beet fresh weight ($gplant^{-1}$)
8. Shoot dry weight ($gplant^{-1}$)
9. Beet dry weight ($gplant^{-1}$)
10. Unit beet weight (g)
11. Yield of sugarbeet (tha^{-1})
12. Pol (%) in beet at harvest
13. Root elongation rate as compared to control

6.4 WORK ELEMENTS

1. Land preparation
2. Basal fertilization
3. Seed sowing
4. Irrigation
5. Weeding and mulching
6. Fertilizer top dressing
7. Foliar spraying of GA_3
8. Insect and pest management
9. Harvesting of sugarbeet
10. Data collection, tabulation and analysis

6.5 TIME SHEDULE

Activity No.	Months																
	2024					2025											
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1.					→												
2.					→												
3.					→												
4.						→				→							
5.					→		→										
6.					→												
7.							→			→							
8.					→						→						
9.											→						
10.					→						→						

6.6 ECONOMIC IMPACT: Positive economic impact is expected

6.7 EFFECTS ON ENVIRONMENT: No adverse effect on environment.

6.8 UTILIZATION OF RESEARCH RESULTS:

The results of this study will provide necessary data about optimized GA_3 application strategies for specific sugarbeet varieties to maximize yield and sugar content.

SOILS AND NUTRITION DIVISION

Rationale

The goal of sustainable crop production and Nutritional security can be achieved through a constant monitoring and correcting the existing and emerging nutrient deficiencies. Climate change and land degradation is a crucial and important issue to our country as well as to the global perspective. To face that challenges Soils and Nutrition Division has been conducting researches with major emphasis on organic and inorganic fertilizer management packages for sustainable sugar crop production. Furthermore, isolation and application of nitrogen fixing and phosphate solubilising bacteria from sugar crop soil-plant system is a continuous activity for developing biofertilizer to maintain soil fertility and increased yield of sugar crop. For the cropping year 2024-2025, 5 (Five) research programmes have been proposed. The proposed programmers will address the existing problems aimed at desirable solutions to provide appropriate nutrient packages for sustainable sugar crop production, which are technically sound, economically attractive and environmentally safe.

LIST OF EXPERIMENTS

Soil Fertility

1.0	Title	:	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	Title	:	Nutrient Management of Sugarcane for Different Spacing
3.0	Title	:	IPNS Based Nutrient Management for Cultivation of Sugarcane with Intercrops
4.0	Title	:	Effect of Vermicompost on Nutrient Uptake, Growth and Yield of Sugarcane In Saline Soil
5.0	Title	:	Effect of fertilizer management on growth, yield and quality of chewing cane black ruby

PROGRAMME IN DETAILS

1.0 NUTRIENT REQUIREMENT FOR SUSTAINABLE SUGAR CROPS PRODUCTION UNDER DIFFERENT AEZs

1.1 TITLE	**:**	**NUTRIENT REQUIREMENT FOR SUSTAINABLE SUGARCANE PRODUCTION UNDER DIFFERENT AEZs**
LOCATIONS	**:**	Shibgonj, Chapai Nawabgonj and Chuadanga
INVESTIGATORS	**:**	M A Haque, M H Rahman, G M A Hossain, M A Sayeed, M K Begum and M Obaidullah
NATURE OF STUDY	**:**	Ongoing
PROJECTED COMPLETION	**:**	Continuous
ESTIMATED COST (TK)	**:**	75,000.00

1.1.1 DEFINITION OF THE PROBLEM:

Sugarcane is a long duration and exhaustive crop which consumes high amount of soil nutrients. Nutrient requirement of sugarcane differs from place to place according to soil and agro-climatic conditions over space and time. Yield potentiality of a crop would not reach a maximum unless proper fertilizer management is practiced. It is spectacular that the poor sugarcane yield is largely attributed to improper use of fertilizer. The inherent capacity of soil to supply nutrients is gradually declining over time for its nutrient mining due to intensive crop cultivation and some other manipulations. With the advancement of technology there would be a continuous need for updating the nutrient requirement of sugarcane at different Agro-Ecological Zones. In view of this, the experiment has been undertaken to find out the nutrient requirement for sugarcane cultivation in different AEZs that will be helpful for updating the next Fertilizer Recommendation Guide.

1.1.2 OBJECTIVE:

To find out the optimum and economic nutrient requirement for sustainable sugarcane production in different AEZs

1.1.3 METHODOLOGY:

The experiment will be conducted at two locations viz. Chapai Nawabganj (AEZ 10) & Chuadanga (AEZ 11). The experiments will be set up at the farmers' field following randomized complete block design with three replications.

Treatments:

T_1 - Control ;
T_2 - Recommended Fertilizer Dose (FRG,2024)
T_3 - Soil Test Basis Fertilizer Dose (STB)
T_4 - 75% of STB
T_5 - 125% of STB
T_6- 150% of STB
T_7 - Khamari App

Design : RCB; Replication: 3; Plot size: 8m x 6m; No. of lines/plot: 8 (8m long)
Gross area : 0.33 acre; Planting material: 2- budded sett
Variety : BSRI Akh 46

1.1.4 DATA TO BE COLLECTED:

1. Physical and chemical properties of initial and post harvest soils
2. Germination counting at 90 days after plantation (DAP)
3. Tiller counting at 150 and180 days after plantation (DAP)
4. Sheath and leaf blades to be analyzed for different nutrient elements at 150 DAP and at 300 DAP
5. Millable cane, cane diameter, cane height, yield and Brix at harvest

1.1.5 WORK ELEMENT:

Activity No.	Name of activity
1	Layout of the field experiments and initial soil sample collection
2	Basal fertilizer application and plantation of sett in the field
3	First top dressing of urea and MOP at 120 DAP
4	Tiller counting at 120 days after plantation (DAP)
5	Second top dressing of urea and MOP at 150 DAP
6	Tiller counting at 150 DAP and 180 DAP
7	Sucrose content before two days of harvest
8	Millable cane counting at harvest
9	Leaf tissues to be analyzed for different nutrient elements at 300 DAP
10	Yield of cane at harvest
11	Post harvest soil sample collection
12	Soil and plant analyses for different nutrients

1.1.6 TIME SCHEDULE:

AC No.	Year	2024				2025											
	Month	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1		→															
2			→														
3						→											
4,5							→										
6							→										
7							→										
8														→			
9-12		→	→	→	→	→	→	→	→	→	→	→	→	→	→		

1.1.7 ECONOMIC BENEFIT :

Location specific recommended fertilizers application for growing sugarcane will reduce cost of production as well as ensure higher sugarcane yield. Therefore sugarcane growing farmers will be economically benefited.

1.1.8 EFFECT ON ENVIRONMENT:

The uses of recommended balanced dose of fertilizers based on the location specific results have no harmful effect on the soil, the crop and the consumer.

1.1.9 UTILIZATION OF RESEARCH RESULTS:

The findings of the study will be useful to the sugarcane farmers and extension workers to improve productivity and ensure good quality of sugarcane.

1.2 TITLE : **EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, BIOMASS YIELD, QUALITY AND NUTRIENT CONTENT OF STEVIA (*STEVIA REBAUDIANA* BER.)**

LOCATIONS : BSRI Farm, Ishurdi (AEZ 11)

INVESTIGATORS : M H Rahman, S Islam, M A Sayeed, M A Haque, K M Alam and M S Arefin

NATURE OF STUDY : New

PROJECTED COMPLETION : 2023-2025

ESTIMATED COST (Tk) : 75,000.00

1.2.1 DEFINITION OF THE PROBLEM:

Stevia (*Stevia rebaudiana* Bertoni) is an herbaceous perennial plant of the Asteraceae family. Dry leaves are the economic part of the stevia plant, with a high concentration of steviol glycosides, which are 300-400 times sweeter than sugarcane and sugarbeet but importantly without any calories. Fertilizer requirement for stevia is moderate and varies according to the environment and soil type. Due to the short time of stevia introduction as a new crop in Bangladesh, there is no information available on nutrient requirement. The aim of the present work is to determine the optimum nitrogen (N), phosphorus (P), and potassium (K) levels for higher dry leaf yield and steviol glycosides content and their accumulation in stevia plant.

1.2.2 OBJECTIVE:

Finding out the economically suitable integrated nutrient management practice for stevia production.

1.2.3 METHODOLOGY:

The experiment will be conducted at one location of BSRI Farm(AEZ 11) Ishurdi following pot and field experiment. The experiments will be set up with randomized complete block design for field experiment and completely randomized design for pot experiment with three replications under the following treatments

T_1 - Control (Native soil fertility)
T_2 - Soil Test Based Fertilizer Dose (STB)
T_3 -75% of STB + FYM @ 3 t ha^{-1}
T_4 -75% of STB + Vermicompost @ 1 t ha^{-1}
T_5 -100% of STB + FYM @ 3 t ha^{-1}
T_6-100% of STB + Vermicompost @ 1 t ha^{-1}
T_7-125% of STB + FYM @ 3 t ha^{-1}
T_8-125% of STB + Vermicompost @ 1 t ha^{-1}
T_9-125% of STB .

Design : RCB (for Field Experiment) and CRD (for pot experiment); Replication: 3; Plot size: 2m x 3m; No. of lines/plot : 4 (3m long)
Gross area : 0.15 acre; Planting material: Stevia seedlings
Variety : BSRI Stevia 1

1.2.4 DATA TO BE COLLECTED:

1. Physical and chemical properties of initial and post harvest soils
2. Plant height, fresh biomass yield, fresh leave yield and dry leave yield
3. Root length,shoot length of stevia plant.

1.2.5 WORK ELEMENT:

Activity No.	Name of activity
1.	Layout of the field experiments and initial soil sample collection
2.	Basal fertilizer application and plantation of sett in the field
3.	First top dressing of urea and MOP
4.	Second top dressing of urea and MOP
5.	Leaf tissues to be analyzed for different nutrient elements at harvest
6.	Yield of Stevia
7.	Post harvest soil sample collection
8.	Soil and plant analyses for different nutrients

1.2.6 TIME SCHEDULE:

AC No.	Year	2024				2025											
	Month	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1			→														
2				→		→											
3				→		→											
4						→											
5						→											
6							→		→								
7										→							

1.2.7 ECONOMIC IMPACT:

It is expected that stevia growers would get higher economic benefit out of the results of this experiment.the total cost of production will be reduced.

1.2.8 EFFECT ON ENVIRONMENT:

This experiment is environmental friendly and there would have no adverse effects on environment.

1.2.9 UTILIZATION OF RESEARCH RESULTS:

The findings of the study will be useful for stevia growers and also be helpful for getting higher economic benefit to the growers.

2.0 TITLE : NUTRIENT MANAGEMENT OF SUGARCANE WITH DIFFERENT SPACING
LOCATION : BSRI Farm and RSRS Thakurgaon
INVESTIGATORS : M A Haque, K M Alam, M H Rahman, S Islam, M A Sayeed and M S Hossain
NATURE OF STUDY : Ongoing
PROJECTED COMPLETION : 2022-2025
ESTIMATED COST (Tk) : 100,000.00

2.1 DEFINITION OF THE PROBLEM:

Sugarcane (*Saccharum officinarum* L.) is a long duration crop producing huge biomass for which it requires optimum management practices. It faces various challenges during its growth cycle to attain its potential yield. Various constraints responsible for low productivity of sugarcane are low germination percentage, use of poor quality seed, inappropriate planting method and other management practices. Conventional planting of sugarcane is less time taking but is not suitable in terms of crop growth, productivity and profitability. In conventional planting closer row spacing and flat method of planting of setts impose serious problems like insect pest infestation, hampers mechanical and inter-culture operations and labor intensive etc. Adoption of suitable planting method and row spacing may help to solve the problem. Kumar (2019) reported that adoption of 90 cm row spacing resulted in enhanced productivity. Crop management techniques which allow minimal loss of seed and nutrient and better utilization of applied resources and nutrients need to be adopted. Improper row spacing, improper and imbalance use of fertilizer and no earthing up or earthing up at improper time are some of the reasons which cause the sugarcane crop to lodge due to which cane yield and quality is badly affected (Anwar *et al.* 2002). Though narrower spacing less than 90 cm is not suitable for better yield and quality of sugarcane but due to lack of knowledge farmers are practicing narrower spacing for cultivation of the crop, thus yield and profitability of sugarcane cultivation are declining in Bangladesh. For narrower spacing plant population of sugarcane increased and requirement of fertilizers also increased.

Considering these factors present study has been carried out to investigate the fertilizer requirement of sugarcane in different row spacing, soil fertility and profitability.

2.2 OBJECTIVES:

i) Determining fertilizer requirement of sugarcane for different row spacing and
ii) Comparing soil fertility status and economics of different row spacing for sugarcane cultivation.

2.3 METHODOLOGY:

The experiment will be conducted at two locations viz. BSRI farm, Ishurdi (AEZ 11) and RSRS farm Thakurgaon (AEZ 1). The variety BSRI Akh 46 will be taken as experiment material for this experiment.

Treatments:

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'2024
F_2= 110% RFD
F_3= 125% RFD

Design: RCB; Replication: 3; Plot size: 8m × 6m; Number of plots: 27; Variety: BSRI Akh 46
Method of planting: 2 budded sett; Recommended fertilizer dose: As per Fertilizer Recommendation Guide (FRG) 2024.

2.4 DATA TO BE RECORDED:

1. Determination of initial soil nutrient statuses for soil pH, Organic C, CEC, and NPKSZnB
2. Tiller dynamics across the growing period
3. Millable cane, height, girth, yield and sucrose content of sugarcane at harvest
4. Determination of post harvest soil for soil pH, Organic C, CEC, and NPKSZnB

2.5 WORK ELEMENTS & TIME SCHEDULE:

Activity No	Name of activities
1	Plot selection
2	Land preparation and initial soil collection
3	Fertilizing and Planting (sugarcane)
4	Germination(%) count.
5	Tiller count at 150 and180 DAP
6	Intercultural operation
7	Disease and pest Management
8	Millable cane, cane diameter, cane height, Brix (%),Pol % cane ,yield and nutrient uptake at harvest
9	Post harvest soil collection

2.6 TIME SCHEDULE:

Ac. No.	Year	2024				2025											
	Month	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1		→															
2			→														
3				→													
4						→											
5					→	→	→	→	→	→							
6					→	→	→	→	→	→	→	→	→	→			
7						→	→	→	→	→	→	→	→	→			
8																	→
9																	→

2.7 ECONOMIC BENEFIT:

Use of balanced fertilizers improves crop yield and quality. Appropriate dose of sugarcane for different row spacing will enhance sugarcane productivity and farmers profitability.

2.8 EFFECT ON ENVIRONMENT:

Use of balanced fertilizer in sugarcane production has no adverse effect on environment. It is environment friendly practice.

2.9 UTILIZATION OF RESEARCH RESULT:

The findings of the study will help farmers, researchers and extension personnel to understand the benefit and adoption of sustainable fertilizer management practices of sugarcane for different row spacing.

3.0 TITLE	**:**	**IPNS BASED NUTRIENT MANAGEMENT FOR CULTIVATION OF SUGARCANE WITH INTERCROPS**
LOCATIONS	**:**	BSRI Farm (AEZ 11)
INVESTIGATORS	**:**	S Islam, M A Sayeed, M A Haque, K M Alam and M H Rahman
NATURE OF STUDY	**:**	Ongoing
PROJECTED COMPLETION	**:**	2022-2025
ESTIMATED COST (Tk)	**:**	1,00,000.00

3.1 DEFINITION OF THE PROBLEM:

In Bangladesh soil fertility status is degrading day by day due to unnecessary use of inorganic fertilizers. It is necessary to develop economically suitable fertilizer management package with organic materials and inorganic fertilizers. There is need to encourage more productive, cost efficient and ecofriendly farming system. The use of organic manure has been the need for improving the sustainable productivity of soil. In Bangladesh, average organic matter content of soils have gone down from about 2% to 1.5% over the past twenty years due to intensive cultivation. Due to continuous mono-cropping and only application of inorganic fertilizer the sugarcane soils are quickly becoming unfertile. Some organic materials, viz. Green manure, Legume crops, Organic fertilizer and Vermicompost are available in our country. Recently, Biofertilizer has developed by Soils and Nutrition Division, BSRI. These organic materials could be recycled back in soil nutrition through biodegradation. Consequently, they could satisfy the high demand of nutrients for sustained production of sugarcane in our poor soils maintaining a suitable nutrient balance. Moreover, organic farming is becoming increasingly popular in the country because of its balanced supply of macro-and-micro nutrients essential for healthy growth and development of crop plant. Hence, a study has been undertaken to bring out the possibility of using these organic materials with integrated plant nutrition system (IPNS) based inorganic fertilizers for sustaining productivity of sugarcane.

3.2 OBJECTIVE:

1. To develop integrated nutrient management strategy for sugarcane with intercrops based cropping patterns;
2. To determine the effect of integrated nutrient management practices of sugarcane based cropping pattern on soil properties and
3. To evaluate the economics of integrated management practices of sugarcane based cropping pattern.

3.3 METHODOLOGY:

The experiment will be conducted at BSRI Farm (AEZ 11). The experiments will be conducted following randomized complete block design with three replications. The following treatments will be considered for the experiment.

Treatments:

T_1= N_{183} P_{69} K_{122} S_{26} Zn_3 $B_{2.5}$ kgha^{-1} as per FRG'2024
T_5= GM @ 5 t/ ha + IPNS based NP KSZnB kgha^{-1}
T_2= Biofertilizer @10 kg/ha + IPNS based NP KSZnB kgha^{-1}

T_3= Mungbean @ 5 t/ha + IPNS based NP KSZnB kgha^{-1}
T_4= CarewÕs Organic Fertilizer @3 t/ha + IPNS based NP KSZnB kgha^{-1}
T_6 = VC @5 t/ha + IPNS based NP KSZnB kgha^{-1}
NPK Based on 20% mineralization of organic material.

Design: RCB; Replication: 3; Plot size: 8m x 6m; No. of lines/plot: 8 (6m long)
Gross area: 0.33 acre; Planting material: 2- budded sett
Variety: BSRI Akh 48

3.4 DATA TO BE COLLECTED:

1 Physical and chemical properties of initial and post-harvest soils.
2 Germination counting at 60 and 90 days after plantation (DAP).
3 Tiller counting at 120, 150 and180 days after plantation (DAP).
4 Sheath and leaf blades to be analyzed for different nutrient elements at 120 DAP and at 300 DAP.
5 Millable cane, cane diameter, cane height, yield, Brix and Pol at harvest.

3.5 WORK ELEMENT:

Activity No.	Name of activity
1	Layout of the field experiments and initial soil sample collection
2	Basal fertilizer application and plantation of sett in the field
3	First top dressing of urea and MOP at 120 DAP
4	Tiller counting at 120 days after plantation (DAP)
5	Leaf tissues to be analyzed for different nutrient elements at 120 DAP
6	Second top dressing of urea and MOP at 150 DAP
7	Tiller counting at 150 DAP and 180 DAP
8	Sucrose content before two days of harvest
9	Millable cane counting at harvest
10	Leaf tissues to be analyzed for different nutrient elements at 300 DAP
11	Yield of cane at harvest
12	Post harvest soil sample collection
13	Soil and plant analyses for different nutrients

3.6 TIME SCHEDULE:

AC No.	Year	2024				2025											
	Month	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1		→															
2		→	→														
3					→	→											
4,5						→	→										
6						→	→	→									
7							→	→									
8															→	→	
9-12																→	
13		→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→

3.7 ECONOMIC IMPACT:

Positive economic impact is expected. Use of IPNS based fertilizer management for sugarcane with intercrop production reduce production cost, increase production, profitability and as well as maintain soil health.

3.8 EFFECT ON ENVIRONMENT:

IPNS based nutrient management for sugarcane based intercropping cropping pattern has no adverse effect on environment. Thus this experiment is environment friendly.

3.9 UTILIZATION OF RESEARCH RESULTS:

The findings of the study will help farmers, researchers and extension personnel to understand the benefit and adoption of IPNS based nutrient management for sugarcane based intercropping cropping pattern.

4.0 TITLE : **EFFECT OF VERMICOMPOST ON NUTRIENT UPTAKE, GROWTH AND YIELD OF SUGARCANE IN SALINE SOIL**

LOCATIONS : Paikgacha, Khulna District

INVESTIGATORS : M A Sayeed, M A Haque, S Islam, M H Rahman and M S Arefin

NATURE OF THE STUDY : New

PROJECTED COMPLETION : 2024-2025

ESTIMATED COST (Tk) : 1,50,000.00

4.1 DEFINITION OF THE PROBLEM:

Expansion of sugarcane growing regions is directed to marginal land because the available arable land is mainly used for food crops. One of the marginal land which is used for sugarcane plantation is saline soil which is spread out along the coastal region (Sembiring *et al.* 2008). Sugarcane is a salinity tolerant crop. It can grow easily up to dS 14 of salinity. Salinity at highest concentration in soil solution has a negative effect on growth and development of sugarcane. For effective expansion of sugarcane, it is essential to minimize the negative effect of high salt concentration by different management practices. Vermicompost could be a break through solution to minimize the salinity problem for sugarcane cultivation. Many researchers reported the role of vermicompost in alleviating negative effect of degraded saline soil (Deng *et al.* 2015; Sandoval *et al.* 2015) which resulted in increasing growth of many crops (Akhzari *et al.* 2016).

4.2 OBJECTIVE:

i). To assess the effect of vermicompost on yield, quality of sugarcane and Gur;
ii). To study the impact of vermicompost on soil fertility and
iii). To evaluate the optimum dose of vermicompost for coastal region.

4.3 METHODOLOGY:

The experiment will be conducted at Khulna District (AEZ-14). The vermicompost will be prepared at BSRI office premises from cowdung, agricultural and municipal wastes or collected from local producer/entrepreneur.

Treatments:

T_1= N_{108} P_{54} K_{53} S_{12} Zn_3 $B_{2.5}$ kgha^{-1} (FRG-2024)	T_6= T_1+ 2.5 tha^{-1} VC + Trash Mulch (TM)
T_2= T_1 + 2.5 tha^{-1} vermicompost (VC)	T_7= T_1 + 5 tha^{-1} VC + TM
T_3= T_1 + 5 tha^{-1} vermicompost	T_8= 75% of T_1 + 2.5 tha^{-1} VC + TM
T_4= 75% of T_1 + 2.5 tha^{-1} vermicompost	T_9= 75% of T_1 + 5 tha^{-1} VC + TM
T_5 = 75% of T_1 + 5 tha^{-1} vermicompost	

Design: RCB; Replication: 3; Plot size: 8m×6m; Gross area: 0.33 acre; Planting material: 2-budded sett
Variety: BSRI Akh 41

4.4 DATA TO BE COLLECTED:

i. Chemical properties of initial and post harvest soils
ii. Germination percentage ,Tiller counting at 120, 150 and 180 days after plantation
iii. Millable cane, cane diameter, cane Height, yield and pol% cane, dry matter yield

iv. Nutrient uptake data
v. Initial and each month salinity data
vi. Gur quality
vii. BCR/MBCR

4.5 WORK ELEMENT:

Activity No.	Name of activity
1	Layout of the field experiments and initial soil sample collection
2	Basal fertilizer application and plantation of sett in the field
3	First top dressing of urea and MOP at 120 DAP
4	Tiller counting at 120 days after plantation (DAP)
5	Leaf tissues to be analyzed for different nutrient elements at 120 DAP
6	Second top dressing of urea and MOP at 150 DAP
7	Tiller counting at 150 DAP and 180 DAP
8	Sucrose content before two days of harvest
9	Millable cane counting at harvest
10	Leaf tissues to be analyzed for different nutrient elements at 300 DAP
11	Yield of cane at harvest
12	Post harvest soil sample collection
13	Soil and plant analyses for different nutrients
14	Soil Salinity measurement
15	Chemical Analysis of Gur

4.6 TIME SCHEDULE:

AC No.	Year	2025												2026				
	Month	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M
1		→	→															
2			→															
3						→	→											
4,5							→											
6								→										
7								→	→									
8															→	→	→	
9-12															→	→	→	
13									→	→	→	→	→	→	→	→	→	→
14		→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
15														→	→	→	→	→

4.7 ECONOMIC IMPACT:

Positive economic impact is expected. Use of Vermicompost based fertilizer management for sugarcane reduce soil salinity, production cost, increase production, profitability, *Gur* quality as well as maintain soil health.

4.8 EFFECT ON ENVIRONMENT:

Vermicompost application in saline area for sugarcane cultivation has no adverse effect on environment. Thus this experiment is environment friendly.

4.9 UTILIZATION OF RESEARCH RESULTS:

The findings of the study will help farmers, researchers and extension personnel to understand the benefit and adoption of Vermicompost for sugarcane based intercropping cropping pattern.

5.0 TITLE	**:**	**EFFECT OF FERTILIZER MANAGEMENT ON GROWTH, YIELD AND QUALITY OF CHEWING CANE BLACK RUBY**
LOCATIONS	**:**	BSRI farm (AEZ 11)
INVESTIGATORS	**:**	M A Sayeed, S Islam, M A Haque, G M A Hossain, M H Rahman and M A Rahman
NATURE OF STUDY	**:**	Ongoing Modified
PROJECTED COMPLETION	**:**	2023-2025
ESTIMATED COST (Tk)	**:**	1,50,000.00

5.1 DEFINITION OF THE PROBLEM:

Chewing sugarcane Black Ruby is cultivated more or less as all over Bangladesh as popular juice cane. This is a high input demanding crop and capable of rapidly depleting soil nutrients, such as nitrogen, phosphorus, potassium and sulphur. A crop production system with high yield targets cannot be sustainable unless nutrient inputs to soils are balanced against nutrient removal by crops. The major constraint for sugarcane production in Bangladesh is the depletion of soil fertility. Soil fertility is declining with the time mainly due to intensive cultivation with high yielding modern varieties and unbalanced use of chemical fertilizers with little or no use of organic fertilizers. Soil fertility degradation has been reported by many researchers in Bangladesh (Rijpma and Jahiruddin, 2004; Hasan and Alam, 2006; Hossain *et al.*, 2007; Jahiruddin and Satter, 2010; World Bank, 2010; FRG-2012). A balanced application of nutrients through an integrated use of organic and chemical fertilizers showed a promise in sustaining the cane productivity of soils (Kumar *et al.*, 2013 Ramesh et al 2004 Gopala sundaram *et al.* 2012). Thus soil fertility management is of utmost importance for optimizing crop nutrition on both short-term and long-term basis to achieve sustainable crop production (FAO, 2006). There was no works have been done on combined application of organic and inorganic fertilizers for chewing sugarcane black ruby cultivation in Bangladesh. Therefore, the present study was under taken with the following objectives:

5.2 OBJECTIVES:

i) Finding the optimum and economic doses of organic and inorganic fertilizers for chewing sugarcane cultivation.
ii) Minimize soil fertility and maintenance of soil health.

5.3 METHODOLOGY:

The experiment will be conducted at one locations at BSRI farm (AEZ 11). The experiments will be set up at the farmers' field following Randomized Complete Block Design with three replications.

Treatments:

T_1 = Control
T_2 = N_{183} P_{69} K_{122} S_{26} Zn_3 $B_{2.5}$ kgha^{-1} as per FRG'2024
T_3 = T_2 + 5 tha^{-1} FYM
T_4 = 125% of T_2 + 5 tha^{-1} FYM
T_5 = 150% of T_2 + 5 tha^{-1} FYM
T_6 = T_2 + Humic Acid @ 10 kgha^{-1}
T_7 = 125% of T_2 + 5 tha^{-1} FYM+ Humic Acid @ 10 kgha^{-1}
T_8 = 150% of T_2 + 5 tha^{-1} FYM+ Humic Acid @ 10 kgha^{-1}
T_9 = Farmers Practice (N_{194} P_{253} K_{253} S_{150} Zn_{18} $B_{8.6}$ $Mg_{6.4}$ Kgha^{-1})

Design: RCB; Replication: 3; Plot size: 8m x 6m; No. of lines/plot: 8 (8m long) Gross area: 0.33 acre; Planting material: 2- budded setts, Variety: Black Ruby

5.4 DATA TO BE COLLECTED:

1. Chemical properties of initial and post harvest soils
2. Tiller data at 120, 150 and180 days after plantation (DAP)
3. Leaf tissue analysis for different nutrient elements at 240 DAP
4. Millable cane, cane diameter, cane height, Number of internodes/plant, Length of internodes, yield and juice quality at harvest

5.5 WORK ELEMENT:

Activity No.	Name of activity
1	Initial and Post harvest soil sample collection
2	Layout of the field
3	Basal fertilizer application
4	Germination data collection at 60 days after plantation (DAP)
5	First top dressing of urea and MP at 120 DAP
6	Tiller counting at 120 days after plantation (DAP)
7	Second top dressing of urea and MP at 150 DAP
8	Detrashing, earthingup. and Tying
9	Tiller counting at 150 DAP and 180 DAP
10	Leaf sample collection at 240 DAP
11	Millable cane counting and Brix % at harvest
12	Yield of cane at harvest
13	Soil and plant analyses for different nutrients

5.6 TIME SCHEDULE:

Act. No.	Year	2024			2025											
	Month	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1		→														
2,3			→	→	→											
4						→										
5,6									→							
7										→						
8										→	→	→	→			
9,10										→			→			
11,12,13														→	→	→

5.7 ECONOMIC IMPACT:

Recommended fertilizers application for growing chewing sugarcane black ruby cultivation will reduce cost of production as well as ensure higher sugarcane yield. Therefore sugarcane growing farmers will be economically benefited.

5.8 EFFECT ON ENVIRONMENT:

The uses of recommended balanced dose of fertilizers have no harmful effect on the soil, the crop and the consumer.

5.9 UTILIZATION OF RESEARCH RESULTS:

The findings of the study will be useful to the sugarcane farmers and extension workers to improve productivity and ensure good quality of chewing sugarcane.

ON-FARM RESEARCH DIVISION

Rationale

Verification of BSRI bred advanced promising clones and their management at different agro-ecological zones under farmers' field is the prerequisite of the National Seed Board (NSB). The performance of advanced clones compared with the released variety BSRI Akh 46 under farmers' field and On-Farm evaluation of acceptability of newly released varieties and their management technologies will be evaluated. Newly released suitable sugarcane varieties will be identified in char land ecosystem. Suitability of different chewing cane under farmers' fieldin different region of Bangladesh would be investigated. To fullfill the food demand of over increasing population as well as animal feed maize become an important crop in Bangladesh. So we have taken the maize-sugacane intercropping experiment. The experiment effect of boron on cracking chewing cane is one of the major concern for reduced market demand and economical loss. So it is very necessary to minimize caracking behavior of chewing cane.

LIST OF EXPERIMEMTS

1.0	Title	:	On-farm trial of promising sugarcane clones at farmers' field of different AEZs
2.0	Title	:	Performance of popular sugarcane varieties in char land ecosystem
3.0	Title	:	Adaptive trial of chewing cane in different region of Bangladesh
4.0	Title	:	On-Farm trial of maize as intercrop with sugarcane in different planting times
5.0	Title	:	Effect of boron on yield, quality and cracking of chewing cane in different region of Bangladesh

PROGRAMME IN DETAILS

PROGRAMME AREA : **VARIETAL IMPROVEMENT**
1.0 TITLE : **ON-FARM TRIAL OF PROMISING SUGARCANE CLONES AT FARMERS' FIELD OF DIFFERENT AEZs**
LOCATION : Joypurhat [AEZ 3], Rajshahi (Barind Tract) [AEZ 26] and Jamalpur [AEZ 9]
INVESTIGATORS : M M Hossain, M M Rahman, M R Islam , S Rasul and Respective Scientist
NATURE OF STUDY : On-going(Modified)
PROJECT COMPLETION : Continuous
ESTIMATED COST (Tk.) : 65,100/-

1.1 JUSTIFICATION:

Modern varieties of sugarcane are developed through introduction, hybridization and selection programme.During varietal development, clones are developed systematically by following a series of stages where new genotypes are tested for adaptability in different agro-ecological conditions. The performance of advanced clone(s) farmers field of different AEZs is the National Seed Board (NSB) prerequisite for releasing new commercial varietie(s). Given the above consideration the experiment has been undertaken to fulfill the following objectives.

1.2 OBJECTIVE:

i. To evaluate thefield level performance of advanced clones/lines in different AEZs and
ii. To collect farmers opinion about the advanced clones/lines.

1.3 METHODOLOGY:

The methodologies of the study are stated below-

Treatments:

T_1= I 94-16
T_2= BSRI Akh 46
T_3= Madhumala
T_4= BSRI Akh 41

Design : RCB
Replications : 3
Plot size : 8m x 6m
Total No. of Plots : 12
Method of planting : STP (Polybag settlings)/Double budded sett
Time of planting : November to December 2024

Data to be recorded:

a) Sugarcane:

i. No. of tillerin the month of March and May
ii. No. of millable cane in August and at Harvest
iii. Major insect and diseases infestation
iv. Brix %
v. Yield (tha^{-1})

b) Farmers' opinion

1.4 WORK ELEMENTS:

Activity No	Name of Activities
i.	Site and Farmer selection
ii.	Land preparation
iii.	Transplanting of cane
iv.	Establishment of settlings record
v.	Intercultural operation
vi.	Fertilizer application(basal and top dressing)
vii.	Pest control
viii.	Tiller count (March and May)
ix.	Millable cane count
x.	Brix % record
xi.	Harvesting and yield record

1.5 TIME SCHEDULE:

AC No.	Year	2024					2025											
	Month	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
i.																		
ii.																		
iii.																		
iv.																		
v.																		
vi.																		
vii.																		
viii.																		
ix.																		
x.																		
xi.																		

1.6 ECONOMIC IMPACT: Assume to be highly profitable.

1.7 EFFECT ON ENVIRONMENT: Assume to be friendly to soil andenvironment.

1.8 UTILIZATION OF RESEARCH RESULTS:

The result of the studywillfulfill therequirement of NSB for releasinga new variety for commercial cultivation.

2.0 TITLE	**:**	**PERFORMANCE OF POPULAR SUGARCANE VARIETIES IN CHAR LAND ECOSYSTEM**
LOCATION	**:**	Jamalpur and Sirajgonj
INVESTIGATORS	**:**	S Rasul, M R Islam, M M Rahman, M M Hossain and Respective Station incharge
NATURE OF STUDY	**:**	On-going
PROJECT COMPLETION	**:**	Continuous
ESTIMATED COST (Tk.)	**:**	47,000/-

2.1 JUSTIFICATION:

The diversified ecosystems of Bangladesh are prone to various environmental hazards. Climate change is an added threat to the Bangladesh's agriculture and vulnerable to ecosystem. Moreover, the cultivable land of Bangladesh is deceasing by 1% every year but the population is increasing at an alarming rate. So, to feed the ever increasing population, crop production measures in unfavourable eco-systems like char land areas under the context of changing climate should be strengthened to ensure food security. Bangladesh has about 0.83 million hectares char land of which about 0.52 - 0.79 million hectares are cultivable. Based on locations char land are of two types i.e., island chars and attached chars. 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 varieties of sugarcane. Moreover, they follow their traditional 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 the livelihood of the poor farmers of char land areas.

2.2 OBJECTIVES:

i. To identify suitable BSRI released varietie(s) for Charlands and
ii. To assess the economic profitability of BSRI released varieties in theCharlands.

2.3 METHODOLOGY:

Treatments:

T_0 = Isd 34 (Check)
T_1 = Isd 37
T_2 = BSRI Akh 44
T_3 = BSRI Akh 45
T_4 = BSRI Akh 46

Design	: RCB
Replications	: 3
Plot size	: 8m X 6m
Number of plots	: 15
Method of planting	: Conventional
Time of planting	: November-December, 2024

Data to be recorded:

a) Sugarcane:
i. No. of tiller at 120,150, and 180 DAP
ii. No. of millable cane at harvest
iii. Tolerance level at flash flood condition
iv. Plant height
v. Girth (mm)
vi. Brix%
vii. Yield (tha^{-1})

b) Farmers' opinion

2.4 WORK ELEMENTS:

Activity No	Name of Activities
i.	Land & farmer selection
ii.	Land preparation supervision
iii.	Planting (sugarcane)
iv.	Germination count.
v.	Fertilizer application (Top dressing)
vi.	Tiller count (March and May)
vii.	Intercultural operation
viii.	Disease and pests control
ix.	Millable cane count
x.	Harvesting and yield record.
xi.	Sucrose/Brix %.

2.5 TIME SCHEDULE:

AC No.	Year	2024					2025											
	Month	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
i.																		
ii.																		
iii.																		
iv.																		
v.																		
vi.																		
vii.																		
viii.																		
ix.																		
x.																		
xi.																		

2.6 ECONOMIC IMPACT: Assumed to be highly profitable.

2.7 EFFECT ON ENVIRONMENT: Assumed to be friendly to soil and environment.

2.8 UTILIZATION OF RESEARCH RESULT:
It will help in selecting suitable varietie(s) for cultivate sugarcane in char lands.

3.0 TITLE : **ADAPTIVE TRIAL OF CHEWING CANE IN DIFFERENT REGIONS OF BANGLADESH**

LOCATION : BSRI Farm, Gazipur, Manikganj and Khulna

INVESTIGATORS : M M Hossain, M M Rahman, M R Islam, S Rasul and Respective Station In-charge

NATURE OF STUDY : On-going

PROJECT COMPLETION : Continuous

ESTIMATED COST (TK.) : 1,14,100/-

3.1 JUSTIFICATION:

Chewing cane is very profitable cash crop in Bangladesh. It also uplifts the nutritional status of the rural people. Cultivation of chewing cane can create huge rural employment and poverty reduction for the rural people.BSRI has been working with several chewing cane varieties in recent years which can also be grown round the year. The Institute released BSRI Akh 41 as a chewing cane in 2012 and BSRI Akh 42 in 2014. Generally, marginal cane growers traditionally cultivate chewing cane using local varieties with little or no management practices in some selected areas of the country. Cane yield is also lower in farmers' field. To popularize chewing canes among the farmers, appropriate variety and improved production technology need to be demonstrated for getting higher yield and monitary return. Therefore, the present study will be undertaken to fulfill the following objectives.

3.2 OBJECTIVES:

i. To evaluate the performance of chewing cane in the farmers field
ii. To select suitable high yielding chewing varieties for higher production and income at farmers level

3.3 METHODOLOGY:

Treatments:

Sugarcane variety:

T_1 = BSRI Akh 41
T_2 = BSRI Akh 42
T_3 = Black Rubby
T_4 = Madhumala
T_5 = Local variety

Design : RCB
Replications : 3
Plot size : 8m X 6m;
Number of plots : 15
Method of planting : Conventional (2 budded setts)/polybag settling
Time of planting : October/November 2024

Data to be recorded:

a) Sugarcane:

i. Tiller production at 120, 150 and 180 DAP
ii. Number of chewable cane at harvest
iii. Plant height at harvest
iv. Major pests and diseases
v. Sucrose / Brix %
vi. Yield (tha^{-1})
vii. Price/stalk
viii. Cost and return analysis

b) Farmers' opinion

3.4 WORK ELEMENTS:

Activity No.	Name of Activities
i.	Land & farmer selection
ii.	Land preparation supervision
iii.	Planting (sugarcane)
iv.	Germination count.
v.	Fertilizer application
vi.	Tiller count (March and May)
vii.	Disease and pests control
viii.	Millable cane count
ix.	Harvesting and yield record.
x.	Sucrose/Brix %.

3.5 TIME SCHEDULE:

AC No.	Year / Month	2025																
		A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
i.																		
ii.																		
iii.																		
iv.																		
v.																		
vi.																		
vii.																		
viii.																		
ix.																		
x.																		

3.6 ECONOMIC IMPACT: Assumed to be highly profitable.

3.7 EFFECT ON ENVIRONMENT: Assumed to be friendlyto soil andenvironment.

3.8 UTILIZATION OF RESEARCH RESULT:

The result of the study will encourage the farmers to cultivate highly profitable chewing cane varieties in different regions of Bangladesh.

4.0 TITLE : **ON-FARM TRIAL OF MAIZE AS INTERCROP WITH SUGARCANE IN DIFFERENT PLANTING TIMES**

LOCATION : BSRI Farm, Chuadanga

INVESTIGATORS : M R Islam, S Rasul, M M Rahman and M M Hossain, Respective station in-charge

NATURE OF STUDY : On-going

PROJECT COMPLETION : 2026

ESTIMATED COST (Tk.) : 63,405/-

4.1 JUSTIFICATION:

Sugarcane is a long duration crop (12-14 months) in Bangladesh. Due to its long duration farmers are not interested in growing sugarcane but they are interested to grow quick growing and profitable crops like maize (*Zea mays*). As a result sugarcane growing fields are replacing by maize.Under this circumstance, intercroping maize with sugarcane is necessary in Bangladesh. Although, both are exhaustive crops (C_4 plant) that compete with nutrients, water and light for their growth and development. Maize has a rapid growth rate and the sugarcane crop has a slow growth rate for 120-150 days after planting. The experiment has been undertaken to know the effect of maize intercropping with sugarcane on growth, yield and quality of different sugarcane varieties.In view of the above consideration the experiment has been undertaken to fulfill the following objectives.

4.2 OBJECTIVES:

i. To evaluate performance of sugarcane with maize as intercrop at different planting times
ii. To observe the suitability of maize as intercrop with sugarcane.
iii. To increase productivity and interim economic benefit per unit area and time in sugarcane field.

4.3 METHODOLOGY:

The details methodology of the study are stated below-

Treatments:

T_0: Sole Sugarcane (First date of plantation)
T_1: Maize +Sugarcane (At a time)
T_2: Maize +Sugarcane (20 DAS of Maize)
T_3: Maize +Sugarcane (40 DAS of Maize)
T_4: Maize +Sugarcane (60 DAS of Maize)
T_5: Sugarcane + Maize (20 DAP of Sugarcane)
T_6: Sugarcane + Maize (40 DAP of Sugarcane)
T_7: Sugarcane + Maize (60 DAP of Sugarcane)

Design : RCB
Replications : 3
Plot size : 6 m x 6m
Total No. of Plots : 24
Method of planting : Two budded settlings
Time of planting : November, 2024

Data to be recorded:

a) Sugarcane:

i. Establishment percentage of settlings
ii. No. of tiller in the month of March and May
iii. No. of millable cane in August and at Harvest
iv. Yield of maize (t ha^{-1})
v. Yield of cane (t ha^{-1})
vi. Brix%
vii. LER (Land Equivalent Ratio)
vii. Cost and Return analysis

b) Farmers' opinion

4.4 WORK ELEMENTS:

Activity No	Name of Activities
i.	Site and Farmer selection
ii.	Land preparation
iii.	Transplanting of cane
iv.	Establishment of settlings record
v.	Intercultural operation
vi.	Fertilizer application (basal and top dressing)
vii.	Pest control
viii.	Tiller count (March and May)
ix.	Millable cane count
x.	Brix % record
xi.	Harvesting and yield record

4.5 TIME SCHEDULE:

AC No.	Year	2024					2025										
	Month	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
i.																		
ii.																		
iii.																		
iv.																		
v.																		
vi.																		
vii.																		
viii.																		
ix.																		
x.																		

4.6 ECONOMIC IMPACT: Positive economic impact is expected.

4.7 EFFECT ON THE ENVIRONMENT: Assumed to be friendly to soil andenvironment.

4.8 UTILIZATION OF THE RESULT:

The result of the study will encourage the farmers to cultivate maize with sugarcane to increase land use efficiency and identify optimum planting date of maize to intercropping with sugarcane

PROGRAM AREA : SOIL MICRONUTRIENT

5.0 TITLE : EFFECT OF BORON ON YIELD, QUALITY AND CRACKING OF CHEWING CANE IN DIFFERENT REGION OF BANGLADESH

LOCATIONS : Bandarban, Manikganj, Rangpur

INVESTIGATORS : M R Islam, S Rasul, M M Rahman, M M Hossain, M A Sayeed & Respective station incharge

NATURE OF STUDY : New

PROJECTED COMPLETION : 2024-26

ESTIMATED COST (TK) : 1,12,500/-

5.1 JUSTIFICATION:

Sugarcane is considered the only sugar crop for sugar production in Bangladesh. Besides sugar production, it is used for chewing purposes. Now a days, sugarcane has gained an important position in Chittagong hill tracts and non mill areas as a chewing cane. There are some chewing canes particularly Rangbilash (BSRI Akh 42) which is gaining popularity among the farmers due to its good yield and high market price. But currently growth cracks are found in BSRI Akh 42 chewing cane which is now a problem for the farmers to get good market price. In general two types of cracks are sometimes found on the surface of the stalk; harmless, small corky cracks, which are restricted to the epidermis, and growth cracks which may be deep and run the whole length of the internodes. Growth cracks are harmful since they allow increased water loss and expose the stalk to disease organisms and insects. Growth cracks are dependent on variety and growing conditions. Some findings reported that sugarcane cracking is reduced or to remove by application of boron in soil (1.5-2 kg B ha^{-1}) or foliar spray at 1-1.5 g l^{-1}. However sugarcane has high requirements for boron (B). Boron is required for all plant growth. Adequate B nutrition is critical for high yields and quality of crops. Boron increases the rate of transport of sugars (which are produced by photosynthesis in mature plant leaves) to actively growing regions.

5.2 OBJECTIVES:

i. To find out the suitable dose of boron to check the growth cracks of sugarcane stem and
ii. To identify the effective application method of boron for chewing cane cultivation.

5.3 METHODOLOGY:

Treatments:

T_1 - RFD as per FRG, 2024 (Boron control)
T_2 - RFD + Boron soil application @ 1.5 kg ha^{-1} from Solubor
T_3 - RFD + Boron soil application @ 2.5 kg ha^{-1} from Solubor
T_4 - RFD + Boron soil application @ 3.5 kg ha^{-1} from Solubor
T_5 - RFD + Boron spray @ 1.5 g/L at four split from Solubor
T_6 - RFD + Boron spray @ 2.5 g/L at four split from Solubor
T_7 - RFD + Boron spray @ 3.5 g/L at four split from Solubor

RFD= Recommended fertilizer dose, FRG= Fertilizer recommendation guide
Methods of boron application:
Soil application: Full dose of Boron will be applied in trench as basal.
Spray application: 1st spray: after stalk formation (120 DAP)
2nd spray: after 20 days of 1st spray
3rd spray: after 20 days of 2nd spray
4th spray: after 20 days of 3rd spray
Design: RCBD with three replications
Plot size: 8m x 6m; Variety: BSRI Akh 42 (Rangbilash); Planting material: STP seedling/Double budded sett

5.4 DATA TO BE COLLECTED:

1. Tiller data will be recorded at 120 and 150 DAP
2. Cracking percentage will be recorded
3. No. of millable cane in August and at Harvest
4. Yield of cane
5. Brix %
6. Initial and Post harvest Analysis of Soil

5.5 WORK ELEMENT:

Activity No.	Name of Activity
1	Lay out of the field and initial soil sample collection
2	Basal fertilizer application and plantation of the experiment
3	Percent germination will be recorded at 60 days after planting (DAP)
4	Boron spray at 120 DAP
5	Tiller count at 120 and 150 DAP
6	Top dressing of the rest of N, P and K fertilizer
7	Mill able cane, sucrose content and yield of cane at harvest
8	Post harvest soil sample collection and analysis

5.6 TIME SCHEDULE:

Ac. No.	Year	2024				2025											
	Month	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1				→	→												
2					→	→											
3						→	→										
4							→	→									
5							→	→		→							
6							→	→		→				→			
7														→		→	→

5.7 ECONOMIC IMPACT:

Farmers of Hill tracts region will be economically benefited by selling good quality of chewing cane in market.

5.8 EFFECT ON ENVIRONMENT:

It will reduce the excessive boron application that is friendly to environment.

5.9 UTILIZATION OF RESEARCH RESULTS:

This study highlights the importance of boron in improving sugarcane yield and quality, offering valuable insights for farmers in Bangladesh. By optimizing boron application, they can enhance plant health, reduce cracking, and boost productivity. The findings also emphasize the need for further research on boron's impact on chewing cane cracking.

AGRICULTURAL ENGINEERING DIVISION

Rationale

Agricultural Engineering Division of BSRI conducts research on (i) Farm Power & Agricultural machinery (ii) Irrigation water management and drainage related to sugarcrop cultivation and (iii) Post harvest technology for sugarcrop.

The higher production cost of crops can be reduced by means of mechanization. A sugarcane planter is important to increase the efficiency of sugarcane planting and reduce the need for manual labour. It can also help to save water, fertilizer, seed as well as increase yield and profit of sugarcane farming. Popularity of jaggery and jaggery powder is increasing day by day considering it's nutritional value. At present jaggery is dried in open air during manufacturing jaggery powder. Moreover, due inefficient storage system about 20% jaggery becomes fermented during rainy season. So, we need an efficient dryer cum storage system. So conservation agriculture approach may be introduced for sugarcane with intercrop. Sustainable sugarcane production cannot be imagining without irrigation. In conventional irrigation system a huge amount of resources, money and time is wasted. So we should go for precision agriculture. In precision agriculture, the application of modern technology as well as IoT based irrigation should adopted. Indigenous Date Palm is a profitable commercial crop in Bangladesh for juice (Sap) and finally jiggery production. But sap yield is not up to satisfactory level due to traditional cultivation especially considering no irrigation practice.

The agricultural machinery already developed at BSRI such as BSRI Power Crusher machine and BSRI Earthing up Machine etc. also need further test for evaluating performances and/or necessary modification.

On the basis of the problems delineated above 6 research experiments have been proposed for 2024-2025: (i) Development and performance evaluation of a real cut sugarcane planter; (ii) Design and development of a food dryer and storage system with air dehumidification; (iii) Conservation agriculture approach for sustainable sugarcane farming in Bangladesh; (iv) Developing an IOT-based irrigation system and residue management practices for sustainable sugarcane farming; (v) Effect of irrigation on juice & fruits yields of date palm and (vi) Demonstration of bsri developed technologies for sugarcane in mill and non-mill zone areas.

Successful completion of these experiments will generate appropriate technologies for sugarcane growers that will promote appropriate technological options for sustainable sugarcrop cultivation.

LIST OF EXPERIMENTS

PROGRAMME AREA: FARM POWER AND MACHINERY

1.0 Title : Development and performance evaluation of a real cut sugarcane planter
2.0 Title : Design and development of a jaggery dryer
3.0 Title : Conservation agriculture approach for sustainable sugarcane farming in Bangladesh

PROGRAMME AREA: IRRIGATION AND WATER MANAGEMENT

4.0 Title : Developing an IoT-based irrigation system and residue management practices for sustainable sugarcane farming

PROGRAMME AREA: TRANSFER OF TECHNOLOGY

5.0 Title : Field performance test of BSRI developed agricultural engineering technologies

PROGRAMME IN DETAILS

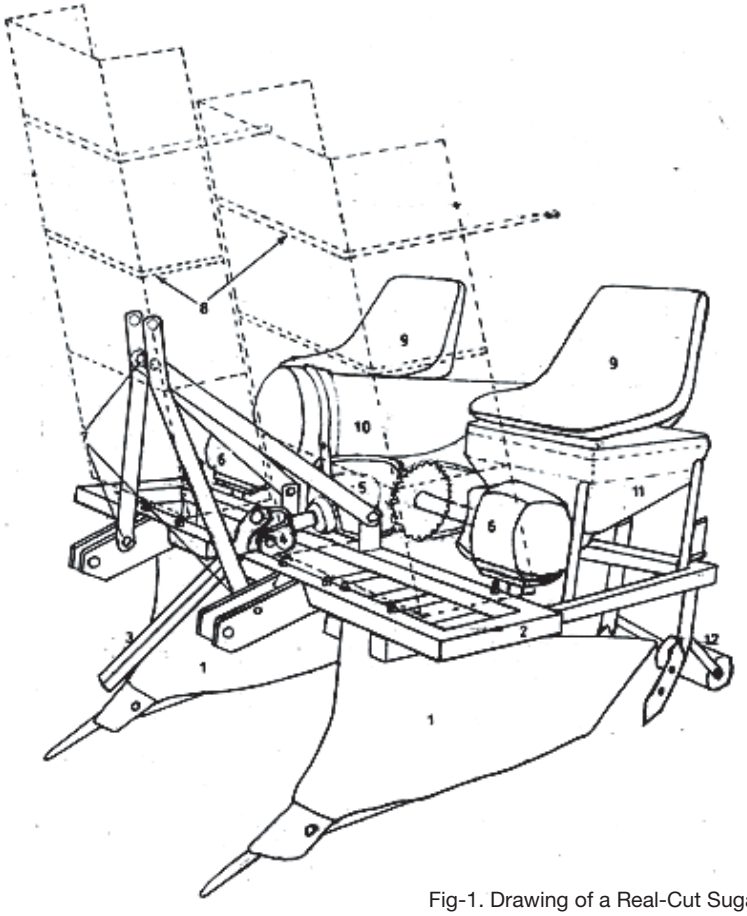
1. TITLE	**:**	**DEVELOPMENT AND PERFORMANCE EVALUATION OF A REAL CUT SUGARCANE PLANTER**
OBJECTIVES	**:**	i. Designing and development of a sugarcane planter; ii. To perform low cost and timeliness operation of sugarcane planting.
LOCATIONS	**:**	BSRI Workshop
INVESTIGATORS	**:**	M A Rahman, S S Tabriz and M S Hossen

STATUS OF THE EXPERIMENT: Ongoing and modified

- Starting date: June, 2024
- Expected completion date: January, 2027

SOURCE OF FUND: GOB

Drawing and Design:



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: Insectiside solution Tank
11: Fertilizer box
12: Soil covering shovel & roller

Fig-1. Drawing of a Real-Cut Sugarcane Planter

Expected outputs:
The program will result in the creation of a functional prototype of a sugarcane planter, specifically designed for local farming conditions Estimated cost: 750,000 Tk/yr

2. TITLE: DEVELOPING AN IoT-BASED IRRIGATION SYSTEM AND RESIDUE MANAGEMENT PRACTICES FOR SUSTAINABLE SUGARCANE FARMING

OBJECTIVES:

i) Developing and evaluation of an integrated IoT-Based fertigation system
ii) Developing and apply ML algorithms for efficient fertigation management
iii) To assess the impact of integrated fertigation and residue management on productivity and soil health

LOCATIONS : BSRI
INVESTIGATORS : S S Tabriz, M S Hossen and M A Rahman

STATUS OF THE EXPERIMENT: New

- Starting date: October, 2024
- Expected completion date: May, 2027

Plan of Activities to archive the objectives

Proposed three activities as below are to achieve the objectives

i) Development and evaluation of a fertigation System for sugarcane

Block diagram of a proposed fertigation System has shown in Figure and the system will be run and validate in the experiment field.

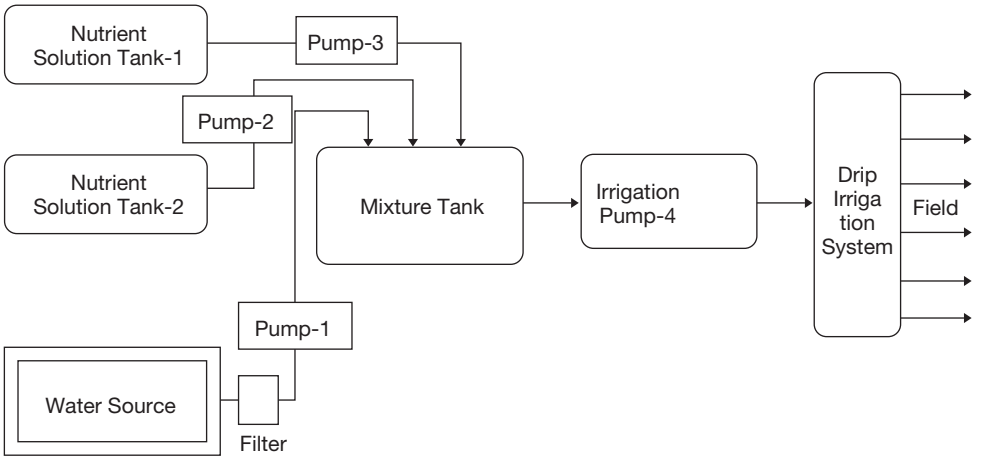
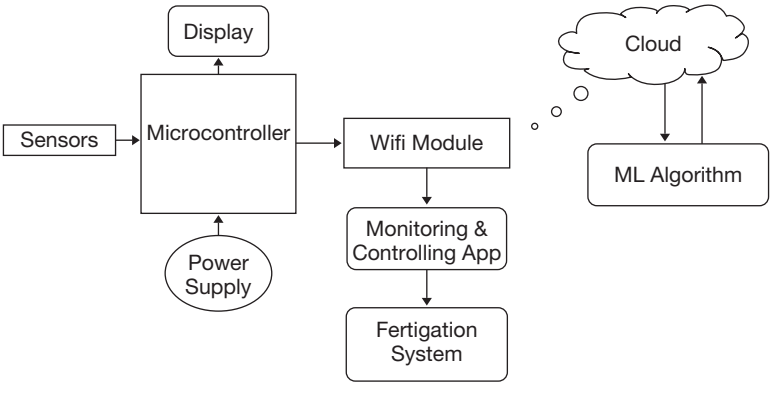


Fig.Block diagram of a proposed fertigation System

ii). Development and evaluation of a IoT-ML based fertigation System

Block diagram of a proposed IoT-ML based fertigation System has shown in Fig. 2. Machine learning algorithm will be developed by python and validated with the system.



IoT-ML based Fertigation System

iii). Residue management strategies with IoT-ML system to enhance productivity and improve soil health

Expected outputs
An IoT-ML based system development that precisely adjusts water and fertilizer delivery using machine learning algorithms.

Estimated cost: 0 Tk/yr
Source of Fund: GOB

3. TITLE	**:**	**DESIGN AND DEVELOPMENT OF A JAGGERY DRYER**
OBJECTIVES	**:**	i) To develop a dryer to dry jaggery powder ii) To produce quality jaggery powder
LOCATIONS	**:**	BSRI Workshop
INVESTIGATORS	**:**	S S Tabriz, M S Hossen and M A Rahman
STATUS OF THE EXPERIMENT	**:**	On going

- Starting date: November, 2023
- Expected completion date: January, 2026

Plan of Activities to archive the objectives

- Design of a Food Dryer
- Purchasing of materials (SS sheet, MS sheet, dehumidifier heater, blower etc.)
- Fabrication according to design
- Tested at the lab
- Problem Identification and analysis
- Modification according to problems
- Again, tested at field
- Then modification again if needed and finalization

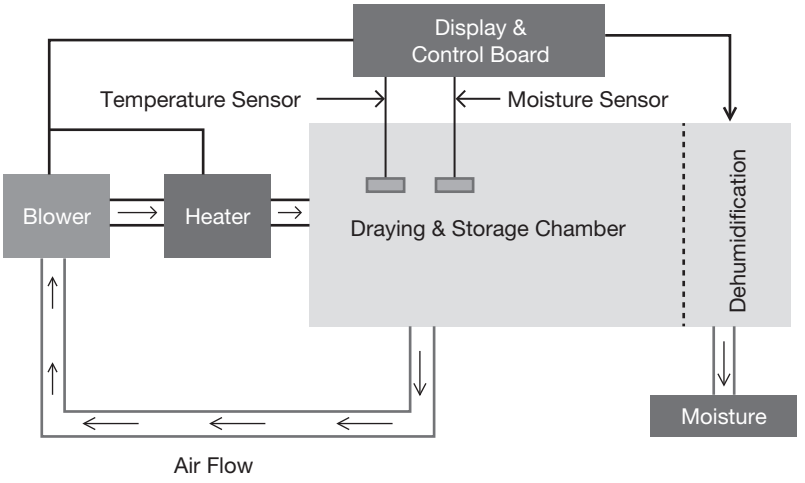


Fig. Flow chat of draying system

Expected outputs:
Development of an efficient and cost-effective jaggery dryer and and extended shelf life.

Estimated cost : 100,000 Tk/yr
Source of Fund : GOB

4. TITLE : **CONSERVATION AGRICULTURE APPROACH FOR SUSTAINABLE SUGARCANE FARMING IN BANGLADESH**

Objectives : i) Evaluating of conservation tillage on sugarcane farming
ii) Finding out effects of residue management and intercropping

Locations : BSRI Farm

Investigators : S S Tabriz, M S Hossen and M A Rahman

Status of the Experiment: On going
- Starting date: September, 2023
- Expected completion date: January, 2026

Plan of Activities to achive the objectives:

Site Selection
Choose appropriate locations for implementing conservation agriculture practices.
Soil Sample Collection for Physical and Chemical Analyses
Collect soil samples from selected sites for analysis to determine baseline conditions.
Land Preparation
Prepare the land according to conservation agriculture principles (e.g., reduced tillage).
Plantation as per Experimental Design
Implement planting according to the experimental design, incorporating conservation agriculture methods.
Intercultural Operation
Perform necessary intercultural operations, such as weeding and pest control, in alignment with conservation practices.
Data Collection
Collect data on crop growth, yield, and soil health throughout the growing season.
Data Analysis
Analyze the collected data to evaluate the impact of conservation agriculture practices on sustainability and productivity.

Expected outputs:
Natural resource saving management system will be developed of sugarcane farming.

Estimated cost : 100,000 Tk/yr
Source of Fund : GOB

5. TITLE : **FIELD PERFORMANCE TEST OF BSRI DEVELOPED AGRICULTURAL ENGINEERING TECHNOLOGIES**

OBJECTIVES : i) Performance evaluation of BSRI developed machineries for sugarcrops (BSRI power crusher, BSRI earthing up machine) among the farmer's,
ii) Improving the workmanship of the machines/tools getting feedback from the demonstration,
iii) Creating interest among the farmers on the use of these machines,
iv) To stimulate local manufacturers for manufacturing these machines.

LOCATIONS : Mill and Non-mill Zone

INVESTIGATORS : M A Rahman, M S Hossen and S S Tabriz

STATUS OF THE EXPERIMENT: On going
- Starting date:
- Expected completion date: Continuous

Plan of Activities to archive the objectives:

i) One unit of each of Crusher, bed Former cum trencher, Weeder, Bud chip cutter and Juicer will be supplied to perform operation in regional stations, substations and sugar mills zone and non-mills zones.

ii) These machines will be demonstrated to popularize among the farmers to create demands of the machineries. On the other hand, local entrepreneurs/workshop can manufacture these machineries and sell among the farmers in less cost involvement.

Expected outputs:

Performance evaluation of BSRI developed machineries at farmers field will help to improve the machinery according to farmers demand, contributing to higher overall production levels. Implementation of BSRI technologies has led to decreased input costs, including labor and fertilizers, improving farm profitability.

- **Estimated cost** **:** 100,000 Tk/yr
- **Source of Fund** **:** GOB

ENTOMOLOGY DIVISION

Rationale

Entomology division of Bangladesh Sugarcrop Research Institute (BSRI) is responsible for crop protection research in related to insect pest management and development works for BSRI mandated crops. About 87 species of insect and mites have been identified in different sugarcrop, of which 70 species in sugarcane, 10 species in sugarbeet, 3 species in date palm, 1 species in nipa palm and 3 species of honeybee. These are grouped into borers, suckers, defoliators and underground pests. The estimated yield loss in sugarcane is about 20% and loss in recovery is about 15% per annum. However, major sugarcane pests are ESB, TSB, RSB, SB, WG, Termite, MB, SI, BLH and PLH. All these are persistent pests and cause considerable damage to the crops and thus of economic importance.TSB and SB are havoc throughout the country. RSB, WG and TM are regional and/or soil textural problem. PLH is a sporadic pest and in some years serious damage is experienced. Black beetle, scale insect, black leaf hopper and woolly aphis infestation are increasing day by day. On the other hand, the black beetle infestation has been increasing. Grasshopper infestation has been observed in Faridpur Sugar Mills Area. Also for last 4 year, leaf eating caterpillar infestation has been observed in BSRI farm and North Bangal Sugar Mills area. Scale insect infestation has been observed in mill and non-mill zones areas of Bangladesh. In sugarbeet yield loss is estimated about 18% by infesting different insect pest. In tropical sugarbeet, caterpillar, cutworm, aphid, red mite etc are major. In recent year, sugarbeet caterpillar and its infestation is markedly observed in sugarbeet growing areas of Bangladesh. In date palm yield loss is estimated about 30% globally. In date palm, red palm weevil is the major. In recent year, red palm weevil and its infestation is markedly observed in different date palm growing areas of Bangladesh. Their management practices have been brought under 5 major groups' viz. resistant variety, cultural, mechanical, biological and chemical control methods. Research plan has been chalked out in accordance with institute's master plan which is again prepared in the light of mandate. Problems have been prioritized and future programme has been designed.

This division has so far developed and recommended some cultural, mechanical and biological tactics for controlling different insect pests of sugarcrops. For their chemical control 329 insecticides of different chemical groups have been recommended and thereby approved by the Government. There are about 50 natural enemies of pests have been identified which are beneficial to the sugarcrop growers and the farmer. About 08 natural enemies of pests have been identified which are beneficial to the sugarbeet and the farmer. The strategy of integrated pest management (IPM) has been patronized where importance of cultural, mechanical and biological control measures has been emphasized and use of insecticides should be considered only when would seem bare necessary and applied as the last resort. But now a days, Bio-rational based management technique is preferred most. Moreover, we conduct several research programmes and have recommended only those insecticides which have to apply in the soil thus advocating least contamination of the microclimate in favour of human health, natural enemies and ultimately to the environment. With the changing situation some chemicals and Bio-rational based management technique have been chosen for foliar and so on application having very short residual effect against target pests.

Research programme for 2024-2025 has been developed to address the very urgent needs of the farmers of those plains, char land, saline belt, coastal area and Hill areas. Priority has been given on varietal screening programme to find out resistant/susceptible varieties, which includes promising clones. Resistant/ susceptible variety is the cheapest and easiest technology for farmers. To reduce the dependence on chemical insecticides, experiments on cultural practice, mechanical control, use of bio-insecticides, microbial insecticides, biological control, use of sex pheromone and lastly chemical insecticides have undertaken in the research programme. Mass rearing of bio-agents and use of those against sugar crop insect pests has been included. The programme is in consonance with IPM and Bio-rational based philosophy. New research has been developed to address date palm insect pest and honeybee management.

LIST OF EXPERIMENTS

1.0 Title : Screening of selected sugarcane clones In ZYT I, II & III for resistance against major insect pests in the field

2.0 Title : Field evaluation of *Trichogramma chilonis* for biological control of sugarcane stem borer

3.0 Title : Evaluation of new molecules for management of major insect pests of sugarcane

4.0. Title : Efficacy of green insecticides against the incidence of sugarcane mealy bug

5.0 Title : Effects of different insecticides on incidence of scale insect (*Melanaspis glomerata* green), yield and quality of sugarcane

6.0 Title : Isolation, screening and characterization of entomopathogenic fungi from agricultural soils of Bangladesh

7.0 Title : Effects of nutritional supplements to improve the health of honey bee colony (*Apis mellifera*)

8.0 Title : Morphological characterization and diversity analysis of honeybee

9.0 Title : Development of IoT based early detection system of red palm weevil infestation on date palm in Bangladesh

PROGRAMME IN DETAILS

PROGRAMME AREA	**:**	**VARIETAL IMPROVEMENT**
1.0 TITLE	**:**	**SCREENING OF SELECTED SUGARCANE CLONES IN ZYT I, II & III FOR RESISTANCE AGAINST MAJOR INSECT PESTS IN THE FIELD**
LOCATION (S)	**:**	I. BSRI Farm, Ishurdi and ii. RSRS, Thakurgaon.
INVESTIGATOR(S)	**:**	M N Alam, M E Reza, M N A Siddiquee, M S Islam and M A Rahman
NATURE OF STUDY	**:**	Continuous
PROJECTED COMPLETION	**:**	Continuous (3 years for each clone)
ESTIMATED COST (TK.)	**:**	100,000.00

1.1 DEFINITION OF THE PROBLEM

Screening for resistant variety is of great importance. Every year the Breeding division develops some promising clones/strains for release as varieties through National Seed Board (NSB). Pest status of those clones/strains is a requirement of NSB. Besides the screening study it will help to sort/resistant out tolerant varieties to insect pests. Varietal resistance is a component of IPM; thus, the finding will help to grow resistant/tolerant varieties by farmers consequently help in minimum use of chemical insecticides.

1.2 OBJECTIVE(S)

i) Screening advance clones for possible resistance to top shoot borer, early shoot borer, rootstock borer, stem borer, pyrilla leaf hopper, black leaf hopper, scale insect, mealy bug, termites and white grubs and

ii) Comparing selected clones with the standard varieties to fulfill the requirement of National Seed Board (NSB).

1.3 METHODOLOGY

Screening will be carried out for resistance to the above-mentioned insect pests. The experiment will be laid out in RCB design having three replications. The plot size will be 6m x 6m. Plot to plot distance will be maintained 2m and block to block distance will be maintained 2m. The total area will be 0.50 ha and net area will be 0.30 ha. For comparison two varieties (one resistant and one susceptible) will be included in the experiment. Following clones/strains will be considered in the study:

ZTY I : Clones will be collected from Breeding Division
ZYT II : I 70-19, I 71-19, I 92-19, I 138-19, I 149-19, I 182-19, I 185-19, I 190-19 and BSRI Akh 46
ZYT III : I 56-18, I 71-18, I 75-18, I 141-18, I 182-18 and BSRI Akh 46

1.4 WORK ELEMENTS

1. Collection of advanced clones/strains from Breeding division, BSRI
2. Preparation of seed materials with proper labelling
3. Planting in the field in replicated plots (Nov.24)
4. Fertilization (Feb.-Mar.'25)
5. Weeding (Feb.-Mar.'25)
6. Irrigation (Mar.-Jun'25)
7. Germination count (Feb.-Mar.'25)
8. Data collection for ESB, TSB, RSB, WG and Termites (Mar.-April'25)
9. Data collection for TSB, SB and available pests (Jul.-Aug.'25)
10. Data collection on RSB, WG at harvest (Nov.-Dec.'25)
11. Recording temperature, humidity and rainfall data (Nov.24-Dec.'25) and
12. Yield record at harvest (Dec.'25-Jan.'26)

1.5 TIME SCHEDULE

Activity No.	Months														
	2024		2025												2026
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1,2,3	→	→	→	→											
4,5				→	→										
6					→	→	→	→							
7				→	→										
8					→	→									
9							→	→	→	→	→				
10													→	→	
11	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
12														→	→

1.6 ECONOMIC IMPACT

It is a fundamental study to find out the insect pest reaction to a clone/ strain for requirement of National Seed Board (NSB). Use of a resistant variety cost nothing to a farmer in pest management.

1.7 EFFECT ON ENVIRONMENT

Insect pest resistant varieties have no adverse effect on the environment, rather an environment friendly technology.

1.8 UTILIZATION OF RESEARCH RESULTS

After the completion of three years experiment, findings regarding the pest reaction to different strains will be compared with the standard variety and the result will be submitted to the Breeding Division for further processing to fulfil the requirement of National Seed Board (NSB). When NSB approves the strains as varieties/clones it will be released for commercial cultivation in different sugar mill areas through multiplication of the strains/varieties at BSRI/ Sugar mills. Pest reaction to the particular variety will be provided. Pest resistant varieties, if any, will be recommended to incorporate in IPM programme.

PROGRAMME AREA : **PEST MANAGEMENT**
2.0 TITLE : **FIELD EVALUATION OF *TRICHOGRAMMA CHILONIS* FOR BIOLOGICAL CONTROL OF SUGARCANE STEM BORER**
LOCATION : BSRI, Ishurdi, Pabna
INVESTIGATOR(S) : N Sultana, M N Alam, M E Reza, M N A Siddiquee, M S Islam and M A Rahman
NATURE OF STUDY : New
PROJECTED COMPLETION : Continuous
ESTIMATED COST (TK.) : 1,00,000.00

2.1 DEFINITION OF THE PROBLEM

Bio-agents are used in Biological control programme of insect pests. Biological control is the integral part in integrated pest management. Sugarcane stem borer is the most destructive pest of sugarcane in Bangladesh. Bio-rational insecticides not so hazardous to human health and natural enemies. Insecticides application is costly and hazardous to human health. Application of bio-agent like *Trichogramma chilonis* needs thorough study for the control of stem borer. *T. chilonis* is mass cultured on eggs of Rice meal moth, *Corcyra cephalonica* is an alternate host which is again mass reared on grind wheat. Rearing of the parasitoid and its alternate host need much care. For their development temperature and humidity are to be maintained properly which needs 25-30^{o}C temperature and 75-85% RH. Experiment conducted showed that rearing of *T. chilonis* in the laboratory is feasible and its application in the field was found successful in controlling the target pests. Therefore, the present study will be taken on mass rearing of *Trichogramma chilonis* in the BSRI Entomology laboratory to facilitate biological control of sugarcane stem borer.

2.2 OBJECTIVE(S)

i) Production of mass quantity of Trichogramma chilonis and ensuring their availability for field release;
ii) Evaluating its field performance of Trichogramma chilonis against sugarcane stem borer and
iii) Finding the effective management practice(s) against stem borer.

2.3 METHODOLOGY

Laboratory Rearing of *Trichogramma chilonis*

In the laboratory rearing of *Trichogramma* and its alternate host *Corcyra* will be carried out. The laboratory will have 2 separate rooms, one for *Trichogramma* and the other for *Corcyra* larvae and *Corcyra* moth. *Corcyra* will be reared on ground wheat in plastic bowl. Eggs of *Corcyra* will be collected for rearing *Trichogramma*. Adults (moths) of rice meal moth will be captured every morning in the emergence room and poured in glass boyams where they mate and lay eggs. These eggs are collected, cleaned, and spread inside the wall of glass Jar that are kept in refrizarator for 2-3 minutes. Eggs of *Corcyra* are attached on the wall of glass jar due to moisture. Newly emerged *Trichogramma chilonis* is to be placed in Jar where they parasitize *Corcyra* eggs. Thus, the process is repeated and continued for generations. The excess eggs of *Corcyra* are used for recycling of it. The eggs are spread on ground wheat contained in plastic bowl. The eggs hatch and larvae feed on ground wheat, their diet and pupates and finally *Corcyra* moths emerge into the bowl, from where they are collected.

1. Rearing of alternate host *Corcyra* throughout the year
2. Rearing of egg parasitoid *Trichogramma* throughout the year and releasing in sugarcane field from May to October.

Field evaluation of *Trichogramma chilonis* against Sugarcane stem borer:

Stem borer incidence generally starts from May (personal observation) therefore, monthly monitoring on stem borer attack will be done through frequent visit to the field upto harvest of cane. Regular data collection will be done to observe the deployment of the proposed management practices. Management practices and their frequencies will depend on the level of infestation. No control measures will be followed in check plots.

Treatments:

T_0: Control (untreated)
T_1: Release of *Trichogramma chilonis* @ 1g ha^{-1}/week from May–Oct.'25
T_2: Complete package from May–Oct.'25

Design : RCB Replication : 3 Plot size : 20m x 20m Total area : 0.14 ha Net area : 0.12 ha

2.4 WORK ELEMENTS

1. Land preparation (Oct.–Nov.'24)
2. Plantation and fertilizer application (Nov.–Dec.'24)
3. Weeding, mulching, Irrigation (Jan.–May'25)
4. Top dressing (Mar.–Jun.'25)
5. Earthing up (Jun.–Jul.'25)
6. Removal of Primary infested cane (May-Jul.'25)
7. Monthly Detrashing (Jul.–Oct.'25)
8. Release of *Trichogramma chilonis* (May–Oct.'25)
9. Insecticide application (Jun.–Aug.'25)
10. Data collection (May–Dec.'25)
11. Harvest (Dec.'25)

2.5 TIME SCHEDULE

Activity No.	Months														
	2024			2025											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
1	→														
2		→													
3			→												
4						→									
5								→							
6									→						
7										→					
8											→				
9															
10															
11															

2.6 ECONOMIC IMPACT

It is a study of mass rearing of *Trichogramma* and alternate hosts *Corcyra* in the laboratory. Chemical-based insecticides are too expensive, so the use of bio agent is considered as a cost-effective insect management practice.

2.7 EFFECT ON ENVIRONMENT

It is the study of rearing bio-control agents is eco friendly insect management technique which has no adverse effect on environment or nature. It will reduce the use of chemical insecticide and preserves the other beneficial insect.

2.8 UTILIZATION OF RESEARCH RESULTS

Integrated pest management, though popular term, but tittle work has been done on it in controlling sugarcane stem borer in Bangladesh. The farmers are very often advised to adopt IPM. Proper experimentation is needed to guide the end users that will actually implement IPM. The present study will give a clear-cut concept about IPM and strengthen skill and knowledge on this strategy and help implement IPM in sugarcane.

PROGRAMME AREA : **PEST MANAGEMENT**

3.0 TITLE : **EVALUATION OF NEW MOLECULES FOR MANAGEMENT OF SOME MAJOR INSECT PESTS OF SUGARCANE**

LOCATION(S) : i) BSRI, Ishurdi, Pabna
ii) RSRS farm and Mohon Farm, Thakurgoan
iii) Bhabanipur Farm, NBSM Ltd, Natore
iv) Farmers plot PBSM, Pabna
V) Uttar Lalpur, Natore

INVESTIGATOR(S) : M A Rahman, M N Alam, M E Reza, M S Islam and M N A Siddiquee

NATURE OF STUDY : Continuous

PROJECTED COMPLETION : Continuous

3.1 DEFINITION OF THE PROBLEM

Top shoot borer, rootstock borer and stem borer are the internal feeders. After hatching from egg the larva immediately enters into the plant. Due to the concealed habit of the pest foliar application of chemicals does not work against the pest. The granular pesticides will be applied in the soil at the root zone may be taken up by the plants and kill the pest. White grubs are serious pests of sugarcane. It may cause 50-100% incidence. However, their attack is more in the Northern and North Western part of Bangladesh. Recently their infestation is in havoc in Rangpur, Joypurhat, Rajshahi, Chuadanga and Rajbari district. Generally, cane damage due to white grubs may be as high as 100%. Most of the insecticides approved against WG are Carbamate compound. So, alternate insecticides are needed against this pest. Termites are social insects.

They live in colony forming termitorium. Cane setts are attacked by pest after plantation through cut ends. Application of chemicals in the trenches as a prophylactic measure will help to control the pest giving ensured germination. Grown up canes/standing canes are also attacked for which chemicals should be applied at the base of the plants in later months. For the purpose several experiments, for controlling of several pests likes TSB, WG and Termites have been planned under this experiment.

3.2 OBJECTIVE(S)

i. Comparing the effectiveness of new insecticides;
ii. Documenting intensity of insect pests infestation against different insecticides;
iii. Finding suitable and effective insecticides and
iv. Getting more chemical control measure for the farmers.

3.3 METHODOLOGY

The proposed insecticides are of granular and EC formulation. The granular will be applied at the root zone in the trenches on both side of cane rows while EC formulation will be applied in plants by sprayer. The chemicals will be applied in June + July + August for Stem borer and March + May + July application of chemicals for Rootstock borer.

Treatments for Top shoot borer (BSRI farm and RSRS, Thakurgaon):

T_0 : Control (untreated)
T_1 : M-Furan 5GR (Chlothianidin) @ 1.4 kg a.i. ha^{-1} at March + May
T_2 : Vistara 4GR (Chlorantraniliprole) @ 800 g a.i. ha^{-1} at March + May
T_3 : Vendora 0.4G (Chlorantraniliprole) @ 60 g a.i. ha^{-1} at March + May
T_4 : Imagine 10SC (Flupyrimin) @ 100 ml a.i. ha^{-1} at March + May
T_5 : Monotaf 50WDG (Monosultap) @ 3 g per litre water a.i. at March + May
T_6 : Ballot 4GR @ (Chlorantraniliprole) @ 800 g a.i. ha^{-1} at March + May
T_7 : Spider 5GR @ (Clothianidin) @ 1.4 kg a.i. ha^{-1} at March + May
T_8 : Tecorel 18.5SC (Chlorantraniliprole) @ 700 ml a.i. ha^{-1} at March + May
T_9 : Zia –M 5GR @ (Clothianidin) @ 1.4 kg a.i. ha^{-1} at March + May
T_{10} : Power XL 18.5SL (Chlorantraniliprole) @ 100 ml a.i. ha^{-1} at March + May
T_{11} : Katrina 0.4GR (Chlorantraniliprole) @ 80 g a.i. ha^{-1} at March + May
T_{12} : Durbar 5G (Clothianidin) @ 1.4 kg ha^{-1} at March + May
T_{13} : Team effort 25SC (Chlorantraniliprole 12.5% + Indoxacarb 12.5%) @ 80ml ha^{-1} at March + May
T_{14} : Cipronil 0.4GR(Chlorantraniliprole) @ 100g ha^{-1} at March + May
T_{15} : Safenil 0.4GR (Chlorantraniliprole) @ 100g ha^{-1} at March + May

Design: RCB Replication: 3 Plot Size: 6m x 6m Total area: 0.16 ha Net area: 0.09 ha

Treatments for Stem borer:

T_0 : Control (untreated)
T_1 : X-Furan 5GR (Clothianidin) @ 1.4 kg a.i. ha^{-1} at June + July + August
T_2 : Oncol 5 G (Benfuracarb) @ 600g a.i ha^{-1} at June + July + August
T_3 : Dhumketu 5 GR (Clothianidin) @ 1.4 kg a.i ha^{-1} at June + July + August
T_4 : Hatiyer 5GR (Clothianidin) @ 1.4 kg a.i ha^{-1} at June + July + August
T_5 : Lotus 40 WG (Chlorantraniliprole 20% + Thiamethoxam 20%) @ 120g a.i ha^{-1} at June + July + August
T_6 : Zombi 40 WDG(Chlorantraniliprole 20% + Thiamethoxam 20%)@ 120g a.i ha^{-1} at June+ July + August
T_7 : Thioprole 40WDG(Chlorantraniliprole 20% + Thiamethoxam 20%)@ 120g a.i ha^{-1} at June+ July+ August
T_8 : Nigel 4GR (Chlorantraniliprole) @ 100g a.i ha^{-1} at June + July + August
T_9 : D-fire 0.4 GR (Chlorantraniliprole) @ 100g a.i ha^{-1} at June + July + August
T_{10} : Fair-Dhan 5GR (Clothianidin) @ 1.4 kg a.i ha^{-1} at June + July + August
T_{11} : Agridin 5GR (Clothianidin) @ 1.4kg a.i ha^{-1} at June + July + August
T_{12} : Ferrtera 0.4 G (Chlorantraniliprole) @ 20 kg ha^{-1} at June + July + August (std)

Design: RCB, Replication: 3 Plot Size: 6m x 6m Total area: 0.14 ha Net area: 0.08 ha

Treatments for White grubs (RSRS and Mohon Farm Thakurgaon):

T_0 : Control (untreated)
T_1 : Spider 5 GR (Clothianidin) @ 1.4 kg a.i ha^{-1} at March + April
T_2 : Vendora 0.4 G (Chlorantraniliprole) @ 40g a.i ha^{-1} at March + April
T_3 : Oncol 5 G (Benfuracarb) @ 600g a.i ha^{-1} at March + April
T_4 : Kalam 50 WDG (Clothianidin) @ 1.4 kg a.i ha^{-1} at March + April
T_5 : Nigel 4 GR (Chlorantraniliprole) @ 100g a.i ha^{-1} at March + April
T_6 : D-fire 0.4 GR (Chlorantraniliprole) @ 100g a.i ha^{-1} at March + April
T_7 : Zia-M 5 GR (Clothianidin) @ 1.4 kg a.i ha^{-1} at March + April
T_8 : Durbar 5 G (Clothianidin) @ 1.4 kg a.i ha^{-1} at March + April
T_9 : Chomok 5 G (Clothianidin) @ 1.4 kg a.i ha^{-1} at March + April
T_{10} : Cipronil 0.4 GR (Chlorantraniliprole) @ 100g a.i ha^{-1} at March + April
T_{11} : Safenil 0.4 GR (Chlorantraniliprole) @ 100g a.i ha^{-1} at March + April
T_{12} : Ferrtera 0.4 G (Chlorantraniliprole) @ 20 kg ha^{-1} at March + April (std)

Design: RCB, Replication: 3 Plot Size: 6m x 6m Total area: 0.16 ha Net area: 0.09 ha

Treatments for Termite (Bhabanipur farm, NBSM and Akandobaria farm, Carew & Co. Bangladesh Ltd.):

T_0 : Control (untreated)
T_1 : Agrimectin 5WSG (Emamectin Benzoate) @ 100 g a. i. ha^{-1} at planting
T_2 : Enfuran 3GR (Fipronil) @ 50g a.i ha^{-1} at planting
T_3 : U-gent 3GR (Fipronil) @ 50g a.i ha^{-1} at planting
T_4 : Pentap 50SP (Cartap) @ 150g a.i ha^{-1} at planting
T_5 : Leader 2.5 EC (Lambda-cyhalothrin) @ 10ml a.i ha^{-1} at Planting
T_6 : Amphan 80 WDG (Nitenpyram+Pymetrozine) @ 160g a.i ha^{-1} at Planting
T_7 : Envoy 50SC (Fipronil) @ 1L a.i ha^{-1} at planting
T_8 : D-Fire 0.4GR (Chlorantraniliprole) @ 100g a.i ha^{-1} at Planting
T_9 : Power XL 18.5 SL (Chlorantraniliprole) @ 100g a.i ha^{-1} at Planting
T_{10} : Keya Gold 55EC (Chlorpyriphos + Cypermethrin)@ 2.25L a.i ha^{-1} at Planting+ March+may
T_{11} : Control 50WDG (Emmamectin Benzoate + Lufenuron) @ 100g a.i ha^{-1} at Planting
T_{12} : Nippy 80WDG (Nitenpyram+Pymetrozine) @ 240g a.i ha^{-1} at Planting
T_{13} : Ustad 10EC (Cypermethirn) @ 200ml a.i ha^{-1} at Planting
T_{14} : Ferrtera 0.4 G (Chlorantraniliprole) @ 20 kg ha^{-1} at March + May (std)

3.4 WORK ELEMENT

1. Plantation & fertilization (Nov.–Dec.'24)
2. Germination count (Feb.–Mar.'25)
3. Weeding and mulching (Feb.–Apr. '25)
4. Application of insecticides as per schedule (Nov. 24- Aug. 24)
5. Irrigation (two times) (Mar.–May' 25)
6. Top dressing (two times) (Mar.–May' 25)
7. Data collection (Apr.-Sept.'25)
8. Harvest (Dec.'25)
9. Statistical analysis/interpretation (Jan.'26)

3.5 TIME SCHEDULE

Activity No.	Months														
	2024		2025												2026
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1	→	→													
2,3				→	→	→									
4	→	→	→	→	→	→	→	→	→	→					
5,6					→	→	→	→							
7						→	→	→	→	→	→				
8														→	
9															→

3.6 ECONOMIC IMPACT

Using chemical insecticides for pest control offers economic benefits, mainly by increasing crop yields and reducing agricultural losses, which boosts farmers' income and helps stabilize food prices. Additionally, overuse can lead to pest resistance, increasing future costs for pest management. For lasting economic gains, it's essential to balance insecticide use with sustainable pest control practices.

3.7 EFFECT ON ENVIRONMENT

Insecticides are in general harmful for the environment but they are not equally hazardous. Granular formulation is always better concerning environment. Granular insecticides will be applied in soils. Otova 10 EC and Virtako 40 WG are non systemic and remains active for a month. Both wetable granular and emulcifiable concentrate will be applied in upland soil hence there is little chance to be toxic to the environment. When more insecticides will be available to the end users the price will automatically be come down.

3.8 UTILIZATION OF RESEARCH RESULTS

The research results will be communicated to the BSFIC, sugarcane farmer and DAE for extension. The growers may be communicated through class room training or by setting large scale demonstration with the chemicals. Finally the farmers will adopt the technology. The result will be published in Annual reports, Journals through which end users will be benefited also.

PROGRAMME AREA : **PEST MANAGEMENT**
4.0 TITLE : **EFFICACY OF GREEN INSECTICIDES AGAINST THE INCIDENCE OF SUGARCANE MEALY BUG**
LOCATION (S) : i) BSRI farm, Ishurdi, Pabna ii) FSM, Faridpur and iii) RSRS, Thakurgaon
INVESTIGATOR(S) : M N Alam, M E Reza, M N A Siddiquee, M S Islam, N Sultana and M A Rahman
NATURE OF STUDY : Modified
PROJECTED COMPLETION : 2024-2026
ESTIMATED COST (TK.) : 60,000.00

4.1 DEFINITION OF THE PROBLEM:

Different insect pest in the world reduces sugarcane production. Among them mealy bug is one of the insect pest which widely spread throughout the world. According to Williams (1970), thirty species of mealybugs are known to attack sugarcane in different regions of the world. And nine species of mealybugs are known to occur in India. In Bangladesh, there are two species of mealybugs are available in sugarcane, *Kiritshenkella sacchari* and *Pseudococcus saccharicola.* It can multiply profusely inflicting loss in tonnage as also as sugar recovery. Nymphs and adults suck the sap from leaves, nodes and internodes of canes. The damage caused by the mealybugs insect occurs partly by sucking the plant sap and so leading to yellowing of leaves, stunting of canes and poor germination. The most serious loss occurs from the industrial point of view, as the residues of wax, honeydew and sooty mold that persist for months (Jayanthi 1986). Due to severe infestation of mealybugs in canes reduced sucrose content by 24.1% and brix by 16.2% (Kalra and Sidhu,1964). Therefore, the study has taken to evaluate the chemical insecticide against mealybug control for increasing the sugarcane yield.

4.2 OBJECTIVE (S)

i) Finding the effective management practices for sugarcane mealy bugs insect and
ii) Estimating the effects of mealy bugs insect on yield of sugarcane.

4.3 METHODOLOGY

The experiment will be conducted at experimental farm of Faridpur Sugar Mills Ltd. The sugarcane variety Isd 34/Isd 37 will be conventionally planted with two bud setts. The following management practices will be applied as per schedule. Scale insect infestation will be recorded in September and November. Data on brix will be recorded at harvest.

Treatments:

T_0 : Control (untreated)
T_1 : Plantation with mealy bug insect free setts
T_2 : Sett dipping in Chlorantraniliprole 18.5 SC @ 3ml/L for 30 minutes before plantation
T_3 : Bio-Clean (Potassium salt of fatty acid) @ 1.0 ml/L water (July + August + September)
T_4 : Virtako 40WG (Chlorantraniliprole + Thiamethoxam) @ 300.0 g ha^{-1} (July + August + September)
T_5 : Nitro 505 EC (Chlorpyriphos + Cypermethrin) @ 3.0 litre ha^{-1} (July + August + September)
T_6 : M-Pede 49SL (Potassium salt of fatty acid) @ 10ml/L water (July + August + September)
Design: RCB Replication: 3 Plot Size: 6m x 6m Total area : 0.17 ha Net area : 0.10 ha

4.4 WORK ELEMENTS

1. Land selection and preparation (Sept.- Oct' 24)
2. Planting of sugarcane (Nov.'24)
3. Irrigation, weeding, mulching and earthing-up (Feb.'25–Jun' 25)
4. Fertilizer top dressing (Mar.–May'25)
5. Detrashing (July-Oct.'25)
6. Application of insecticides (July-Sept.'25)
7. Data collection (Dec.'25)
8. Harvest (Jan.'26)
9. Data analysis (Jan.'26)

4.5 TIME SCHEDULE

Ac. No.	Months																	
	2024				2025												2026	
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1	→	→																
2		→	→															
3					→	→	→	→	→	→								
4						→	→	→	→									
5											→	→	→	→				
6											→	→	→					
7																→		
8																	→	
9																	→	

4.6 ECONOMIC IMPACT

By definition IPM is the intelligent selection and use of pest control actions that will fulfil economical, ecological and sociological consequences. Since detrashing, use of insect free setts etc. are cultural control measures and these are not too costly, could be considered as economical in IPM of Scale insect. Unnecessary excess actions/expenses are avoided.

4.7 EFFECT ON ENVIRONMENT

Ecological consequences are considered in IPM. Actually, the concept of IPM is to manage the pest in favour of environment. Non chemical control measures are encouraged, whereas, chemical control measures are abandoned and only used as the last resort. Detrashing and use of insect free setts will be environmentally friendly practices.

4.8 UTILIZATION OF RESEARCH RESULTS

The results obtained from this study may be helps the sugarcane growers to manage the Scale insect economically.

5.0 TITLE : **EFFICACY OF DIFFERENT INSECTICIDES ON INCIDENCE OF SCALE INSECT (MELANASPIS GLOMERATA GREEN), AND ITS EFFECT ON YIELD AND QUALITY OF SUGARCANE**

LOCATION : i) BSRI, Ishurdi, Pabna
ii) Chuadanga and
iii) RSRS, Thakurgaon

INVESTIGATOR(S) : M. N. Alam, M. E. Reza, M.N.A. Siddiquee, M. S. Islam, N. Sultana, M. O. Sheikh and M. A. Rahman

NATURE OF STUDY : New

PROJECTED COMPLETION : 2024-2027

ESTIMATED COST (TK.) : 60,000.00

5.1 DEFINITION OF THE PROBLEM

In Bangladesh, the scale insect (*Melanaspis glomerata* Green) is a minor pest of sugarcane but nowadays it is becoming a major pest that affecting both productivity of cane and quality of juice. A wide range of climatic conditions high to moderate temperatures and humidity helps to abundant scale insect in sugarcane. It promotes mainly from July onwards until harvest. In Andhra Pradesh, a study indicated that heavy infestations by *M. glomerata* reduced cane weight, juice brix, sucrose content of the juice and purity by 51.6, 27.7, 39.0 and 13.4%, respectively (Goel *et al.*, 1983). It is also noted that scale infestation reduced cane yield by 32.6% and sugar recovery by 1.5 - 2.5% (DACNET, 2012). After harvesting of the main crop the pest remains in the underground stubble and acts as a primary source of infestation in ratoon crops. During growth period at stalk formation it would be effective and economical spraying insecticides followed by detrashing. Agarwal and Sunil Kumar (1973) and Venugopala Rao *et al.* (1983), emphasized the need for trashing the cane before applying insecticidal sprays for checking the pest buildup. Jhansi and Babu (2001) also reported that spraying 0.1% malathion followed by 0.03% dimethoate preceded by detrashing significantly reduced the scale insect infestation. Therefore, in view of the above circumstances, the present investigation was carried out to test insecticide from different chemical groups so to reduce the risk of cross resistance to scale insect.

5.2 OBJECTIVE (S)

i) Finding out the effective insecticides for controlling scale insect of sugarcane and
ii) Evaluating the yield and quality loss of sugarcane due to infestation of scale insect.

5.3 METHODOLOGY

Studies on the efficacy of selected insecticides against scale insect (*Malanaspis glomerata* Green) on sugarcane will be conducted at the BSRI farm and Regional Station at Thakurgaon from 2024 to 2026 with eight treatments including control replicated three times, laid out in Randomised Block Design. The sugarcane setts will be treated with the test insecticides for before planting. Then the foliar sprays of the seven insecticides were applied after assessing the scale insect incidence in August, September and October. Treatments will be applied using a spray volume of 1000 liters/ha preceded by detrashing of the older leaves. The incidence of scale insect will be assessed by counting the number of nodes and the number of infested nodes per cane at the time of harvest in 20 randomly selected canes in each plot. Values will be converted into percentage incidence of scale insect per plot. The scale incrustation will be scraped from all these infested cane stalks and the weight of the scale incrustation will be recorded as mg/cane in each treatment. Juice analysis (percent

sucrose and purity) will be carried out before the harvest of the crop and estimated for each treatment. Cane yield and number of millable canes (NMC) will be recorded at harvest. The data on per cent incidence of scale insect, scale incrustation, cane yield, NMC/ha and quality parameters will be analysed by using statistical tools.

Treatments:

T_1: Control (Untreated)
T_2: Sett treatment with Imidacloprid 200SL@ 1 ml/L and spraying of imidacloprid @ 1 ml/L.
T_3: Sett treatment with Acephate 75SP @ 1 g/L and spraying of acephate @ 1 g/L.
T_4: Sett treatment with Acetamiprid 20SP@ 1 g/L and spraying of acetamiprid @ 1 g/L.
T_5: Sett treatment with Dimethoate 30 EC @ 1 ml/L and spraying of diemethoate @ 1 ml/L.
T_6: Sett treatment with Phenthoate 40EC @ 1 ml/L and spraying of phenthoate 40EC @ 1 ml/L.
T_7: Sett treatment with Malathion 57EC @ 3 ml/L and spraying of malathion @ 3 ml/L.
T_8: Sett treatment with Acephate 50%+Imidaclorprid 25% 70WP @ 1 g/L and spraying of current @ 1 g/L.
T_9: Sett treatment with Potassium salt of fatty acid 49SL @ 10ml/L water and spraying @ 10ml/L water

5.4 WORK ELEMENTS

1. Sett treatment with insecticides and planting in field
2. Intercultural operations and fertlilizer application
3. Detrashing and spraying insecticides
4. Collection data and analysed

5.5 TIME SCHEDULE

Activity No.	Months															
	2024			2025											2026	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1	→	→														
2			→	→	→	→	→	→	→	→	→	→	→			
3										→	→	→	→	→		
4															→	→

5.6 ECONOMIC IMPACT

Farmers are thoughtful about the insect pests throughout the cane growing areas of Bangladesh. These are serious problem in cane cultivation and without managing the pest it is difficult to achieve good harvest. Very recently scale insect becomes as a serious pest of sugarcane due to climate change. There are no insecticidey recommended for controlling scale insects of sugarcane. Cheaper and effective chemicals are needed for farmers to control this insect.

5.7 EFFECT ON ENVIRONMENT

Insecticides are in general harmful for the environment but they are not equally hazardous. When more insecticides will be available to the end users the price will automatically be come down.

5.8 UTILIZATION OF RESEARCH RESULTS

The research results will be communicated to the BSFIC, sugarcane farmer and DAE for extension. Finally, the farmers will be adopted the technology. The result will be published in Annual reports, Journals through which end users will be benefited also.

PROGRAMME AREA	**:**	**PEST MANAGEMENT**
6.0 TITLE	**:**	**ISOLATION, SCREENING AND CHARACTERIZATION OF ENTOMOPATHOGENIC FUNGI FROM AGRICULTURAL SOILS OF BANGLADESH**
LOCATION(S)	**:**	i. BSRI, Ishurdi, Pabna
INVESTIGATOR (S)	**:**	M S Islam, M A Rahman, M N Alam, M N A Siddiquee, M E Reza and N Sultana
NATURE OF STUDY	**:**	New
PROJECTED COMPLETION	**:**	2024-2027
ESTIMATED COST (Tk.)	**:**	300,000.00

6.1 DEFINITION OF THE PROBLEM

Farmers are generally oriented towards chemical control because it provides immediate control of insect pests. But the indiscriminate use of chemical insecticides has serious environmental impacts, such as harmful effects on environmentally friendly organisms, causing resistance to insect pests, contamination, and an increase in toxic substances in food, endangering human health as well as that of animals and wildlife, and disrupting natural control systems in the field. Subsequently, it can cause insecticide-induced diseases such as kidney and liver failure, cancer, and genetic disorders in humans (Usman *et al.*, 2021; Ambethgar, 2009). In view of the issues mentioned above, it is, therefore, an urgent need to develop safe, environmentally friendly, effective, and sustainable strategies for the management of insect pests. Biological control agents (BCAs) are environmentally friendly alternatives to chemical insecticides. Among the BCAs, entomopathogenic fungi (EPFs) are specific in action, safe, compatible with IPM tactics, and are not harmful to natural enemies and the environment. They are key regulatory factors in insect pest populations and considered very promising biological control agents (Du *et al.*, 2020). Soil is an important habitat for entomopathogenic fungi. Local isolates have many advantages over exotic isolates in that they can have ecological compatibility with insect pest species. The EPFs can adapt to their environmental conditions, such as habitat types and climatic conditions. Moreover, the virulence of EPFs is strain-dependent and influenced by environmental conditions (Gürlek *et al.*, 2018; Kryukov *et al.*, 2010). In view of the above, it is necessary to isolate local EPFs that are adapted to the local environment and therefore more effective in controlling the pest population in related areas to ensure the production of biopesticides for the replacement of conventionally used chemical insecticides. Concerning the importance of EPFs as effective biocontrol agents for the insect population, it is essential to correctly identify entomopathogenic fungi at the species level. The morphological characteristics of fungi isolates represent fundamental information for researchers in the identification of fungi to the genus level. However, the identification of fungi at the species level is very difficult, even for an expert, due to the high similarity of the morphological features. As reported by Druzhinina *et al.* (2005), only morphological features are not reliable and sufficient for fungi species identification. Therefore, for the correct identification of EPFs species, it is essential to combine morphological characterization and molecular data analysis. Different EPFs have been extensively and successfully tested on various species of insect pests by many researchers, and EPFs have been reported to be useful and potential agents for the biological control of insect pests (Liu *et al.*, 2022; Sayed *et al.*, 2019; Ramanujam *et al.*, 2018; Lopez *et al.*, 2014; Kepenekci *et al.*, 2014). But previously no study has been conducted on the efficacy of locally isolated EPFs towards the major insect pest of sugarcrop in Bangladesh. From this point of view, this study will be undertaken.

6.2 OBJECTIVE (S)

To isolate, screen and identify entomopathogenic fungi species based on a combination of morphological characteristics and molecular data analysis.

6.3 METHODOLOGY

A. Isolation of Entomopathogenic Fungi

i. Collection of Soil Samples
ii. Collection of Insect Samples
iii. Preparation of Selective Media
iv. Isolation by Soil Dilution Method
v. Isolation by the Insect Bait Method (IBM)

B. Protease-base Screening of the Isolates

i. Preparation of Skimmed Milk Agar (SMA) Medium

ii. Protease Assay

C. Morphological Analysis

a. Macroscopic Characterization

A number of groups of fungi colonies will be observed for morphological characteristics for the identification of fungi species. From the stock slants, isolates will be cultured under aseptic conditions in SDAY in 90mm Petri dish and then incubated for 5–15 days at a temperature of 28ºC and a humidity of 70%. The isolates were grouped according to the following characteristics: growing pattern of the colony; the color of the colony on both sides of the Petri dish; mycelium density; and appearance of the colony (Luangsa-Ard *et al.*, 2011; Houbraken *et al.*, 2011; Visagie *et al.*, 2020).

b. Microscopic Characterization

Slide culture technique will be used for microscopic observation of the isolates. The slide culture will be prepared using a Petri dish (90 mm) containing the u-shaped glass rod on sterile filter paper. About 4 mL of sterile water will be poured onto the filter paper to wet it completely. This step will be performed to maintain the humidity necessary for the growth of the fungi. From the agar plate, a thin agar block (one cm square) will be cut using a sterile blade and transferred to the center of the slide that was placed on the glass rod. After that, the agar blocks will be inoculated by the fungal spores with the sterile inoculating loop. Next, a sterile cover slip will be placed on the upper surface of the agar cube. Subsequently, the slide will be incubated for 2-4 days at room temperature (28 ± 2°C). Then, the slide will be observed in a light microscope with 100× and 400× magnifications. Observations were conducted on the branching pattern of the conidiophores, the presence of phialides, the color, size, and shape of the conidia (Luangsa-Ard *et al.*, 2011; Houbraken *et al.*, 2011; Visagie *et al.*, 2020; Siddiquee, 2017).

D. Molecular Identification of Isolates

a. DNA Extraction

The genomic DNA of the isolates will be extracted following the Cetyltrimethylammonium Bromide (CTAB) method according to Cubero *et al.* (1999). Approximately 100 mg of fresh mycelia of each isolate will be collected from three to seven-day-old culture plates and taken into a 1.5 mL Eppendorf tube using a sterilized inoculating loop. Then, 500 µL of CTAB buffer (20 g CTAB, 280 mL 5 M NaCl, 100 mL 1 M Tris HCl pH 8.0, 40 mL 0.5 M EDTA, and adjusted to 1,000 mL with sterile distilled water) will be added to each sample and vortexed (Minishaker IKA MS1). The mixture will be incubated at 60°C for one hour at 85 g (Thermomixer Comfort, Eppendorf). Next, 5 µL of RNase A (10 mg/mL) will be added to the sample mixture and incubated once again for 15 min. A cold mixture of 500 µL of phenol-chloroform-isoamyl alcohol (25: 24: 1, v / v) will be then added to the tubes under a fume hood and will be inverted 40-50 times and centrifuged at 17949 g for 10 min at 4°C. Next, the top aqueous layer will be transferred to a new Eppendorf tube (1.5 mL). Then, an equal volume of isopropanol will be added, inverted several times, and incubated at 4°C for 30 min. Subsequently, the tube will be centrifuged at 4°C for 10 min at 17949 g. The supernatant will be removed and the resulting DNA pellet will be washed two times with 500 µL of ice-cold 70% ethanol. Each washing step included centrifugation at 4°C for 10 min at 17949 g. Then, the DNA pellet will be dried in a speed vac at 45°C for 15 min. After that, the DNA will be resuspended in a 50 µL Tris-EDTA (TE) buffer. DNA purity and quantity will be determined by agarose gel electrophoresis (1%) and UV spectrophotometry (NanoVue, Thermo Scientific). The absorbance ratio (A260/A280) between 1.8 and 2.0 was considered good quality DNA. The final eluted DNA will be kept at -20°C until the next use.

b. DNA Amplification and Visualization

The polymerase chain reaction (PCR) will be performed to amplify the ITS 1–5.8 S-ITS 2 regions of the rDNA using two primers, ITS1 (5'-TCC GTA GGT GAA CCT GCG G-3') and ITS4 (5'-TCC TCC GCT TAT TGA TAT GC-3') (White *et al.*, 1990). The PCR reactions will be performed with an automated thermal

cycler (PTC-200 Peltier Thermal Cycler) using 25 µL of reaction mixtures containing 2.5 µL of 10× PCR buffer, 2.0 µL of 25 mM magnesium chloride (MgCl2), 0.5 µL of 10 mM PCR deoxynucleotide triphosphate mix (dNTPs), 0.25 µL of 5 Units of Taq DNA polymerase, 0.625 µL of each 10 µM primers (ITS1 and ITS4), 16.5 µL of sterile distilled water (ddH2O) and 2.0 µL of 100 ng/µL template DNA. The ITS 1-5.8 S-ITS 2 regions of the rDNA will be amplified according to the following PCR protocols: initial denaturation at 95°C for 4 min, followed by 39 cycles of denaturation at 95°C for 45 sec, primer annealing at 55°C to 58.8°C for 45 sec, and extension at 72°C for 1 min. The amplification will be completed with one additional step of final extension at 72°C for 10 min.

A total of 5 µL of the PCR products will be electrophoresed in 1% (w/v) of agarose gel in 1 × Tris-borate-EDTA (TBE) buffer (89 mM Tris Base, 89 mM Boric acid, and 2 mM EDTA, pH 8.0) at 70 V for 50 min. The approximate sizes of the amplified fragments will be determined by comparing them with a 100 bp DNA ladder (GeneRuler, 100 bp Plus DNA Ladder, 1st BASE). The gel was stained with Ethidium Bromide (EtBr) for 15 min and observed visually under UV light and photographed using the AlphaImager® HO.

c. Purification of PCR Products

Purification of the amplified PCR products of each isolate will be performed using the QIAquick® PCR Purification Kit (QIAGEN) based on the instructions of the manufacturer. First, the binding buffer (PB buffer) will be added to the PCR products in a ratio of 5:1 and mixed thoroughly. For binding the DNA, the mixture will be transferred to the QIAquick spin column that will be placed in a collection tube (2 mL) and centrifuged at 17949 g for 1 min. The flow-through will be discarded and the QIAquick column will be backed to the same collection tube. A 750 µL of wash buffer (PE buffer) will be added to the QIAquick column and centrifuged at 17949 g for 1 min. The flow-through will be discarded once again, and then the QIAquick column will be backed to the collection tube. The QIAquick column will be centrifuged for an additional 1 min to remove any remaining wash buffer. Next, the QIAquick column will be placed in a new sterile microcentrifuge tube (1.5 mL) and 50 µL of elution buffer (buffer EB) will be added to the center of the Qiaquick membrane. The tube will be centrifuged at 17949 g for 1 min to elute the purified PCR products. Then, the purified PCR products will be electrophoresed in 1% (w/v) of agarose gel in 1× Tris-borate-EDTA (TBE) buffer and their concentration will be determined by using a UV spectrophotometry (NanoVue, Thermo Scientific). Finally, the purified PCR products (50 µL) will be sent to the NIB, Sava, Dhaka for DNA sequencing.

d. Sequence Analysis of ITS 1-5.8 S-ITS 2 Regions of the rDNA

DNA sequencing will be performed NIB, Savar, Dhaka. The sequences of the ITS 1–5.8 S–ITS 2 regions of the rDNA will be checked and edited manually with BioEdit Sequence Alignment Editor. The forward and reverse sequences will be aligned and formed a consensus sequence. The sequences will be compared with information from public databases in NCBI (National Center for Biotechnology Information, Bethesda, MD, USA) (http://www.ncbi.nlm.nih.gov/BLAST/) using the Base Local Alignment Search Tool (BLAST). According to the BLAST results, the sequences will be taken based on the similarity value >97% with known sequences in the NCBI database (Castillo *et al.*, 2012).

e. Phylogenetic Analysis

The ITS 1-5.8 S-ITS 2 phylogenetic tree of the rDNA will be performed by comparing it with the sequences from NCBI. The trees will be constructed according to the unweighted pair-group method based on the arithmetic average (UPGMA) (Sneath *et al.*, 1973) using molecular evolutionary genetics analysis (MEGA X) software version 10 (Kumar *et al.*, 2018). The reliability and interior branches and the validity of the trees will be tested with 10,000 replications using bootstrap.

6.4 WORK ELEMENTS

1. Collection of soil and insect samples (2024-2026)
2. Isolation of fungi (2024-2026)
3. Screeining of protease producing fungi (2024-2026)
4. Morphological analysis of the isolates (2025-2027)
5. Molecular identification of the isolates (2025-2027)

6.5 TIME SCHEDULE

Activity No.	2024	2025	2026	2027
1	→	→	→	
2	→	→	→	→
3	→	→	→	→
4	→	→	→	→
5		→	→	→

6.6 ECONOMIC IMPACT

Entomopathogenic fungal-based biopesticides are expected to be an alternative to chemical-based insecticides for the sustainable management of insect pests in agricultural crops. Since chemical-based insecticides are too costly, EPF-based biopesticides are considered economical in pest management.

6.7 EFFECT ON ENVIRONMENT

In recent times, there has been a substantial increase in activities related to the commercial development of EPFs-based biopesticides (Wraight *et al.*, 2001). The increased usage of bio-pesticides is owing to the ban of some chemical pesticides and the phase-out of others. In addition, chemical-based insecticides are well-known to pollute groundwater, enter the foodstuff and harm health of human being (Butt *et al.*, 2001). The benefits of entomopathogenic fungal-based biopesticides over chemical-based insecticides incorporate human and non-target organism safety, improved biodiversity, reduced pesticide residues in food, and conservation of other beneficial organisms (Lacey *et al.*, 2001). It provides better ecological insect pest control compared to chemical-based insecticides (Moore and Prior, 1993).

6.8 UTILIZATION OF RESEARCH RESULTS

Identified entomopathogenic fungal-based biopesticides will be evaluated for their virulence on sugarcrop insect pest management through laboratory bioassay and field application.Mass production of local virulent isolate will be done using available products such as broken rice, wheat, maize, etc. to control different kinds of insects such as leaf sap suckers, leaf feeders, borers and underground feeders.

PROGRAMME AREA : **PEST MANAGEMENT**
7.0 TITLE : **EFFECTS OF NUTRITIONAL SUPPLEMENTS TO IMPROVE THE HEALTH OF HONEY BEE COLONY (*Apis mellifera*)**
LOCATION (S) : i) Biological Control Laboratory, BSRI, Ishurdi, Pabna
INVESTIGATOR (S) : N Sultana, M E Reza, M S Islam, M A Rahman, M N A Siddiquee and M N Alam
NATURE OF STUDY : New
PROJECTED COMPLETION : 2025-2027
ESTIMATED COST (TK) : 1,00000.00

7.1 DEFINITION OF THE PROBLEM

Apiculture plays an important role in improving crop productivity all over the world. Honeybees play a crucial role as beneficial insects, collecting nectar and pollen to produce honey and serving as pollinators to enhance crop productivity. The enrichment and enhancement of apiculture lies in the good health and hygiene of honey bees. Honeybees require pollen and nectar from rich flowers to satisfy their nutritional requirements. But such flowers of bee's interest are not available round the year. The period of the year when there is a lack of flower that attracts bees is referred to as the dearth period. Therefore, honey bees require special care and management during dearth periods. Like all other animals, honey bees do have specific nutritional requirements. Pollen collected by bees from flowers are the major sources of protein, carbohydrates, minerals and vitamins whereas, nectar is the source of energy. During prolonged dearth periods, lack of pollen result into low nutritional reserves which reduces the longevity, negatively impact the brood's rearing , poor growth of hypopharyngeal gland, less honey and royal jelly production, inferior growth of worker larvae and young bees colonies may be attacked by various pest and diseases. To avoid this situation, colonies are either physically moved to a bee flora rich region or provision of feeding pollen are made. There are some disadvantages to both

migration and pollen feeding. The shifting of bee colonies is a tedious work, which causes huge loss to honey bees in term of mortality during transportation. Also a lot of time and labour is required for packaging and moving the colonies to distant places. Secondly, beekeepers usually neither collect and feed natural pollen to bee colonies, nor pollen is available in the market commercially. Further, commercial pollen may be contaminated with various pathogens. This experiment will help to formulate highly palatable and nutritionally balanced pollen substitute during dearth period so as to further strengthen commercial beekeeping in Bangladesh. Artificial pollen feeding during the dearth period make the bee colonies stronger as well as strong colony during dearth period witness early build-up and more foraging bees during the subsequent floral period for augmenting honey production and better pollination service.

7.2 OBJECTIVE (S)

i) To supplement nutrient substitutes among the honey bee colonies in dearth period and
ii) To screening of different pollen substitutes to improve the health of honeybee colony.

7.3 METHODOLOGY

The field experiment will be conducted in Bio-control Lab., Entomology Division, BSRI, Ishurdi, Pabna and honey grower's apiary, Pabna from July 2025- September 2025. Five different treatments will be applied to give different pollen substitutes. Every treatment will be given 500 gram nutritional supplements at 15 days interval. In case of mustard pollen 15g pollen powder will be supplied. Sugar syrup will be added with every treatment as a regular food substitutes. In treatment one, only sugar syrup will be added as a control treatment. No nutritional substitute will be added in treatment one. Each treatment repeated after 3 boxes. Each honeybee rearing box will be treated with different treatments and the number of brood cell, honey cell, pollen cell of the hive will be counted before and after application of every treatment. The design of the experiment is Randomized Complete Block Design with three replications.

Treatments:

T_1: Sugar syrup (July'25 – Sep. '25)
T_2: Sugar syrup + Yeast (500ml Sugar syrup + 10g yeast) (July'25 – Sep. '25)
T_3: Mustard Pollen (15g pollen powder) (July'25 – Sep. '25)
T_4: Soybean flour + Mungbean flour + Chick pea flour + Maize flour+ Scented Rice flour (25g Flour each) (July'25 – Sep. '25)
T_5: Pollen patty (pollen 15% + Sugar syrup 85% + Honey 20%) (July'25 – Sep. '25)

7.4 WORK ELEMENTS

1. Selection of different Honeybee colonies (July '25)
2. Application of different treatments (July'25 – Sep. '25)
3. Data Collection (July'25 – Sep. '25)

7.5 TIME SCHEDULE

Activity no.	Months													
	2024		2025											
	Nov	Dec	Jan	Feb	Mar	April	May	Jun	July	Aug	Sep	Oct	Nov	Dec
1									→					
2									→	→	→			
3									→	→	→			

7.6 ECONOMIC IMPACT

Every year bee farmers face problem to maintain honeybee population in lacking of flower and spend a lot of money to feed them. This technique minimizes the cost of bee keeping as well as it contributes to improve the health of honeybee colony in the dearth period.

7.7 EFFECT ON ENVIRONMENT

Honeybees are beneficial insect. They are great pollinator for the environment. They also produce honey which is very nutritious and has a great medicinal value. This experiment reduces the cost of rearing honey bees during the dearth period as well as it reduces the total honey price in Bangladesh. There is no adverse effect on the environment and human being.

7.8 UTILIZATION OF RESEARCH RESULTS

The results obtained from this study may be helpful for the commercial honey growers and other honeybee researcher.

PROGRAMME AREA : PEST MANAGEMENT
8.0 TITLE : MORPHOLOGICAL CHARACTERIZATION AND DIVERSITY ANALYSIS OF HONEYBEE
LOCATION (S) : Honey & Honeybee Research Lab and Biotechnology Lab, BSRI, Ishurdi, Pabna
INVESTIGATOR (S) : M E Reza, M A Azim, N Sultana, M S Islam, A K Ghose, M N Alam, N Islam and M A Rahman
NATURE OF STUDY : New
PROJECTED COMPLETION : 2024-2027
ESTIMATED COST (TK) : 1,80,000.00

8.1 DEFINITION OF THE PROBLEM

Honeybees (*Apis Mellifera* L.) are crucial pollinators, contributing significantly to global agriculture and biodiversity. Their morphological traits, such as body size, wing length, and coloration, vary widely across populations due to environmental adaptations and evolutionary pressures. Understanding these morphological variations provides insights into their adaptation strategies and ecological roles.

Moreover, genetic diversity within honeybee populations is vital for their resilience to environmental changes, diseases, and breeding programs. Traditional morphological analysis, while useful, may not capture underlying genetic variability. To address this, molecular markers, particularly Random Amplified Polymorphic DNA (RAPD), have proven to be efficient in revealing genetic diversity across populations. RAPD markers provide a cost-effective and rapid approach to identifying genetic polymorphisms without prior knowledge of the genome, making them ideal for assessing genetic variation in wild and domesticated honeybee populations.

This study aims to combine morphological characterization with RAPD analysis to assess the genetic diversity of honeybees, providing a comprehensive understanding of their evolutionary patterns and aiding in conservation efforts.

8.2 OBJECTIVE (S)

i) To characterize morphological traits of honeybees;
ii) To analyze genetic diversity using RAPD markers, and
iii) To explore relationships between phenotypic traits and genetic variations.

8.3 METHODOLOGY

a. Sample Collection

Honeybee samples were collected from eight different honeybee colonies located in diverse geographic regions (list or describe the locations, if relevant). From each colony, 10 worker bees were randomly selected, yielding a total of 80 individual samples. The bees were collected in the early morning to avoid excessive disturbance and placed into sterile collection tubes, preserved on ice for transport to the laboratory. The samples were then stored at -20°C until further analysis.

b. Morphological Characterization

Morphological traits of the honeybee workers were assessed under a stereomicroscope. The following characteristics were measured for each of the 80 bees:

- Wing Length (mm): Measured from the wing base to the wingtip using digital calipers.
- Body Length (mm): Measured from the head to the abdominal tip.
- Antennae Length (mm): Measured from the base of the antenna to the tip.
- Color Variation: Body coloration was classified into distinct categories based on visual observation (e.g., yellow, dark brown, black).

Each measurement was recorded three times for each individual bee to minimize error, and the average value was used for analysis.

c. DNA Extraction

Total genomic DNA was extracted from the thorax of each honeybee worker. The thorax was crushed using sterile forceps, and DNA extraction was performed using the CTAB (Cetyltrimethylammonium Bromide) method, modified as follows:

- 50 mg of bee tissue was homogenized in 600 µL CTAB extraction buffer (2% CTAB, 100 mM Tris-HCl, 20 mM EDTA, 1.4 M NaCl).
- Samples were incubated at 65°C for 30 minutes, followed by the addition of chloroform alcohol (24:1), vortexing, and centrifugation at 12,000 rpm for 10 minutes.
- The upper aqueous layer was transferred to a new tube, and DNA was precipitated by adding an equal volume of isopropanol.
- The DNA pellet was washed with 70% ethanol, air-dried, and resuspended in 50 µL TE buffer (10 mM Tris-HCl, 1 mM EDTA, pH 8.0).

The quality and concentration of extracted DNA were checked using a Nanodrop spectrophotometer and 1% agarose gel electrophoresis.

d. RAPD Marker Analysis

Genetic diversity was assessed using Random Amplified Polymorphic DNA (RAPD) markers. A total of 10 decamer primers (listed in Table 1) were selected for PCR amplification based on preliminary tests of polymorphism.

- PCR Reaction: Each 25 µL PCR reaction contained 10 ng of genomic DNA, 1X PCR buffer, 1.5 mM $MgCl_2$, 0.2 mM dNTPs, 0.5 µM primer, and 1.0 U of Taq DNA polymerase. The thermal cycling conditions were as follows:
  - o Initial denaturation at 94°C for 4 minutes.
  - o 40 cycles of denaturation at 94°C for 1 minute, annealing at 36°C for 1 minute, and extension at 72°C for 2 minutes.
  - o Final extension at 72°C for 5 minutes.
- Gel Electrophoresis: PCR products were separated by electrophoresis on a 1.5% agarose gel stained with ethidium bromide, and bands were visualized under UV light. The sizes of the bands were estimated using a 100 bp DNA ladder.

e. Data Analysis

- **Morphological Data:** The morphological measurements were statistically analyzed using ANOVA to determine significant differences between colonies. Post-hoc Tukey tests were performed for pairwise comparisons.
- **RAPD Data Analysis:** The RAPD bands were scored as either present (1) or absent (0) to create a binary matrix. Genetic diversity indices such as Nei's genetic diversity and Shannon's index were calculated. A genetic distance matrix was generated, and a dendrogram was constructed using UPGMA (Unweighted Pair Group Method with Arithmetic Mean) to represent the genetic relationships among the colonies.

8.4 WORK ELEMENTS

1. Sample Collection (Dec.'24-Jan. 25)
2. DNA Extraction: (Jan.'25 – Feb. '25)
3. RAPD-PCR Amplification (Jan.'25 – Feb. '25)
4. Gel Electrophoresis (Jan.'25 – Feb. '25)
5. Data Analysis (Mar.'25 – Apr. '25)
6. Comparison and Interpretation (Mar.'25 – Apr. '25)

8.5 TIME SCHEDULE

Activity no.	Months													
	2024		2025											
	Nov	Dec	Jan	Feb	Mar	Aprl	May	Jun	July	Aug	Sep	Oct	Nov	Dec
1		→	→											
2			→	→										
3			→	→										
4			→	→										
5						→	→							
6						→	→							

8.6 ECONOMIC IMPACT

This research has significant economic implications, particularly in agriculture and beekeeping. Honeybees are essential pollinators and by understanding their genetic and morphological diversity, this study supports efforts to enhance crop yields and ensure food security. The findings can inform selective breeding programs to improve traits like disease resistance and honey production, benefiting the beekeeping industry. Additionally, identifying diverse bee populations helps guide conservation strategies, ensuring the sustainability of pollination services, which are critical for both ecosystems and agricultural productivity, ultimately contributing to economic stability.

8.7 EFFECT ON ENVIRONMENT

The research on honeybee morphological and genetic diversity has important environmental effects. Honeybees play a crucial role in pollinating wild plants, supporting biodiversity and ecosystem stability. By conserving genetically diverse bee populations, this study helps maintain healthy ecosystems that rely on pollinators for plant reproduction. Diverse and resilient bee populations are better equipped to adapt to environmental changes, such as climate shifts or habitat loss, ensuring the continued functioning of ecosystems. Furthermore, healthier pollinator populations help reduce the need for artificial interventions, such as chemical pesticides, promoting a more sustainable and balanced environment.

8.8 UTILIZATION OF RESEARCH RESULTS

The results will be utilized by beekeepers, agriculturists, and conservationists to enhance breeding programs, crop productivity, and pollinator conservation. Researchers and policymakers will also use the findings to inform further studies and develop strategies for sustainable environmental management.

PROGRAMME AREA : PEST MANAGEMENT
9.0 TITLE : DEVELOPMENT OF IoT (Internet of Things) BASED EARLY DETECTION SYSTEM OF RED PALM WEEVIL INFESTATION ON DATE PALM IN BANGLADESH
LOCATION (S) : BSRI, Ishurdi, Pabna
INVESTIGATOR (S) : M E Reza, M S Hossain, M S Hossain, H P Roy, N Sultana, M S Islam, M N A Siddiquee, M N Alam, S Akhter and M A Rahman
NATURE OF STUDY : New
PROJECTED COMPLETION : 2024-2027
ESTIMATED COST (TK) : 1,80,000.00

9.1 DEFINITION OF THE PROBLEM

Red palm weevil (*Rhynchophorus ferrugineus*) infestation remains a significant and escalating problem for palm tree cultivation worldwide. This pest, native to Southeast Asia, has spread to various regions including the Middle East, North Africa, and parts of Europe, inflicting considerable damage to date palms and other palm species. Infestations are often characterized by the larvae's destructive feeding habits, which cause internal damage to the palm's trunk and can lead to tree death if not promptly addressed. Studies indicate that the red palm weevil can cause up to 50% yield loss in heavily infested plantations, with economic impacts

reaching millions annually (EPPO, 2023). The red palm weevil poses a severe threat to palm trees, often resulting in substantial economic losses due to late or ineffective detection using traditional methods. Despite efforts to manage the pest through chemical treatments and manual inspections, these methods have proven inadequate for comprehensive control due to the weevil's rapid reproduction and elusive nature. Hence, integrating advanced monitoring systems like IoT-based solutions is increasingly seen as a crucial strategy to improve early detection and management of red palm weevil infestations.

The development of an IoT-based red palm weevil detection system is crucial for improving pest management in palm plantations. By integrating IoT technology, the system enables continuous, real-time monitoring of environmental conditions and pest activity through strategically placed sensors. This proactive approach facilitates early detection of infestations, which helps in mitigating damage and reducing the need for labor-intensive inspections. Furthermore, the system's ability to provide actionable data supports informed decision-making and efficient resource allocation, making it a cost-effective and scalable solution for managing red palm weevil outbreaks and protecting valuable crops like date palm.

9.2 OBJECTIVE (S)

i) To develop IoT based sensors for early detection of RPW and
ii) To deploy smart sensor and collect sound related data for possible early detection system of RPW.

9.3 METHODOLOGY

The experiment for developing the IoT-based early detection system for red palm weevil infestation involves several key steps. First, deploy a network of IoT sensors in a palm trees to continuously monitor critical environmental factors such as temperature, humidity, vibrations specially sound that produced by a RPW inside a palm tree. These sensors will transmit real-time data to a central cloud-based platform via a wireless network. Next, implement data analytics and machine learning algorithms on the platform to analyze the incoming data for patterns and anomalies associated with red palm weevil activity. The system will generate alerts and recommendations based on detected infestation risks, allowing for prompt and targeted intervention. Regular calibration and updates will ensure the system's accuracy and effectiveness in varying environmental conditions.

9.4 WORK ELEMENTS

1. Selection of Iot based smart sensors for development a device for early sound detection (Nov.'24-Feb. 25)
2. Deploy the device in three different palm trees (Apr.'25 – Oct. '25)
3. Data Collection (Mar.'25 – Oct. '25)

9.5 TIME SCHEDULE

Activity no.	Months													
	2024		2025											
	Nov	Dec	Jan	Feb	Mar	Aprl	May	Jun	July	Aug	Sep	Oct	Nov	Dec
1	→	→	→	→	→									
2						→	→	→	→	→	→			
3					→	→	→	→	→	→	→			

9.6 ECONOMIC IMPACT

Every year red palm weevil infestation increasing day by day. It will be projected that RPW can reduce 50% of palm production. Sometimes severe attack can damage the whole tree that why a huge economic loss may occur due to this pest. An early detection system can be a solution for the problem and can save the palm tree from huge economical losses by RPW.

9.7 EFFECT ON ENVIRONMENT

The development of an IoT-based early detection system for red palm weevil infestation is likely to have positive environmental effects. By enabling early detection and targeted intervention, the system can

significantly reduce the need for widespread chemical pesticide applications, which are often harmful to non-target organisms and ecosystems. This precision approach minimizes environmental contamination and preserves beneficial insects and soil health. Additionally, it promotes more sustainable palm cultivation practices by reducing the overall use of pesticides, which can lead to improved biodiversity and ecosystem resilience in affected areas. Overall, the IoT-based system supports environment friendly pest management tool that maintaining the health of palm tree cultivation.

9.8 UTILIZATION OF RESEARCH RESULTS

The results obtained from this study may be helpful for the date palm orchard owner and other research fellows, researcher.

PATHOLOGY DIVISION

Rationale

The use of resistant cultivar is the least expensive and most practical means of controlling diseases. In the variety development programme, it is a prime need to sort out the resistant or tolerant clones to major diseases having good qualities with other agronomic characters. Hence research programme has been undertaken on varietal resistance trial against major diseases like red rot, wilt and smut disease.

Sett rot is one of the major problems in profitable cultivation of sugarcane. It causes germination failure as a result crop stand is reduced and eventually yield of cane declined significantly. To protect sett from the attack of soil borne sett rotting fungi, we generally use different sett treating fungicides. The Sub PTAC recommends setting a trial of some chemicals against sett rot. That is why pathology division set trial with recommended chemicals.

There are no satisfactory chemical or biological control measures available that can control red rot efficiently. An experiment has taken to find out comparative efficacy of the different fungicides and bio-control agents against the *C. falcatum* Went. to obtain an effective control measure for recommendation to the farmer. *Orobanche* (*Orobanche aegyptiaca*) is a root holo parasitic plant devoid of chlorophyll and entirely depending on the host for nutritional requirements and cause considerable yield losses of sugarcane in some mill zones. To reduce the yield losses of sugarcane by *Orobanche* the present study has been undertaken.

There are some other sugar crops namely date palm, stevia which are also mandate crop for BSRI. In Bangladesh, identification and documentation of diseases of above mentioned crops are negligible till to date, that's why an experiment has been undertaken in order to identify and documentation of their diseases. To meet up the demands of disease free clean seeds, to minimize experimental error, to set up experiments of different divisions as well to supply to different mills and non mill zones, program of production and distribution of breeder and foundation seed has been undertaken.

The research program proposed by pathology division is directed towards developing disease resistant varieties and to find out effective disease management practices for the benefit of sugarcrop farming community.

LIST OF EXPERIMENTS

PROGRAMME AREA : VARIETAL IMPROVEMENT

1.0 TITLE : Screening of sugarcane genotypes under commercial varieties, ZYT-III, ZYT-II, ZYT-I, AYT, PYT and advanced clones to red rot

2.0 TITLE : Screening of sugarcane genotypes under commercial varieties, ZYT-III, ZYT-II and ZYT-I against wilt disease

3.0 TITLE : Screening of sugarcane genotypes under commercial varieties, ZYT-III, ZYT-II, ZYT-I and AYT against smut disease

PROGRAMME AREA : DISEASE MANAGEMENT

4.0 TITLE : Performance of different sett treating chemicals in controlling sett rot disease of sugarcane

5.0 TITLE : Management of red rot of sugarcane through chemical and biological means

6.0 TITLE : Management of *Orobanche* in sugarcane cultivation

7.0 TITLE : Identification and documentation of date palm and stevia diseases in Bangladesh

PROGRAMME AREA : SEED TECHNOLOGY

8.0 TITLE : Production, quality control and distribution of disease free clean seed of sugarcane

PROGRAMME IN DETAILS

PROGRAMME AREA	:	**VARIETAL IMPROVEMENT**
1.0 TITLE	:	**SCREENING OF SUGARCANE GENOTYPES UNDER PYT, AYT, ZYT-I, ZYT-II, ZYT-III, ADVANCED AND TISSUE CULTURE DERIVED CLONES AGAINST RED ROT**
LOCATION	:	BSRI, Ishurdi and RSRS, Thakurgaon
INVESTIGATORS	:	BSRI Ishurdi: M I Hossain, M A Rahman, M Alinewas, S Sultana and M R Islam RSRS, Thakurgaon: M I Hossain, M A Rahman, M Alinewas, S Sultana and M R Islam
NATURE OF STUDY	:	On-going
DURATION	:	Continuous
ESTIMATED COST (TK)	:	45000.00

1.1 DEFINITION OF THE PROBLEM:

Red rot caused by *Colletotrichum falcatum* Went. is the most serious disease of sugarcane in Bangladesh. It is the oldest known disease of sugarcane that is mainly responsible for the deterioration and eradication of a good number of promising cultivars. The disease causes extensive losses in yield and quality and has been aptly called the cancer of sugarcane. The losses due to this disease may go up to 80-100% when occurs in epidemic form. Red rot pathogen *Colletotrichum falcatum* possess different pathotypes. There are no satisfactory chemical or physical control measures available that can control this disease efficiently. Therefore, breeding for disease resistance has become the main procedure to combat the red rot menace (Dattamajumdar and Singh, 1999). For that reason evaluation process has to be continued without break so that resistant clones are ready in the pipeline to replace susceptible ones in the endemic areas. Cultivation of sugarcane varieties having higher level of resistance is the crying need to mitigate the loss caused by red rot disease. Aiming this, field screening is being conducted to find out the level of resistance in the promising clones/varieties of sugarcane against different isolates of red rot pathogen.

1.2 OBJECTIVES:

i. To identify and select the sugarcane genotypes having higher level of resistance against red rot disease and
ii. To recommend new resistant varieties/tolerant clones for final release to the growers and to preserve in the gene bank for breeding purposes.

1.3 METHODOLOGY:

Sugarcane genotypes under ZYT-III, II, I, AYT, PYT, tissue culture derived clones and irradiated clones with resistant and susceptible standard will be planted at BSRI and RSRS, Thakurgaon farm. Isolates of *C. falcatum* of different cane growing zones will be used for inoculation. The pathogen collected from different zones will be maintained in the oat meal agar slant. Artificial inoculation with different isolates will be done at the age of 7-8 months of the test clones. Eight to ten days old sporulating cultures of the fungus will be used for inoculation. Inoculation will be made with individual as well as with mixed isolates of *C. falcatum.* Fifteen healthy canes of each clone will be inoculated by spore suspension (spore conc.106/ml) with the help of hypodermic syringe method. After two months of inoculation, data on disease development in the canes will be recorded. On the basis of disease index the clones will be categorized as Resistant, Moderately Resistant, Moderately Susceptible, Susceptible and Highly Susceptible to this disease.

1.4 WORK ELEMENTS:

1. Land selection, seed selection and planting.
2. Collection, isolation and culturing of different isolates of *C. falcatum.*
3. Inoculation of sugarcane plants with red rot pathogen.
4. Data collection on disease development in the inoculated canes and naturally infected canes.
5. Data analysis and reporting.

1.5 TIME SCHEDULE:

Ac. No.	2024			2025											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	→	→													
2									→	→	→				
3											→	→			
4												→	→		
5															→

1.6 ECONOMIC IMPACT:

Development of red rot resistant variety will definitely help in economic improvement through increased yield and sugar. By replacing red rot resistant variety the yield of cane as well as production of goor and sugar will be increased.

1.7 EFFECTS ON ENVIRONMENT:

Development of red rot resistant variety will have positive impact on environment. It will reduce the disease incidence in the cane field.

1.8 UTILIZATION OF RESEARCH RESULTS:

With the completion of the experiment, the red rot resistant/tolerant varieties will be sorted out. With the use of resistant variety, red rot disease could be successfully controlled which will boost up sugarcane production at least by saving 6-10% losses due to this destructive disease. The other sugarcane growing countries may also be benefited through mutual exchange of these resistant/tolerant clones.

2.0 TITLE : SCREENING OF SUGARCANE GENOTYPES AGAINST WILT DISEASE
LOCATION : BSRI, Ishurdi
INVESTIGATORS : M A Rahman, M I Hossain, M Alinewas, S Sultana and M R Islam
NATURE OF STUDY : On-going
DURATION : Continuous
ESTIMATED COST (TK) : 15,000.00

2.1 DEFINITION OF THE PROBLEM:

Wilt caused by Fusarium sacchari, is one of the baffling diseases of sugarcane and found to be of considerable importance especially under stress conditions such as infestation by soil pests or other soil factors (Kumar & Kumar, 2005). The disease has a wide occurrence in the cane growing areas. It reduces the germination of seed materials, dries up young shoots and subsequently the cane stalks become wilted. The pathogen is soil borne and chemical control method is not effective against this disease. Substitution of susceptible varieties with resistant one is the most successful and reliable method to curb the disease (Anonymous, 2000). Therefore, screening of varieties/clones for resistance to wilt has become a regular feature prior to go for commercial cultivation.

2.2 OBJECTIVES:

i. To identify and select the sugarcane genotypes having superior resistance to wilt disease and
ii. To recommend new resistant varieties/tolerant clones for final release to the growers.

2.3 METHODOLOGY:

Sugarcane genotypes under ZYT-III, II, I, with resistant and susceptible standard will be planted at BSRI and RSRS Thakurgaon. Wilt affected cane samples will be collected from different cane growing zones of Bangladesh. The wilt pathogen *Fusarium sacchari* will be isolated and cultured in the laboratory and will be maintained on PDA slants. Artificial inoculation of the testing clones will be made by spore suspension of mixed inoculum of *Fusarium sacchari* collected from different agro-ecological zones. Fifteen canes of each clone will be inoculated by hypodermic syringe method. Data on disease development will be recorded after three months of inoculation. On the basis of disease index, the genotypes will be grouped as resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible.

2.4 WORK ELEMENTS:

1. Land selection and preparation.
2. Seed selection, preparation and plantation.
3. Collection, isolation and maintenance of different isolates of wilt causing organism.
4. Inoculation of sugarcane genotypes with organism of wilt disease.
5. Data collection on wilt disease development in different clones of sugarcane.
6. Data analysis and reporting.

2.5 TIME SCHEDULE:

Ac. No.	2024			2025											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	→	→													
2	→	→													
3									→	→					
4											→				
5													→	→	
6															→

2.6 ECONOMIC IMPACT:

By this experiment variety (s) showing resistant or tolerant reaction to wilt disease will be sorted out to release for commercial use. As a result, the farmers will be economically benefited by getting higher yield of both the cane and sugar.

2.7 EFFECTS ON ENVIRONMENT:

This experiment has no adverse effect on environment.

2.8 UTILIZATION OF RESEARCH RESULTS:

Wilt disease causes a great loss of cane every year. So by cultivating wilt resistant varieties the economic condition of farmers could be improved.

3.0 TITLE : SCREENING OF SUGARCANE GENOTYPES UNDER AYT, ZYT-I, ZYT-II AND ZYT-III AGAINST SMUT DISEASE
LOCATION : BSRI, Ishurdi
INVESTIGATORS : S Sultana, M A Rahman, M I Hossain, M Alinewas and M R Islam
NATURE OF STUDY : On-going
DURATION : Continuous
ESTIMATED COST (TK) : 13,000.00

3.1 DEFINITION OF THE PROBLEM:

Smut (*Ustilago scitaminea* Sydow) is one of the most important sugarcane diseases not only in Bangladesh but also in other sugarcane growing countries of the world. The smut fungus has the potential to infect all types of cane. The loss may go 59.45 to 83.92% when naturally infected setts are planted (Rahman *et al.* 1998). Data on quality parameters indicate that in smutted canes brix, sucrose and purity are adversely affected. Chemical control and agronomic practices are not effective to reduce the infection of smut. Substitution of susceptible varieties by resistant ones is one of the most successful and reliable method to combat the disease. Resistant genotypes of sugarcane could play an important role in reducing the loss caused by the disease. Accordingly, screening of genotypes against the disease tends to be a routine work before releasing as varieties for commercial cultivation.

3.2 OBJECTIVES:

i. To identify and select the sugarcane germplasms having superior resistance to smut disease and
ii. To recommend new resistant varieties/tolerant clones for variety development.

3.3 METHODOLOGY:

Required quantity of two budded setts of the sugarcane clones under ZYT-III, II, I, AYT and with resistant and susceptible standard will be inoculated by dipping setts in smut spore suspension (spore conc. 106/ml) mixed with Tween Twenty solution for 30 minutes before planting. Data on disease incidence will be recorded at an interval of one month from 60 DAP up to harvest. The plant crop will be kept for ratoon for observation in the next year. Finally, on the basis of disease index the test clones will be categorized as Resistant, Moderately Resistant, Moderately Susceptible, Susceptible and Highly Susceptible. Only the Resistant and Moderately Resistant varieties/clones will be recommended for final release as varieties. The experiment will be surrounded with 2-4 rows of first growing highly smut resistant variety as guard row.

3.4 WORK ELEMENTS:

1. Land selection and preparation.
2. Seed selection, preparation, dipping setts in suspension of smut spores and plantation. The experiment will be surrounded with 2-4 rows of first growing highly smut resistant variety as guard row.
3. Data recording on germination of setts on 30, 45, 60 and 75 days of plantation.
4. Data collection on smut disease development on sett/ clump basis.
5. Data analysis and reporting.

3.5 TIME SCHEDULE:

Ac. No.	2024			2025												2026	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
1	→	→															
2	→	→															
3			→	→	→												
4						→	→	→	→	→	→	→	→	→			
5															→	→	

3.6 ECONOMIC IMPACT:

Smut resistant varieties will be sorted out. This will help the growers to get expected yield by cultivating the tolerant/resistant varieties.

3.7 EFFECTS ON ENVIRONMENT:

Screening for smut resistance and cultivation of resistant variety commercially will have positive effect on environment finally.

3.8 UTILIZATION OF RESEARCH RESULTS:

Smut disease not only reduces cane yield but also directly influences the juice quality and sucrose content. So by cultivating disease resistant varieties the cane yield and sugar/goor will be increased as well as the economic condition of farmers will be improved.

PROGRAMME AREA : **DISEASE MANAGEMENT**
4.0 TITLE : **PERFORMANCE OF DIFFERENT SETT TREATING CHEMICALS IN CONTROLLING SETT ROT DISEASE OF SUGARCANE**
LOCATION : BSRI, Ishurdi
INVESTIGATORS : M I Hossain, M A Rahman, M Alinewas, S Sultana and M R Islam
NATURE OF STUDY : Modified
DURATION : Continuous
ESTIMATED COST (TK) : No budget from revenue fund

4.1 DEFINITION OF THE PROBLEM:

Sett rot is one of the major problems in profitable cultivation of sugarcane. It causes germination failure as a result crop stand is reduced and eventually yield of cane declined significantly. To protect sett from the attack of soil borne sett rotting fungi, we generally use different sett treating fungicides. The Sub PTAC recommends setting trial of some chemicals. That is why pathology division set trial with recommended chemicals. With that aim the present research program has been proposed.

4.2 OBJECTIVES:

i. To determine the performance of new chemicals over existing recommended sett treating fungicides in controlling sett rot disease of sugarcane and
ii. To recommend more fungicides in controlling sett rot disease of sugarcane.

4.3 METHODOLOGY:

Variety: Isd 38

Treatments:

T_0: Control (sett dipping in water)
T_1: Sett dipping in 0.1% solution of ANTI Blast 38 EC for 30 minutes (1mL/L)
T_2: Sett dipping in 0.15% solution of Horti 80 WDG for 30 minutes (1.5gm/L)
T_3: Sett dipping in 0.2% solution of Maduri 72 WP for 30 minutes (2gm/L)
T_4: Sett dipping in 0.15% solution of Photo Seed Care 35 FS for 30 minutes (1.5gm/L)
T^5: Sett dipping in 0.1% solution of Fyzi 50 WDG for 30 minutes (1gm/L)
T_6: Sett dipping in 0.1% solution of Rjim 50 WDG for 30 minutes (1gm/L)
T_7: Sett dipping in solution of Anin 56 SC for 30 minutes (600mL/ha)
T_8: Sett dipping in solution of Pento Zeb 80 WP for 30 minutes (1000gm/ha)
T_9: Sett dipping in solution of Zyka 50 DF for 30 minutes (750gm/ha)
T_{10}: Sett dipping in 0.1% solution of Bio top 32.5 Sc for 30 minutes (1mL/L)
T_{11}: Sett dipping in solution of Therapi 1WP for 30 minutes (5kg/ha)
T_{12}:Sett dipping in 0.1% solution of Commando 32.5 SC for 30 minutes (1mL/L)
T_{13}: Sett dipping in 0.1% solution of Colazim 50 WP for 30 minutes (1gm/L)
T_{14}: Sett dipping in 0.1% solution of Doyazim 50WDG for 30 minutes (1gm/L)
T_{15}: Sett dipping in solution of W TONIGHT 83WP for 30 minutes 350gm/ha
T_{16}: Sett dipping in 0.1% solution of Unizol 32.5 SC for 30 minutes (1mL/L)
T_{17}: Sett dipping in 0.1% solution of Experts Sinaplus for 30 minutes (1mL/L)
T_{18}: Sett dipping in 0.1% solution of Landzim 50 WDG for 30 min (1gm/L)
T_{19}: Sett dipping in 0.1% solution of Agrozim 50 WP for 30 min (1gm/L)
T_{20}: Sett dipping in 0.1% solution of Shicarman 75 WP for 30 minutes (1gm/L)
T_{21}: Sett dipping in solution of Orizeb 80 WP for 30 minutes (2kg/ha)
T_{22}: Sett dipping in 0.2% solution of Sunzeb 80 WP for 30 minutes (2gm/L)
T_{23}: Sett dipping in 0.1% solution of Remade 32.5 SC for 30 minutes (1gm/L)
T_{24}: Sett dipping in solution of Display 32.5 SC for 30 minutes (1L/ha)
T_{25}: Sett dipping in solution of Orvisin 50 WP for 30 minutes (600gm/ha)
T_{26}: Sett dipping in solution of Femazim 80 WP for 30 minutes (1800-2100gm/ha)
T_{27}: Sett dipping in solution of Havistin 50 WP for 30 minutes (600gm/ha)
T_{28}: Sett dipping in 0.1% solution of Skzim 50 WP for 30 minutes (1gm/L)
T_{29}: Sett dipping in 0.15% solution of Zen 80 WG for 30 minutes (1.5gm/L)
T_{30}: Sett dipping in 0.1% solution of Topper Zim 50 WP for 30 minutes (1gm/L)
T_{31}: Sett dipping in 0.1% solution of Autostin 50 WDG for 30 minutes (1gm/L)
T_{32}: Without any soaking

Replication: 3 **Design:** RCB **Category of sett:** 2 bud setts

Procedure: Replicated soil bed will be inoculated by *Ceratocystis paradoxa* pathogen and setts will be planted on the treated soil bed. Germination of setts will be recorded at 30, 45, 60, and 75 days of planting. Non-germinated setts will be examined for infection by sett rotting fungi. Finally survival % of settling up to the age of 90 days will be recorded to evaluate the bio-agents and fungicides.

4.4 WORK ELEMENTS:

1. Soil bed preparation.
2. Inoculation of soil bed with Ceratocystis paradoxa
3. Sett preparation, sett treatment and planting on soil bed
4. Germination count on15, 30, 45, 60 and 75 days of planting
5. Survival % of settlings on 90 days of planting

4.5 TIME SCHEDULE:

Ac. No.	2024			2025											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	→	→													
2		→	→												
3		→	→												
4				→	→	→									
5						→	→	→							

4.6 ECONOMIC IMPACT:

Effective seed treating chemicals will increase germination of sugarcane setts and thereby yield of cane will be increased.

4.7 EFFECT ON ENVIRONMENT:

Use of recommended doses of chemicals has no adverse effect on environment.

4.8 UTILIZATION OF RESEARCH RESULTS:

The research results will be utilized by sugarcane growers for their economic benefit.

5.0 TITLE : MANAGEMENT OF RED ROT OF SUGARCANE THROUGH CHEMICAL AND BIOLOGICAL MEANS

LOCATION : BSRI, Ishurdi

INVESTIGATORS : M R Islam, M A Rahman, M I Hossain, M Alinewas and S Sultana

NATURE OF STUDY : Modified

DURATION : 2024-2025

ESTIMATED COST (TK) : 19,000.00

5.1 DEFINITION OF THE PROBLEM:

In Bangladesh, the most severe disease affecting sugarcane (*Saccharum officinarum* L.) is red rot, which is caused by *Colletotrichum falcatum* Went. It is the most well-known and oldest disease that is mainly responsible for the degeneration and destruction of many promising sugarcane cultivars. The majority of chewing cane cultivars grown in Bangladesh are very sensitive to red rot. When this disease is in epidemic condition, losses can range from 80 to 100%. Red rot causing pathogen *Colletotrichum falcatum* Went. possess several pathotypes. So far no satisfactory chemical, physical or biological control measure is available to control this disease efficiently. However, some chemicals and bio-control agents have been used in India to control red rot disease in field condition (Malathi *et al.*, 2002; Malathi *et al.*, 2004; Singh *et al.*, 2010). Considering these aspects, the present study will be undertaken to find out the comparative efficacy of the different fungicides and bio-control agents against the *Colletotrichum falcatum* went. in order to obtain an effective control measure for recommendation to the farmer.

5.2 OBJECTIVES:

i. To investigate the efficacy of different chemicals and biocontrol agents throughout the cropping season and
ii. To find out the most suitable management practice (chemical and/or biological) of red rot to suggest the farmers.

5.3 METHODOLOGY:

An experiment through ring pit method will be carried out in the semi-control condition at BSRI farm ((24.1156° N, 89.0817° E), Ishurdi-6620, Pabna with a red rot susceptible chewing variety "BSRI Akh 42". The design of the experiment will be assigned in randomized complete block design (RCBD) having three replications. Five two-budded setts (12 cm long) from 10 months old sugarcane cultivar "BSRI Akh 42" will be used in this experiment per pit. Soil of the research field will be silty clay loam soil (Ganges-river floodplain soil) consisting of around 15.6% sand, 46.1% silt, 34.3% clay, and 4.1% organic matter, with a pH of approximate 7.3. Field soil will then be inoculated with red rot spore suspension prepared by mixing 45 isolates of red rot pathogen be cultured in the laboratory previously. Plants will be raised in those inoculated pits (radius: 70 cm). Each pit will receive a standard fertilizer dose recommended by Bangladesh Agricultural Research Council (BARC) for sugarcane cultivation using Ganges-river floodplain soil. The experiment consists of 11 (eleven) treatments including control which are as follows:

Treatments:

T_0 : Control (No treatment)

T_1 : Sett treatment & Soil drenching with Trichoderma harzianum @ 106 C.F.U/mL (30 days interval upto 240 DAP)

T_2 : 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)

T_3 : 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)

T_4 : Sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & Spraying with Amistar Top 325 SC (Azoxystrobin + Difenoconazole) @ 2mL/L (30 days interval upto 240 DAP)

T_5 : Sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & Soil drenching with Amistar Top 325 SC (Azoxystrobin + Difenoconazole) @ 2mL/L (30 days interval upto 240 DAP)

T_6 : Sett treatment & Soil drenching with Tricost 1% WP (*Trichoderma* spp.) @ 5g/L (30 days interval upto 240 DAP)

T_7 : Sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & Spraying with Wtontight 83 WP (Tricyclazole 63% + Bismerthiazole 20%) @ 350g/ha (30 days interval upto 240 DAP)

T_8 : Sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & Soil drenching Wtontight 83 WP (Tricyclazole 63% + Bismerthiazole 20%) @ 350g/ha (30 days interval upto 240 DAP)

T_9 : Sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & Spraying with Wtontight 83 WP (Tricyclazole 63% + Bismerthiazole 20%) @ 350g/ha (15days interval upto 240 DAP)

T_{10} : Sett treatment with Autostin 50 WDG (Carbendazim) @1g/L for 30 minutes & Soil drenching Wtontight 83 WP (Tricyclazole 63% + Bismerthiazole 20%) @ 350g/ha (15 days interval upto 240 DAP)

5.4 WORK ELEMENTS:

1. Land preparation.
2. Inoculation of soil filled pots with red rot pathogen.
3. Plantation of sugarcane setts.
4. Application of chemicals and bio-control agents as per treatment.
5. Observation of experimental plot and data collection on parameters such as final germination %, plant height, no. of internode, no. of tillers, girth, Brix% content, chewable cane, weight, disease severity, disease index and disease reaction.
6. Data analysis and reporting.

5.5 TIME SCHEDULE:

Ac. No.	2024			2025											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1			→	→											
2					→										
3					→										
4					→	→	→	→	→	→	→	→	→		
5					→	→	→	→	→	→	→	→	→		
6													→	→	→

5.6 ECONOMIC IMPACT:

By using biological and chemical methods, sugarcane production losses might be reduced by managing red rot disease. As a consequence, sugarcane production will increase, and eventually sugarcane growers will experience maximum financial gain.

5.7 EFFECTS ON ENVIRONMENT:

Several methods of controlling red rot diseases through biological and chemical means will be tested. Only the effective and eco-friendly measures will be selected for recommendation. Therefore, there will be no risk of any adverse effect on the environment.

5.8 UTILIZATION OF RESEARCH RESULTS:

With the completion of the experiment, the most effective control measure will be selected and finally recommended for the farmers. As a result, disease problem associated with *Colletotrichum falcatum* Went. will be minimized by the recommended management practice and yield will increase undoubtedly. Control of red rot disease through different bio-agents will be tested. Bio-agents are environment friendly and therefore, there will be no risk of any adverse effect on the environment.

6.0 TITLE : MANAGEMENT OF *OROBANCHE* IN SUGARCANE
LOCATION : Faridpur Sugar Mill Area
INVESTIGATORS : M R Islam, M A Rahman, M I Hossain, M Alinewas and S Sultana
NATURE OF STUDY : Modified
DURATION : 2024-2025
ESTIMATED COST (TK) : 26,000.00

6.1 DEFINITION OF THE PROBLEM:

Orobanche (*Orobanche* sp.) is a root holo parasitic plant devoid of chlorophyll and entirely depending on the host for nutritional requirements. It cause considerable yield losses (5-100%) in the crops, especially in the drier and warmer areas of Europe, Africa and Asia where it is reported to mainly parasitize species of leguminous, oilseeds, solanaceous, cruciferous and medicinal plants. It is a serious root parasite threatening the livelihood of the farmers with its devastating effect on the mentioned crops. The long term impact of the *Orobanche* is even more serious: their seeds may easily spread to other fields and can persist in soil up to 20 years, leading to an accelerated increase in the in the infested areas in which susceptible crops are under danger. *Orobanche* seed dispersal is facilitated by man, agricultural tools, crop seeds, propagules and also by animals through their excreta. At present, *Orobanche* is a serious root parasite threatening the livelihood of the sugarcane farmers of the some mill zones in Bangladesh and it causes considerable yield losses. However, the control measure of this parasitic weed is not well known in Bangladesh. Considering the above facts, the present study has been proposed with the following objectives.

6.2 OBJECTIVES:

i. To find out the appropriate management practices of controlling *Orobanche* parasite under field condition and
ii. To find out an eco-friendly package against *Orobanche* parasite management.

6.3 METHODOLOGY:

Variety: lsd 37

Treatments:

T_0 : Control
T_1 : Application of Urea solution @ 10 % after emergence of *Orobanche*
T_2 : Application of Kolmine 48 SL @ 5ml/L after emergence of *Orobanche*
T_3 : Application of Glycel 41 SL @ 5ml/L after emergence of *Orobanche*
T_4 : Application of U 46 D fluid @ 5ml/L after emergence of *Orobanche*
T_5 : Application of Jahama 62 SL @ 5ml/L after emergence of *Orobanche*
T_6 : Application of Gramoxn @ 3ml/L after emergence of *Orobanche*
T_7 : Mechanical Control

Plot size: 10m × 8 m Design: RCB Replication: 3

6.4 WORK ELEMENTS:

1. Land selection, sugarcane seed selection and planting.
2. Collection of Chemicals
3. Practicing of cultural Methods.
4. Application of nutrient and chemical solution after emergence of *Orobanche* seed.
5. Data collection, analysis and reporting.

6.5 TIME SCHEDULE:

Ac. No.	2024			2025											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	→	→													
2			→	→											
3			→	→	→	→	→								
4							→	→	→	→	→				
5								→	→	→	→	→	→	→	

6.6 ECONOMIC IMPACT:

Orobanche reduces sugarcane yield drastically. Use of these chemicals is very easy and available, therefore controlling *Orobanche* by spraying of these chemical will increase the sugarcane yield and thereby the farmers will be benefitted.

6.7 EFFECTS ON ENVIRONMENT:

Spraying of this herbicide will be in very low dose. As a result there will be no any adverse effect on environment.

6.8 UTILIZATION OF RESEARCH RESULTS:

With the completion of the experiment, the most effective control measure will be selected and finally recommended for the farmers. As a result, *Orobanche* problem will be minimized by following recommended package(s) and yield will be increased certainly. Eventually, the farmers will be benefited by getting more yields.

7.0 TITLE : IDENTIFICATION AND DOCUMENTATION OF DATE PALM AND STEVIA DISEASES IN BANGLADESH
LOCATION : BSRI, Ishurdi
INVESTIGATORS : S Sultana, M A Rahman, M I Hossain, M Alinewas and M R Islam
NATURE OF STUDY : Modified
DURATION : 2024-2025
ESTIMATED COST (TK) : 20,000.00

7.1 DEFINITION OF THE PROBLEM:

Date palm (*Phoenix dactylifera* L.) is a tropical or sub- tropical crop which is widely cultivated across the Middle East, South Asia and North Africa. In the world, the production of the dates has been increased over the years due to the fast growing demand. All parts of the date palm and final products have economic value. The sap is also used as a beverage, either fresh or fermented. Date fruit is good source of high nutritional value food. Indeed it is rich in carbohydrates, dietary fibers, proteins, minerals and vitamin B complex, such as thiamine (B1), riboflavin (B2), niacin (B3), pantothenic (B5), pyridoxine (B6), and folate (B9) (Eoin, 2016), phytochemicals etc. Date palms are susceptible to several diseases that reduce date and juice production. Diseases cause considerable losses in date palms groves. Diseases like bayound (Killian & Maire,1930), leaf spot (Uchida, J. Y. 2004), leaf blight, graphiola leaf spot (Abbas & Abdulla, 2004), inflorescence rot, black scorch (Suleman *et al.*, 2001) etc. have been recorded in almost all date palm growing countries.

Stevia, botanically known as Stevia rebaudiana Bertoni (Asteraceae) is a sweet perennial herb. In Bangladesh, stevia cultivation is very limited. Multiple diseases of stevia have been identified in all over the world. Most of the diseases are of fungal origin (Paul and Singh, 2002). Some major diseases like sclerotium stem rot, pythium root rot, septoria leaf spot, charcoal rot, anthracnose, crown gall, root knot etc are observed in different countries. Many disease symptoms regarding those crops are also observed in Bangladesh but very few research works exist related to the phenomenon. Therefore, the present study has been undertaken to identify and document diseases of date palm, palmyra palm and stevia in Bangladesh.

7.2 OBJECTIVES:

i. To identify different diseases of date palm and stevia in Bangladesh and
ii. To investigate and document the pathogens that are responsible for such diseases in those crops.

7.3 METHODOLOGY:

Data will be recorded on different diseases from different locations. Diseased plant parts will be collected; suspected pathogen isolation, culturing the isolated pathogen in PDA (Potato Dextrose Agar) media and pathogenicity test will be performed at Pathology laboratory in BSRI, Ishurdi and finally morphological and molecular identification of disease causal organism will be done.

7.4 WORK ELEMENTS:

1. Survey to date palm and stevia growing areas
2. Collection of diseased plant parts
3. Isolation, culturing and pathogenicity test
4. Morphological and molecular identification of disease causal organisms

7.5 TIME SCHEDULE:

Ac. No.	2024			2025											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1		→	→	→	→	→	→	→	→	→					
2			→	→	→	→	→	→	→	→	→				
3			→	→	→	→	→	→	→	→	→				
4												→	→	→	→

7.6 ECONOMIC IMPACT:

By identifying different diseases of date palm and stevia ultimately yield losses could be minimized. As a result, growers of those crops will be economically benefited through increased yield, juice and goor production.

7.7 EFFECTS ON ENVIRONMENT:

The research work has no adverse effect on environment. Rather, it will reduce the disease incidence in the field.

7.8 UTILIZATION OF RESEARCH RESULTS:

With the completion of the experiment, different diseases of date palm and stevia will be identified. As a result, proper management and control measures of identified diseases will be innovated through further research. Eventually, the farmers will be benefited by getting more yields and escaping losses due to diseases.

PROGRAMME AREA	**:**	**SEED TECHNOLOGY**
8.0 TITLE	**:**	**PRODUCTION, QUALITY CONTROL AND DISTRIBUTION OF DISEASE FREE CLEAN SEED OF SUGARCANE**
LOCATION	**:**	BSRI, Ishurdi
INVESTIGATORS	**:**	M A Rahman, M I Hossain, M Alinewas, S Sultana and M R Islam
NATURE OF STUDY	**:**	On-going
DURATION	**:**	2024-2025
ESTIMATED COST (TK)	**:**	-

8.1 DEFINITION OF THE PROBLEM:

Major diseases of sugarcane like red rot, white leaf, wilt, smut, RSD and mosaic are seed piece transmissible. So to control these diseases it is prime need to supply disease free clean seed. To conduct experiments of different divisions of BSRI as well as to supply to the growers of different sugar mill zones and non mill zones, quality control for diseases and seed production of different varieties of sugarcane is a routine programme of the division. It should be mentioned that about 60% clean seeds are being used in mill zones. However use of clean seeds in the non-mill zones is almost absent.

8.2 OBJECTIVES:

I. To supply the disease free clean seeds for the requirement of different divisions of BSRI and out-station experiments;
II. To distribute the disease free clean seeds to the mills and non-mill zones for further multiplication and
III. To minimize the disease incidence of sugarcane throughout the country.

8.3 METHODOLOGY:

High lands with proper drainage facilities will be selected for Foundation/Certified seed production. Required quantity seeds of all promising clones under ZYT III and commercial varieties will be planted in the soil bed after treating by MHAT at 54ºC for 4 hours (including initial heating time) followed by Autostin treatment. After planting following STP method, regular inspection (every two months interval) will be made to find out disease infected clumps/plants. Disease infected clumps will be rogued out and affected plant or plant parts will be removed as soon as it will be noticed. Mechanical as well as chemical control will be followed to control insects. Recommended doses of fertilizers and other cultural practices will be followed. Finally the seed plots will be kept 100% free from different major diseases. Seed plots will be surrounded with 2-4 guard rows with the same variety.

8.4 WORK ELEMENTS:

1. Land selection and preparation.
2. Seed Collection.
3. Seed treatment by MHAT at 54ºC for 4 hrs (including initial heating time) to raise the temperature at 54ºC) followed by Autostin treatment
4. Planting of treated setts in the seed bed.
5. Transplanting of settlings in the main field.
6. Inspection for disease(s) and pests and rouging out of diseased clumps or removal of affected plant or plant parts.
7. Mechanical pest control.
8. Application of fertilizer and biocides.
9. Tying of canes to protect from lodging.
10. Harvest of crop.
11. Reporting.

8.5 TIME SCHEDULE:

Ac. No.	2024			2025												2026	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
1	→	→															
2	→	→															
3	→	→															
4			→	→													
5					→	→											
6								→	→	→							
7								→	→	→							
8					→	→	→	→	→								
9												→	→	→			
10															→	→	
11																	→

8.6 ECONOMIC IMPACT:

By using disease free foundation seeds the yield of cane could be increased at least by 25-30%.

8.7 EFFECTS ON ENVIRONMENT:

This project has good impact on environment by using of disease free healthy seed cane.

8.8 UTILIZATION OF RESEARCH RESULTS:

The produced disease free breeder and foundation seeds will be used by different divisions of BSRI to set up different experiments in the mills and non-mill zones. Simultaneously the foundation seeds will be distributed to BSRI farm division and different sugar mills for further multiplication as certified seed. Through distribution of disease free foundation and certified seed to different research divisions and sugar mills, experimental error could be minimized and disease incidence in the sugar mills could be reduced as well.

TRAINING AND TECHNOLOGY TRANSFER DIVISION

Rationale

Sugarcane is one of the important cash cum industrial crops of Bangladesh. It plays an important role in national economy. In Bangladesh, it is used as raw materials in sugar industry, *gur* factory and juice production and also used for chewing purposes. The by-product of sugar industry such as molasses, bagasse etc. has multipurpose industrial use. But the sugar industry of Bangladesh has been suffering from the under-capacity production syndrome due to shortage of its raw material i.e. sugarcane. Again yield of sugarcane is very poor due to lack of modern technology adoption by the farmers.

Many sugarcane production technologies generated at the research premises can hardly find their way among the members of the farming community. The low-level adoption of modern BSRI technologies and yield indicate that there are some problems associated either with the technologies or with the mechanism of dissemination or with the both that should be investigated. The first study of this division is the identification of these problems so that BSRI, BSFIC and DAE can improve their technology development and dissemination mechanism.

The second study is effects of subsidy program in sugarcane production. A subsidy programme is continued on some selected sugarcane production technologies during last few years. Hence, a follow up study is essential for effectiveness of the subsidy program.

In addition to the above studies, this division will also organize and conduct technology transfer program through TOT (training of trainers program) like; training of extension personnel of BSFIC and DAE and also advanced farmers of mills as well as non-mill zones and setting up of demonstrations in cane growers' field, especially in non-mill zones.

LIST OF EXPERIMENTS

A. RESEARCH PROGRAM

POROGRAMME AREA: SOCIO-ECONOMICS & TECHNOLOGY TRANSFER

1.0 Title : Adoption of modern BSRI technologies in selected sugar Mills and Non-Mill zones (On going)

2.0 Title : Effects of subsidy program on sugarcane production

B. TECHNOLOGY TRANSFER PROGRAM

a. TRAINING PROGRAM

1.0 TITLE OF THE COURSE : Modern technologies of sugarcrop production for SACDO of BSFIC

2.0 TITLE OF THE COURSE : Modern technologies of sugarcrop production for Sub Assistant Agriculture Officers (SAAO) of DAE

3.0 TITLE OF THE COURSE : Improved sugarcrop production technologies for Farmers, Gachi, Entrepreneur of Bangladesh

b. DEMONSTRATION

i. Demonstration of BSRI Bred Latest Sugarcane Varieties
ii. Demonstration of BSRI Sugarcane Varieties with Intercropping
iii. Demonstration of BSRI Chewing Varieties with Intercropping

c. FIELD DAYS

d. SEMINARS AND WORKSHOPS

A. Research Program

PROGRAM AREA	:	**SOCIO-ECONOMICS & TECHNOLOGY TRANSFER**
1.0 TITLE	:	**ADOPTION OF MODERN BSRI TECHNOLOGIES IN SELECTED SUGAR MILLS AND NON-MILL ZONES**
LOCATIONS	:	Mill Zone (TSM, JSM & NBSM) and Non-Mill Zone (Chapainawabganj, Sirajganj & Gazipur)
INVESTIGATORS	:	M A Rasel, M S Islam & N J Upoma
NATURE OF STUDY	:	On-Going (Modified)
ESTIMATED COST (TK)	:	32,000/-
Co-PI	:	Dr. Md. Kamruzzaman, SSO, Agricultural Economics Division, BSRI

1.1 DEFINITION OF THE PROBLEM

Very often, people at the policy level show their concern about the level of technology adoption in the field. Many technologies are generated in the research institutions of which very few get their entrance in the farmers' level. Adoption of technology ranged from 1-98% in sugar mills zones (BSFIC 2004-05). It appears from another study that technology adoption rate is as low as 2.4 - 56.4 % in case of different improved sugarcane production technologies (Kranti Associate 1996). Present low level technology adoption and sugarcane yield indicates that there must are some problem either with the technologies or with the dissemination mechanism or with the both which should be investigated and recorded for future improvement of the scenario.

1.2 OBJECTIVES

i) To determine the extent of adoption of BSRI developed modern sugarcane production technologies in the sugar mills and non-mill zones;
ii) To assess sugarcane farmers' knowledge on BSRI recommended sugarcane production technologies;
iii) To identify the bottlenecks that retard adoption of modern sugarcane production technologies and
iv) To ascertain the differences in adoption of modern sugarcane production technologies between the growers of sugar mills and non-sugar mills zones.

1.3 METHODOLOGY

Thirty sugarcane farmers will be selected from each sub zone of the selected sugar mills area and concentrated sugarcane growing upazilas of the mill and non-mill zones following stratified random sampling techniques representing small, medium and large farmers. Farmers' knowledge and adoption of selected BSRI technologies as well as bottlenecks for adoption will be identified through using personal interview schedules. Technology adoption will be measured by using the following formula:

$$\text{Adoption quient} = \frac{\sum (T_i/L)}{N} \times 100$$

Where,
i = 1, 2, 3 ...N
N = Total numbers of technologies
L = Total area under sugarcane in ha
T_1 = Area of sugarcane in hectare under early planting
T_2 = Area of sugarcane in hectare under high and medium highland
T_3 = Area in hectare under recommended sugarcane varieties
T_4 = Area of sugarcane in hectare under recommended row spacing
T_5 = Area of sugarcane in hectare under planting/transplanting in trenches
T_6 = Area of sugarcane in hectare under STP
T_7 = Area in hectare under methodological intercropping
T_8 = Area in hectare under paired - row cane for cultivation of more than one intercrop

T_9 = Area of sugarcane in hectare under application of recommended fertiliser dose
T_{10} = Area of sugarcane in hectare under control of insect pests by mechanically & chemically
T_{11} = Area of sugarcane in hectare planted/transplanted with treated seed cane with chemicals
T_{12} = Area of sugarcane in hectare under irrigation

1.4 WORK ELEMENTS

Following specific works to be undertaken:
a. Preparation of data gathering instruments
b. Selection of sample sugarcane farmers
c. Gathering information by using semi structured interview schedule
d. Compilation and analysis of data
e. Report writing and submission

1.5 TIME SCHEDULE

Data related to the knowledge and adoption of modern sugarcane production technologies will be gathered from the sample sugarcane farmers during August to January every year. Compilation of data will be completed within April of each year.

1.6 ECONOMIC IMPACT

The study results will be helpful in determining the level of technology adoption and problems faced by the farmers in adopting sugarcane technologies. This feedback will benefit the scientists (for further refinement of the technology) and the extensionists (for undertaking appropriate extension methodology).

1.7 EFFECTS ON ENVIRONMENT

There will be no impact on environment as it is a socio-economic survey-based study.

1.8 UTILIZATION OF RESEARCH RESULTS

The research results are expected to be of much benefit to the BSRI, BSFIC and DAE as well as the sugar mills for improving the technologies and dissemination mechanism.

PROGRAM AREA	**:**	**SOCIO-ECONOMIC & TECHNOLOGY TRANSFER**
2.0 TITLE	**:**	**EFFECTS OF SUBSIDY PROGRAM ON SUGARCANE PRODUCTION**
LOCATION	**:**	NBSM and NTSM
INVESTIGATORS	**:**	N J Upoma, M S Islam & M A Rasel
NATURE OF THE STUDY	**:**	New
PROJECT COMPLETION	**:**	2024-2025
ESTIMATED COST (TK)	**:**	42,000.00
Co-PI	**:**	Dr. Md. Kamruzzaman, SSO, Agricultural Economics Division, BSRI

2.1 DEFINITION OF THE PROBLEM

The government of Bangladesh started subsidizing the farmers in the mill zone from the financial year 2003-2004 with an aim of encouraging the sugarcane growers to adopt more sugar producing varieties and improved sugarcane cultivation technologies developed by BSRI. This subsidy is given directly to the farmers for cultivation of specified varieties and certain technologies. BSRI has mediated this process from the government to the sugarcane grower via BSFIC. In this process BSRI has included the improved varieties and technologies as precondition to receive the benefit, with a view to enhancing the technology transfer activities. To execute this subsidy program successfully and to help the farmers to derive the best benefit from this program, it is necessary to know the effects of the program and its drawbacks and thus the program was formulated.

2.2 OBJECTIVES

i) To describe the socio-economic characteristics of the respondent beneficiaries in the study area;
ii) To examine the benefits derived by the respondent beneficiaries from the subsidy program in the study area.

iii) To explore the relationship between socioeconomic characteristics and benefits derived from the subsidy program by the respondent beneficiaries in the study area and
iv) To identify the challenges or problems faced by the respondent beneficiaries in subsidy program.

2.3 METHODOLOGY

Eighty (80) of respondents which are receiver of subsidy program will be selected and 80 of non-receiver respondents will be selected from two mills which are North Bengal Sugar Mills ltd. and Natore Sugar Mills Ltd. considering simple random sampling technique. Respondents' socio-economic characteristics, benefits derived and identify the challenges faced by the respondents will be identified through using personal interview schedules. Collected data will be sorted, compiled and tabulated. Analysis like frequency counts, percentages, ranged will be used. Chi-squares, Pearson product moment correlation and t-test will be employed through SPSS computer program.

2.4 WORK ELEMENTS

Following specific works to be undertaken for the survey work.
1. Construction of data gathering instruments
2. Gathering information by using semi structured questionnaires/ interview schedules
3. Compilation and analysis of data
4. Report writing

2.5 TIME SCHEDULE

Ac. No.	2024		2025											
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	→	→	→											
2				→	→	→	→	→						
3								→	→	→	→			
4											→	→	→	→

2.6 ECONOMIC IMPACT

The study results will be helpful determining the effects and drawbacks of the subsidy program and thus will be helpful for the scientist and planners to execute it in a more economically feasible way.

2.7 EFFECTS ON ENVIRONMENT

There will be positive impact on environment as it is a socio-economic survey based study.

2.8 UTILIZATION OF THE RESEARCH RESULTS

The results or recommendation of the study may suggest the effects of subsidy program and problems faced by the farmers in this subsidy program which will be useful for the planner and decision makers to plan and execute subsidy program in a more fruitful way.

B. TECHNOLOGY TRANSFER PROGRAM

a. TRAINING PROGRAM

1.0 TITLE OF THE COURSE : **MODERN TECHNOLOGIES OF SUGARCROP PRODUCTION FOR SACDO OF BSFIC**
VENUE : BSRI, Ishurdi, Pabna
COURSE DURATION : 5 Days
SPONSORING/CO-OPERATING AGENCY : BSRI/BARC
LEVEL & NO. OF PARTICIPANTS : SACDO of BSFIC batch , Farmers, Entrepreneur, wooden lamp-stand, food beverages can also be included (total 30 participants in 1 batches).
COURSE CO-ORDINATOR : M S Islam, M A Rasel & N J Upoma
ESTIMATED BUDGET (TK) : 1,50,000/-

1.1 JUSTIFICATION OF THE TRAINING COURSE

Sugar Industry in Bangladesh has been suffering from the under capacity production syndrome due to shortage of its raw material i.e. Sugarcane. It is due to the supply of sugarcane to the goor makers in mills zones area. Limited supply of sugarcane in sugar mills hampers to achieve its target in sugar production each year. Thus, sugar industry in Bangladesh is now a losing concern. To improve this situation, sugar crop production in goor zones will have to be increased. In non-mill zone, DAE is directly involved with extension of improved sugar crop production technologies to the growers. So, DAE personnel need to be well-trained on modern sugar crop production technologies. Hence, the training program will be arranged for knowledge improvement of Agricultural Extension Officers on modern sugar crop production technologies. To increase the production of sugarcane in mill zone, cane officer of sugar mills should have high knowledge on modern sugarcane production technologies. To make them highly knowledgeable, training is must on sugar crop production technologies.

1.2 OBJECTIVES

1. To increase trainee's capacity to advise their subordinate extension workers as well as sugarcane growers on the modern sugar crop production technologies;
2. To support the participants for guiding the sugarcane growers to produce intercrops methodologically and
3. To capacitate the trainee officers to advise the goor processors to produce quality goor hygienically.

1.3 EXPECTED OUTCOME

The training course will help the Cane Officer of sugar mills to improve knowledge on Modern sugar crop production technologies. They will be able to give proper advice to the sugar crop farmers for improvement of cultivation practices of sugarcane and intercrops. Thus, total sugar crop production will be increased as well as socio-economic condition of the farmers will be improved.

1.4 METHODOLOGY

A five (5) days duration training course will be conducted at BSRI head quarter for three batches of SACDO of Sugar Mills on modern technologies of sugar crop production. The similar courses will be organized for cane officers of sugar mills also. Classroom lecture, multimedia presentation and slide show, group discussion, laboratory visit, field visit etc. will be followed in conducting the training course.

1.5 MONITORING AND EVALUATION: Pre and post course evaluation will be followed.

2.0 TITLE OF THE COURSE	**:**	**MODERN TECHNOLOGIES OF SUGAR CROP PRODUCTION FOR SUB-ASSISTANT AGRICULTURE OFFICERS OF DAE**
VENUE	**:**	BSRI HQ
COURSE DURATION	**:**	5 days
SPONSORING / CO-OPERATING AGENCY	**:**	BSRI/BARC
LEVEL & NO. OF PARTICIPANTS:		Sub-Assistant Agriculture Officers of DAE-3 batches, Farmers, Entrepreneur, wooden lamp-stand, food beverages can also be included.
COURSE CO-ORDINATOR	**:**	M S Islam, M A Rasel & N J Upoma
ESTIMATED BUDGET(TK)	**:**	4,38,000/-

2.1 JUSTIFICATION OF THE TRAINING COURSE

Department of Agricultural Extension (DAE) is working for extension of sugarcane cultivation in non-mill zones. Cane department of Bangladesh Sugar and Food Industries Corporation (BSFIC) is directly involved in extension of sugarcane cultivation in mills zones. To fulfil the sugar and goor requirement of the country dissemination of modern sugar crop production technologies among sugarcane farmers is very essential. By using modern technologies goor farmers will be benefited and the country will become self-sufficient in *gur* production. So, extension personnel of DAE and BSFIC should be well-trained on modern sugar crop production technologies. Hence, training program will be arranged for knowledge improvement of Sub-Assistant Agriculture Officers of DAE and Sub-Assistant Cane Development Officers of BSFIC on modern sugar crop production technologies, the grass root level extension workers of DAE & BSFIC.

2.2 OBJECTIVES

1. To update the trainees for improvement of capacity to advise the sugar crop farmers on the modern sugar crop production technologies;
2. To enhance participant's capacity to suggest the sugarcane farmers to produce intercrops methodologically and
3. To capacitate the trainee to provide efficient advice the *gur* processors to produce *gur* hygienically.

2.3 EXPECTED OUTCOME

The training course will help the Sub-Assistant Agriculture Officers of DAE and Sub-Assistant Cane Development Officers of BSFIC to generate knowledge on modern sugar crop production technologies. They will be able to give proper advice to the sugarcane farmers for improved cultivation practices of sugarcane and intercrops. Thus, total sugarcane production will be increased as well as socio-economic condition of the farmers will be improved.

2.4 METHODOLOGY

Five (5) days duration training course will be conducted at BSRI head quarter for Sub-Assistant Agriculture Officers of DAE and Sub Assistant Cane Development Officer of BSFIC on appropriate technologies of sugarcane and intercrops production. Classroom lecture, multimedia presentation, slide show, group discussion, laboratory visit, field visit etc. will be followed in conducting the training course.

2.5 MONITORING AND EVALUATION: Pre and post course evaluation will be followed.

3.0 TITLE OF THE COURSE	**:**	**IMPROVED SUGARCROP PRODUCTION TECHNOLOGIES FOR FARMERS, GACHI, ENTREPRENEUR OF BANGLADESH**
VENUE	**:**	BSRI Head Quarter and BSRI Sub-Stations (Joypurhat,Chuadanga, Rahmatpur and Jamalpur), Sugar Mills and Different Locations in Non-Mill Zone
COURSE DURATION	**:**	1 day
SPONSORING / CO-OPERATING AGENCY	**:**	BSRI/BARC
LEVEL & NO. OF PARTICIPANTS:		Farmers, Gachi, Entrepreneur of Bangladesh (1380 Trainees in 46 Batches).
COURSE CO-ORDINATOR	**:**	M S Islam, M A Rasel & N J Upoma, BSRI Sub-Stations- Station In Charge of Chuadanga, Joypurhat, Jamalpur, Rahmatpur, Sirazganj, Chunarughat, Rajshahi, Gaibandha, Bandarban and Station In-charge RSRS Subarnachar
ESTIMATED BUDGET	**:**	Tk. 9,20,000/-

3.1 JUSTIFICATION OF THE TRAINING COURSE

Most of the sugarcane farmers follow the influential and progressive farmers of the locality who maintain close contract with the extension agents. Influential and progressive farmers should have adequate knowledge on improved sugarcane production technology to increase sugarcane yield. Hence, this training program will be organised for improving model farmers' knowledge and attitude on improved sugarcane cultivation.

3.2 OBJECTIVES

1. To update the model farmers on improved sugarcane and intercrops production technologies; and
2. To capacitate the farmers for guiding other neighbour sugarcane farmers on improved sugarcane and intercrops production technologies.

3.3 EXPECTED OUTCOME

The training course will help the model sugarcane farmers to improve knowledge on improved sugarcane and intercrops production technologies. They will be able to give proper advice to other neighbour sugarcane farmers for improved cultivation practices of sugarcane and intercrops. Thus, total sugarcane production will be increased as well as socio-economic condition of the farmers will be improved.

3.4 METHODOLOGY

One-day training program will be conducted in 30 batches at BSRI head quarter, substations, sugar mills and different locations in non-mill zone for model sugarcane farmers of both mills and non-mill zone. Classroom lecture, multimedia presentation and slide show, laboratory visit, field visit etc. will be followed in conducting the training course.

b. DEMONSTRATION PROMRAMME

1.0 TITLE	**:**	**DEMONSTRATION OF BSRI BRED LATEST SUGARCANE VARIETIES**
LOCATIONS	**:**	Ishurdi, Jamalpur, Pabna, Joypurhat, Kushtia, Chuadanga, Subarnachar, Gaibandha, Barishal, Hobigonj, Bandarban, Khagrachari, Rangamati (41)
DEMONSTRATOR	**:**	BSRI HQ: M S Islam, M A Rasel & N J Upoma, BSRI Sub-Stations: Station In Charge of Chuadanga, Joypurhat, Jamalpur, Rahmatpur, Chunarughat, Bandarban, Rangamati and Khagrachari
ESTIMATED BUDGET	**:**	Tk. 7,58,500/-
2.0 TITLE	**:**	**DEMONSTRATION OF BSRI SUGARCANE GUR VARIETIES WITH INTERCROPPING**
LOCATIONS	**:**	Ishurdi, Jamalpur, Pabna, Joypurhat, Kushtia, Chuadanga, Subarnachar, Gaibandha, Barishal, Hobigonj, Bandarban, Khagrachari, Rangamati (45)
DEMONSTRATOR	**:**	BSRI HQ: M S Islam, M A Rasel & N J Upoma, BSRI Sub-Stations: Station In Charge of Chuadanga, Joypurhat, Jamalpur, Rahmatpur, Chunarughat, Bandarban, Rangamati and Khagrachari
ESTIMATED BUDGET	**:**	Tk. 9,67,500/-
3.0 TITLE	**:**	**DEMONSTRATION OF CHEWING VARIETIES WITH INTERCROPPING**
LOCATIONS	**:**	Khagrachari, Bandarban, Rangamati, Chunarughat, Subarnachar, Gaibandha, Barishal, Sherpur (60)
DEMONSTRATOR	**:**	BSRI HQ: M S Islam, M A Rasel & N J Upoma, BSRI Sub-Stations: Station In-Charge of Chunarughat, Joypurhat, Jamalpur, Rahmatpur, Bandarban, Rangamati and Khagrachari
ESTIMATED BUDGET	**:**	Tk. 13,80,000/-

AGRICULTURAL ECONOMICS DIVISION

Rationale

Sugarcane is a crucial cash crop in Bangladesh, supporting nutrition and economic stability. Despite its importance, the industry faces significant challenges in meeting production demands. However, as a long-duration crop, sugarcane production exhibits yearly fluctuations due to variations in cultivated area, compounded by multiple constraints in production and marketing that hinder yield improvement. Accurate forecasting is essential to mitigate risks, stabilize supply, and guide policies on pricing and trade. Given these challenges, developing a reliable forecasting model is imperative for sustainable sugarcane production.

As an agriculture-dependent nation, Bangladesh sees many resource-poor farmers engaged in beekeeping as a vital livelihood option. Traditional beekeeping methods, limited technological adoption, and insufficient support hinder productivity and income growth. Although the Bangladesh Sugarcrop Research Institute (BSRI) has introduced improved beehives, adoption remains low. This study aims to assess the impact of BSRI-modified beehives on honey yield and beekeepers' income to guide policy interventions for sustainable apiculture development, poverty reduction, and ecosystem conservation.

Sugarcane is a vital crop in Bangladesh, supporting nutrition, industry, and livelihoods for over 0.6 million farming families. However, production has sharply declined from 51.52 lakh MT (2012-13) to 20.12 lakh MT (2023-24), with only 9 of 15 sugar mills now operational. Key challenges include shrinking cultivation areas due to sugarcane's long duration (10-12 months), financial constraints among smallholders, labor shortages, high costs, and delayed payments. Despite government interventions, mill-zone farmers continue reducing sugarcane acreage in favor of quicker-yielding crops. This study examines the constraints and determinants influencing farmers' perceptions of sugarcane cultivation in mill zones to inform policies that can revitalize this critical sector and stabilize sugar production.

LIST OF EXPERIMENTS

1.0	Title	:	Forecasting sugarcane production in Bangladesh through ARIMA model
2.0	Title	:	Impact of BSRI-modified bee hive technology on honey productivity and income of beekeepers of Bangladesh
3.0	Title	:	Evaluation the determinants of farmers' perception in sugarcane cultivation: a case study of Bangladesh

PROGRAMME IN DETAILS

PROGRAMME AREA	:	**SOCIO-ECONOMIC AND TOT**
1.0 Title	:	**FORECASTING SUGARCANE PRODUCTION IN BANGLADESH THROUGH ARIMA MODEL**
LOCATIONS	:	All mill and non-mill areas of Bangladesh
INVESTIGATORS	:	M Kamruzzaman, M S Islam and S Khatun
NATURE OF STUDY	:	New
DURATION	:	1 years
PROJECT COMPLETION	:	2024-2025
ESTIMATED COST (TK)	:	1.00 Lakh

1.1 DEFINITION OF THE PROBLEM

Sugarcane (*Saccharum officinarum* L.) is a significant commercial sugar crop in the low rainfall areas of the North-West and South-West regions of Bangladesh. It is a crop valued for its numerous uses in daily life and industrial usage aimed at nutrition and financial stability. At the present, of the fifteen (15) sugar mills, only nine (09) operate under the Bangladesh Sugar and Food Industries Corporation (BSFIC), with an annual production capacity of 0.21 million tons of sugar. The sugar mills were unable to reach their present production capacity due to insufficient sugarcane supply at the mill gates and an inadequate sugar recovery rate. In the 2023-24 cropping season, sugarcane was cultivated on 40.73 thousand hectares in Bangladesh, yielding 20.16 lakh metric tons and achieving a production rate of 48.95 tons per hectare (Anonymous, 2023). As it is a long-duration crop, the production of sugarcane fluctuates from year to year due to fluctuation of the area under sugarcane cultivation. Multiple obstacles in the production and sale of sugarcane impeded the desired increase in yield and production. Forecasting is the process of predicting future events by analyzing and utilizing historical data. Accurate forecasting of essential commercial crops is necessary for future planning and policymaking. Proper information on crop failures might alleviate adverse effects of public policy, including price increases and agricultural distress. Therefore, an effort has been undertaken to develop a suitable forecasting model, as predicting sugarcane productivity may assist in estimating production and informing decisions on export and import policies, distribution, pricing strategies, storage, and marketing approaches (Priya and Suresh, 2009).

1.2 OBJECTIVES:

i. To forecast sugarcane production in Bangladesh and
ii. To suggest policy recommendations based on research findings.

1.3 METHODOLOGY

Nature of data

The study considered the secondary data of the annual sugarcane production in mill zone and non-mill zone of Bangladesh. Mill zone sugarcane production data will be obtained from the published annual reports of Bangladesh Sugar and Food Industry Corporation (BSFIC) non-mill zone sugarcane production data will be collected from Department of Agriculture Extension (DAE), Ministry of Agriculture. The prediction of sugarcane production will be made using time series analysis. The data will be used per year from 1980 to 2024 and it will predict production data for the next five years, from 2025 to 2030.

Analytical technique:

In order to forecast sugarcane production in Bangladesh, Autoregressive Integrated Moving Average (ARIMA) model (Box and Jenkins, 1970) will be used. An ARIMA model is in-fact a combination of Autoregressive Model

(AR) and Moving Average Model (MA) with integration. The theoretical aspects of the models can be written as follows:

Autoregressive model

The notation AR (p) refers to the autoregressive model of order p. The AR (p) model can be written as:

$Y_t = \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \Phi_3 Y_{t-3} + \ldots\ldots\ldots + \Phi_p Y_{t-p} + e_t$

Where,

Ytis the original series for every t; and

e_t is independent of Y_{t-1}, Y_{t-2}, Y_{t-3},……$Y_{t-p.}$

Moving average model

The notation MA (q) refers to the moving average model of order q. The MA (q) model can be written as:

$Y_t = e_t + \theta_1 e_{t-1} + \theta_2 e_{t-2} + \theta_3 e_{t-3} + \ldots\ldots\ldots + \theta_q e_{t-q}$

Where,

Y_t is the original series; and

e_t is the series of errors.

The Box and Jenkins (1970) procedure is a milestone of the modern approach to time series analysis. Given an observed time series, the aim of the Box and Jenkins procedure is to build an ARIMA model. In particular, passing by opportune of preliminary transformation of the data, the procedure focuses on stationary processes. In this study, it is tried to fit the Box-Jenkins ARIMA model. This model is the generalized model of the non-stationary ARMA model denoted by ARMA (p,q) can be written as

$Y_t = \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \Phi_3 Y_{t-3} + \ldots + \Phi_p Y_{t-p} + e_t + \theta_1 e_{t-1} + \theta_2 e_{t-2} + \theta_3 e_{t-3} + \ldots + \theta_q e_{t-q}$

Where,

Y_t is the original series for every t; and

e_t is independent of Y_{t-1}, Y_{t-2}, Y_{t-p}.

A time series $\{Y_t\}$ is said to follow an integrated autoregressive moving average (ARIMA) model if the dth differences is a stationary ARMA process. If $\{W_t\}$ follows an ARMA (p,q) model, we say that $\{Y_t\}$ is an ARIMA (p,d,q) process. Fortunately, for practical purposes, we can usually take d =1or at most 2. Consider then an ARIMA (p,1,q) process with $W_t = Y_t - Y_{t-1}$, we have

$Wt = \Phi_1 W_{t-1} + \Phi_2 W_{t-2} + \ldots\ldots\ldots + \Phi_p W_{t-p} + e_t + \theta_1 e_{t-1} + \theta_2 e_{t-2} + \ldots + \theta_q e_{t-q}$

1.4 WORK ELEMENTS

Sl. No.	Activity		Duration (Month)
1.	Study area selection	:	02
2.	Questionnaire preparation	:	01
3.	Pre-test questionnaire	:	02
4.	Finalize questionnaire	:	01
5.	Data collection	:	06
6.	Data entry	:	03
7.	Data management	:	02
8.	Data analysis	:	02
9.	Report writing	:	02

1.5 TIME SCHEDULE

Activities	Year (2024)					Year (2025)					
	July	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
1	→	→									
2		→									
3		→	→								
4			→								
5			→	→	→	→	→	→			
6						→	→	→			
7							→	→			
8									→	→	
9										→	→

1.6 ECONOMIC IMPACT

Predicting sugarcane production can enhance resource management. Long-term sustainability ensures the viability of the sugarcane sector, mitigating agricultural land degradation and conserving resources, thus securing future economic advantages for the sugar industry.

1.7 EFFECT ON ENVIRONMENT:

This investigation is environment-friendly and would have no adverse impact on the environment.

1.8 UTILIZATION OF RESULTS:

In Bangladesh, where domestic sugar output fails to satisfy demand, employing the ARIMA model to predict sugarcane production offers essential information for stakeholders in the agricultural and sugar sectors. Policymakers can utilize production predictions to construct long-term strategies for sugarcane development. This may encompass determinations regarding import-export regulations, subsidies, and assistance for sugarcane cultivators.

PROGRAMME AREA : **SOCIO-ECONOMIC AND TOT**
2.0 Title : **IMPACT OF BSRI-MODIFIED BEE HIVE TECHNOLOGY ON HONEY PRODUCTIVITY AND INCOME OF BEEKEEPERS OF BANGLADESH**
LOCATIONS : Sirajganj, and Pabna districts.
INVESTIGATORS : M Kamruzzaman, M E Reza, M S Islam and S Khatun
NATURE OF STUDY : New
DURATION : 1 years
PROJECT COMPLETION : 2024-2025
ESTIMATED COST (TK) : 1.5 Lakh

2.1 DEFINITION OF THE PROBLEM

As a nation primarily reliant on agriculture, the majority of Bangladesh's populace is directly or indirectly involved in a diverse array of agricultural pursuits. Beekeeping is an important alternative source of livelihood for many resource-poor farmers. The country has more than four (04) lakh beehives, and around twenty (20) thousand beekeepers are involved in honey production (DAE, 2023). The Beekeepers have the potential to produce 100,000 tons of honey, but current output is limited to 20,000 tons of honey in Bangladesh. Still, despite the favorable natural environment and the potential for establishing sustainable livelihoods in rural areas, it often lacks the necessary financial and technological support required to fully exploit its great potential in conserving forests and natural ecosystems and reducing poverty. As it is known, the traditional way of beekeeping is practiced throughout the country. Technological improvement is the foremost requirement for increasing agricultural productivity and poverty reduction in the long term. The low

productivity of honey calls for measures to provide improved technologies to beekeeping to boost honey production. By realizing the potential of the apiculture subsector and the problem associated with a traditional beehive, Bangladesh Sugar Crop Research Institute (BSRI) has increased its attention by developing apicultural research to assist beekeepers by introducing and promoting improved beehives to increasing productivity and production of honey. However, it is observed that the number of BSRI-modified beehive technologies used by beekeepers was very limited. Therefore, this study has been designed to support policymakers in formulating strategic policies for the impact of BSRI-modified bee hive technology on honey productivity and income of beekeepers in Bangladesh.

2.2 OBJECTIVES:

i) To find out the factors affecting BSRI-modified bee hive of bee keepers;
ii) To estimate the effects of BSRI-modified bee hive on honey productivity and income;
iii) To identify the constraints of honey production and
iv) To suggest some policy recommendations based on research findings.

2.3 METHODOLOGY

Nature of data

A total of 120 bee keepers will be interviewed for primary data collection. These bee keepers were classified as adopters (45) and non-adopters (75) of BSRI-modified bee hive. Bee keepers who exclusively utilized BSRI-modified bee hive were classified as adopting bee keepers. Non-adopting bee keepers were included who utilized traditional bee hive.

Analytical technique:

The endogenous switching regression model (ESRM) and propensity score matching (PSM) method will be employed to obtain unbiased and consistent results considering endogeneity, heterogeneity and self-selection bias. An econometric issue involving sample selection bias and heterogeneity is the driving force behind the use of endogenous switching regression model. The adoption of BSRI modified bee hive and its impact on honey productivity and household income will be evaluated using the endogenous switching regression model (ESRM) and the propensity score matching (PSM) method. The PSM method will be used to supplement the endogenous switching regression in comparing the honey productivity outcome of adopters of BSRI modified bee hive and their counterparts. The probit model will used to create the propensity score for those who initially adopt BSRI modified bee hive. The propensity score is expressed as in equation:

$$p(x) = P_r\{Z = 1|X|\} = E\{Z|X|\}$$

Where, p(x) is the propensity score, Z= {1, 0} is the treatment variable or the dummy adoption variable and X is a vector of bee keepers' characteristics.

2.4 WORK ELEMENTS

Sl. No.	Activity		Duration (Month)
1.	Study area selection	:	02
2.	Questionnaire preparation	:	01
3.	Pre-test questionnaire	:	02
4.	Finalize questionnaire	:	01
5.	Data collection	:	06
6.	Data entry	:	03
7.	Data management	:	02
8.	Data analysis	:	02
9.	Report writing	:	02

2.5 TIME SCHEDULE

Activities	Year (2024)					Year (2025)					
	July	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
1	→	→									
2		→									
3		→	→								
4			→								
5			→	→	→	→	→	→			
6						→	→	→			
7							→	→			
8									→	→	
9										→	→

2.6 ECONOMIC IMPACT:

BSRI-modified bee hive technology aims to enhance honey productivity and improve beekeepers' livelihoods. It may reduce production costs by improving the management of bee colonies and reducing losses due to inefficiency or disease. By optimizing hive design and colony health, beekeepers can minimize costs associated with traditional practices, such as purchasing additional hives or replacing bee colonies.

2.7 EFFECT ON ENVIRONMENT:

The study has no adverse effect on environment.

2.8 UTILIZATION OF RESULTS:

The results from studies can guide policymakers to provide targeted subsidies, training programs, and investment in rural beekeeping infrastructure. Government support in the form of technical assistance and financial incentives can help scale up the use of improved hives and boost honey production nationwide.

PROGRAMME AREA : **SOCIO-ECONOMIC AND TOT**
3.0 Title : **EVALUATION THE DETERMINANTS OF FARMERS' PERCEPTION IN SUGARCANE CULTIVATION: A CASE STUDY OF BANGLADESH**
LOCATIONS : Mubaraganj, and Natore sugar mills
INVESTIGATORS : M Kamruzzaman, M S Islam and S Kahtun
NATURE OF STUDY : New
DURATION : 1 years
PROJECT COMPLETION : 2024-2025
ESTIMATED COST (TK) : 1.5 Lakh

3.1 DEFINITION OF THE PROBLEM

Sugarcane is a significant crop due to its diverse uses in daily life and industrial uses related to nutrition and economic benefits. A total of 41 thousand hectares are cultivated, comprising 17.41 thousand hectares in the mill zone and 23.59 thousand hectares in the non-mill zones of Bangladesh. It constitutes around 0.97% of the country's total arable land and over 0.6 million agricultural families rely on sugarcane cultivation for their livelihood. Despite the sugar sector's importance to the national economy, the production of sugarcane has declined. Over the past decade, production has dropped from 51.52 lakh MT in 2012-13 to 20.12 lakh MT in 2023-24. The annual fluctuations in sugarcane acreage resulted in a decrease in production. Furthermore, sugarcane is the sole source of sugar and jaggery. There are fifteen (15) sugar mills in Bangladesh. Six (06) sugar mills have been laid off, and now nine (9) are operating, with a total production capacity of 0.21 million tons/year. The sugar mills could not attain their current output capability due to insufficient sugarcane supply

at the mill gates. It is a long-duration crop, occupying the land for 10 to 12 months from planting to harvesting. Marginal and small farmers cannot afford to cope with lengthy waiting periods due to their unstable financial circumstances and increased demand for food and vegetables. As a result, they frequently decreased the amount of sugarcane they cultivated. Moreover, the most significant challenge affecting the sugar industry is farmers' inadequate input access, labor unavailability and rising labor prices, lack of financial support and payment delays. The government has implemented many initiatives to mitigate the decrease in sugarcane production. In light of the circumstances mentioned above, it is essential to examine the challenges and determinants impacting farmers' views regarding sugarcane cultivation in the mill-zone regions of Bangladesh.

3.2 OBJECTIVES:

i. To determine the profitability of sugarcane production;
ii. To analyze the determinants and resource use efficiency of sugarcane cultivation;
iii. To find out the constraints of sugarcane production and
iv. To suggest some policy recommendations based on research findings.

3.3 METHODOLOGY

The methodology to be followed for the proposed study is as follows:

Selection of the study area:

For collecting the necessary field-level data, the study will be conducted at the mill zone area named Mubarakganj, and Natore sugar mills.

Sampling technique and sample size:

The field survey method will be followed to collect primary data from the sample producers using a structured questionnaire. The questionnaire will be constructed and pre-tested for necessary modifications before starting the data collection. A total of 120 farm households, 60 from each location, will be interviewed randomly for primary data collection from sugarcane farmers. The data will be collected with a well-structured pre-tested questionnaire. In addition, FGD and KII will be conducted to validate the research findings.

Analytical technique:

After collecting necessary data and information from field surveys, interviews, communications and interactions, those will be classified, edited and coded. For analyzing the data, a combination of descriptive, mathematical and statistical techniques will be used to achieve the objectives and to get meaningful results. In the present study, the following techniques will be used:

Descriptive statistics: Descriptive statistics like sum, averages and percentages will be calculated to identify the farmers' socioeconomic status for producing sugarcane.

Profitability analysis: Profitability of sugarcane production per hectare from the view point of individual farmer will be measured in terms of gross return, gross margin, net return and benefit cost ratio (Dilon and Hardaker, 1993). The formulas needed for the calculation of profitability is as below:

$$GR = P \times Q;\ GM = GR - TVC;\ NR = GR - (TFC + TVC);\ BCR = GR \div (TFC + TVC)$$

Where,

GR = Gross return (Tk.); P = Sales price of the product (Tk.); Q = Yield per hectare (metric ton); GM = Gross margin (Tk.); TVC = Total variable cost (Tk.); NR = Net return (Tk.); TFC = Total fixed cost (Tk.); and BCR = Benefit cost ratio.

Functional analysis: The input-output relationship in sugarcane production will be analyzed with the help of Cobb-Douglas production function approach (Gujarati and Porter, 2008). To determine the contribution of the

most important variables in the production process of sugarcane, the following specification of the model was used.

$$Y=ax_1^{b1}x_2^{b2}x_3^{b3}x_4^{b4}x_5^{b5}x_6^{b6}e^{ui}$$

The Cobb-Douglas production function will be transformed into following logarithmic form so that it could be solved by ordinary least squares (OLS) method.

$$\text{Ln } Y_i = B_0+B_1 \text{ ln}X+B_2 \text{ ln}X_2+B_3 \text{ ln}X_3 + B_4 \text{ ln}X_4+ B_5 \text{ ln}X_5+B_6 \text{ ln}X_6$$

Where,

Y=Net return (Tk./ha); B_0= Constant or intercept value; X_1= Cost of labor (Tk./ha); X_2= Cost of setts (Tk./ha); X_3= Cost of mechanical power (Tk./ha); X_4= Cost of fertilizer (Tk./ha); X_5 = Cost of insecticide (Tk./ha); X_6 = Cost of irrigation (Tk./ha); Ln=Natural logarithm; and B_1……B_8 = Coefficient of the respective explanatory variables estimated.

Resource use efficiency: In order to investigate the resource use efficiency, the ratio of marginal value product (MVP) to the marginal factor cost (MFC) for each input will be computed and tested for its equality to 1, That is,

$$\frac{MVP}{MFC} = r$$

Where,

r = Efficiency ratio;
MVP =Marginal Value Product; and
MFC = Marginal Factor Cost.

Under this method, the decision rules are that, when:

r >1, the level of resource use is below the optimum level implying under-utilization of resources. Increasing the rate of use of that resource will help increase productivity.

r <1, the level of resources use is above the optimum level implying over utilization of resources. Reducing the rate of use of that resource will help improve productivity.

r = 1, the level of resource use is at optimum implying efficient resource utilization.

The most reliable perhaps the most useful estimate of MVP is obtained by taking all input resources (Xi) and gross return (Y) at their geometric means (Dhawan and Bansal, 1977). All the variables of the fitted model will be calculated in monetary value. As a result, the slope co-efficient of those independent variables in the model represent the MVPs, which were estimated by multiplying the production co-efficient of given resources with the ratio of geometric mean (GM) of gross return to the geometric mean (GM) of the given resources, that is,

$$MVP(X_i) = \beta_i \frac{\bar{Y}(GM)}{\bar{X}\ (GM)}$$

Where,

$\bar{Y}(GM)$ = Geometric mean of gross return (BDT);
$\bar{X}\ (GM)$ = Geometric mean of different independent variables (BDT);
β_i = Co-efficient of parameter; and i = 1, 2,……..n.

3.4 WORK ELEMENTS

Sl. No.	Activity		Duration (Month)
1.	Study area selection	:	02
2.	Questionnaire preparation	:	01
3.	Pre-test questionnaire	:	02
4.	Finalize questionnaire	:	01
5.	Data collection	:	06
6.	Data entry	:	03
7.	Data management	:	02
8.	Data analysis	:	02
9.	Report writing	:	02

3.5 TIME SCHEDULE

Activities	Year (2024)					Year (2025)					
	July	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
1	→	→									
2		→									
3		→	→								
4			→								
5			→	→	→	→	→	→			
6						→	→	→			
7							→	→			
8									→	→	
9										→	→

3.6 ECONOMIC IMPACT:

Assessing the factors influencing farmers' perceptions of sugarcane production might have significant economic implications. Understanding these perceptions illustrates the reasoning behind farmers' decisions to cultivate (or not cultivate) sugarcane.

3.7 EFFECT ON ENVIRONMENT:

The study has no adverse effect on environment.

3.8 UTILIZATION OF RESULTS:

The findings from such an evaluation can help formulate policies that address the barriers to sugarcane farming and encourage its adoption where appropriate. Moreover, it can guide efforts to optimize resource allocation, improve farmer income, and ensure the long-term viability of the sugarcane industry in the face of changing economic and environmental conditions.

REGIONAL SUGARCROP RESEARCH STATION, THAKURGAON

Rationale

Regional Sugarcrop Research Station (RSRS) Thakurgaon started functioning since 1985. This region mainly covers the districts of Panchagar, Thakurgaon and Dinajpur. Soil of this northern region falls under the Old Himalayan Piedmont Plain which is light textured with low organic matter. Sugarcane is the main cash crop in this region, but its average yield is low at farmers' level. The major objectives of this station are to select suitable high yielding, high sugar content varieties, tolerant to pests and diseases, drought and water logging. Other responsibilities are to develop appropriate technologies to control pests and diseases, to ascertain fertilizer requirement based on field trial, soil and plant tissue analyses and also to develop remunerative sugarcane based farming with economic and high value intercrops.

This station has developed the technology of double intercropping in paired-row cane over the conventional system, recommended gypsum @ 187 kg ha^{-1} which increased the cane yield of 6-7 tha^{-1}. Through varietal trial LJC, Isd 16, Isd 20, Isd 32, Isd 34, Isd 36, Isd 37, Isd 39, BSRI Akh 41, BSRI Akh 43, BSRI Akh 45, BSRI Akh 46 and BSRI Akh 48 were found more suitable for this region. The variety LJC was found more resistant to Root Stock Borer (RSB) a major pest of this region. So far, more than 10,000 trainees were given short training on modern cane and intercrops, sugarbeet, date palm, palmyra palm and stevia production technologies.

In the current research programme, two research programmes have been taken under the programme area of varietal improvement for sugarcane, one research programme has been taken under the programme area of crop and soil management for stevia and the rest programmes are addressing the socio-economic & technology transfer, farmers training, demonstration, field days on varietal performance and intercropping with modern technologies both in mill and non-mill zones.

LIST OF EXPERIMENTS

PROGRAMME AREA: VARIETAL IMPROVEMENT

1.0 TITLE : Performance of BSRI Bred Latest Sugarcane Varieties Grown in Old Himalayan Piedmont Plain

2.0 TITLE : Ratooning Potentiality of BSRI Bred Latest Sugarcane Varieties in Old Himalayan Piedmont Plain

PROGRAMME AREA: CROP AND SOIL MANAGEMENT

3.0 TITLE : Effects of Pruning on Vegetative Traits and Biomass Production of Stevia

PROGRAMME AREA: SOCIO-ECONOMICS AND TECHNOLOGY TRANSFER

4.0 TITLE : Training/Demonstration/Field Days at RSRS, Thakurgaon

PROGRAMME IN DETAILS

PROGRAMME AREA : **VARIETAL IMPROVEMENT**
1.0 TITLE : **PERFORMANCE OF BSRI BRED LATEST SUGARCANE VARIETIES GROWN IN OLD HIMALAYAN PIEDMONT PLAIN**
LOCATION : TSM
INVESTIGATORS : M M Rashid, M S Hossain and N Chowdhury
NATURE OF STUDY : On-going
PROJECT COMPLETION : 2022-cont.
ESTIMATED COST (Tk) : 60,000/-

1.1 DEFINITION OF THE PROBLEM:

Bangladesh Sugarcrop Research Institute releases a number of high yielding sugarcane varieties which are suitable for growing in different agro-climatic conditions. But local and old varieties are being cultivated in different parts of the country following inappropriate production technologies resulting poor yield and quality. The production of latest cane varieties is varying from place to place and even from farmers to farmers. The present experiment has been undertaken to select suitable cane variety(s) for Old Himalayan Piedmont plain Soils (AEZ 1) getting high yield and economic return.

1.2 OBJECTIVES:

i) to select the latest sugarcane variety suitable for AEZ 1 and
ii) to increase farmers' income.

1.3 METHODOLOGY:

Treatments:

T_1 : Isd 34
T_2 : Isd 37
T_3 : Isd 39
T_4 : BSRI Akh 43
T_5 : BSRI Akh 44
T_6: BSRI Akh 45
T_7 : BSRI Akh 46
T_8 : BSRI Akh 48

Replication : 03
Design : RCB
Planting material : Two budded setts
Plot size : 8m x 8m
Date of planting : November, 2024

Data to be collected:

1) Germination (%)
2) Tiller population at 120, 150 and 180 DAT
3) Stalk height (m), stalk diameter (cm), no. of internodes
4) Millable cane at harvest
5) Brix (%) at harvest
6) Cane yield at harvest

1.4 WORK ELEMENTS:

1) Seed collections
2) Land preparation
3) Basal fertilizer application
4) Cane plantation

5) Irrigation
6) Weeding and mulching
7) Top dressing of fertilizer
8) Insect and pest control
9) Harvesting of cane
10) Data collection
11) Data tabulation, analysis and reporting

1.5 TIME SCHEDULE:

Activity No.	MONTHS																		
	2024					2025												2026	
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1	→																		
2	▲		→																
3					→														
4					→														
5						→			→										
6						→			→		→								
7						→			→		→		→						
8															→				
9																			
10						→			→		→		→		→		→		
11																		→	→

1.6 ECONOMIC IMPACT: Positive economic impact is expected.

1.7 EFFECTS ON ENVIRONMENT: Friendly to soil and environment.

1.8 UTILIZATION OF RESEARCH RESULTS:

The experimental result will help the farmers to grow suitable latest cane varieties for getting higher yield and economic benefit.

PROGRAMME AREA : VARIETAL IMPROVEMENT
2.0 TITLE : RATOONING POTENTIALITY OF BSRI BRED LATEST SUGARCANE VARIETIES IN OLD HIMALAYAN PIEDMONT PLAIN
LOCATION : TSM
INVESTIGATORS : M M Rashid, M S Islam and M S Hossain
NATURE OF STUDY : On-going (modified)
PROJECT COMPLETION : 2022-cond.
ESTIMATED COST (TK) : 50,000/-

2.1 DEFINITION OF THE PROBLEM :

Sugarcane production through ratoon management is a common practice in sugarcane growing areas of Bangladesh. This practice significantly reduces the cost of land preparation, planting and seed material. But this is a rare practice in Rangpur region of Bangladesh. Benefit of ratooning is not well known to sugarcane growers of this region. Good ratoon variety(s) is not available among the growers of that region. There is ample scope to introduce ratooning practice if good ratoon variety is made available to farmers. Therefore, the experiment has been undertaken to select suitable variety (s) of ratooning as well as profitable cane production for this region of Bangladesh.

2.2 OBJECTIVES:

i) To screen out the ratooning potential sugarcane varieties for AEZ 1 and
ii) To popularize ratooning practice in AEZ 1.

2.3 METHODOLOGY:

Treatments:

T_1 : Isd 34
T_2 : Isd 37
T_3 : Isd 39
T_4 : BSRI Akh 43
T_5 : BSRI Akh 44
T_6 : BSRI Akh 45
T_7 : BSRI Akh 46
T_8 : BSRI Akh 48

Replications : 03
Design : RCB
Plot size : 8m x 6m

Cane planted in 2023-2024 cropping season will be harvested during the month of December, 2024 and there-after the left over stubbles will kept for raising ratoon crop.

Data to be collected:

1) Tiller population at 90, 120, 150 and 180 days after stubble shaving
2) Stalk height (m), stalk diameter (cm), no. of internodes
3) Millable cane at harvest
4) Brix% at harvest
5) Cane yield at harvest

2.4 WORK ELEMENTS:

1. Stubble shaving
2. Irrigation
3. Inter row space mulching
4. Gap filling and basal fertilizer application
5. Weeding and mulching
6. Fertilizer top dressing
7. Pest control
8. Data collection (tiller, mllablecane, Brix% etc.)
9. Yield of ratoon cane at harvest

2.5 TIME SCHEDULE:

Activity No.	MONTHS																	
	2024					2025											2026	
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1				→	→														
2	▲				→	→													
3					→	→	→	→	→	→									
4					→	→													
5						→	→												
6						→	→	→											
7							→	→	→	→	→	→	→						
8							→	→	→	→	→	→	→	→	→	→	→		
9									→	→	→	→	→	→	→	→	→		
10																→	→		

2.6 ECONOMIC IMPACT: Methodological ratoon management practice as well as selection of good variety(s) will help to increase sugarcane production and economic return.

2.7 EFFECTS ON ENVIRONMENT: Friendly to soil and environment.

2.8 UTILIZATION OF RESEARCH RESULTS:

The result of the study will give a clear idea to the growers of TSM, PSM, STSM, SHSM region about ratoonning variety(s) and ratoon management practices.

PROGRAMME AREA : CROP AND SOIL MANAGEMENT
3.0 TITLE : EFFECTS OF PRUNING ON VEGETATIVE TRAITS AND BIOMASS PRODUCTION OF STEVIA
LOCATION (S) : RSRS, Thakurgaon
INVESTIGATOR(S) : N Chowdhury, M S Hossain, M M Rashid and M S Islam
NATURE OF STUDY : New
PROJECTED COMPLETION : 2023-2026
ESTIMATED COST (TK.) : 50,000/-

3.1 DEFINITION OF THE PROBLEM:

Stevia rebaudiana (Bertoni) is a herbaceous perennial plant of the Asteraceae family, native to Paraguay (South America). It is commonly known as "sweet weed", "sweet leaf", "sweet herb" and "honey leaf". It has achieved economic importance due to the different natural sweet compounds called steviol glycosides (SG) which are obtained from its leaves with taste sweet but with zero calories. The main sweet components in stevia dry leaves are steviosides (STV) which is about 200-300 times sweeter than sucrose. The stevia dried leaves powder is used in the tea cup as well as in other food items as calorie-free sweetener. It is completely natural, safe for human health and beneficial to diabetic patients. Apart from this it has some health benefits too. In recent time cultivation of stevia has made significant impact in countries like Japan, China, Brazil, Paraguay, Mexico, Russia, Indonesia, Korea, United States, India, Tanzania, Canada, and Argentina. This crop is highly potential in Bangladesh so it is necessary to get a higher yield of stevia for its increasing demand among the diabetec patients and health concerned peoples. People also like to grow their own calorie-free sweetener in pots for quick consumption. So, we are aiming at finding a way to increase the growth and yield of stevia in field for growers as well as in pot for household cultivation.

3.2 OBJECTIVES:

i. to know pruning effect on stevia productivity and
ii. to find appropriate pruning time.

3.3 METHODOLOGY:

The field study will be conducted at RSRS, Thakurgaon following RCB design with three replications. The following factors will be considered.

Treatments:

T_1 : Field Condition
T_2 : Pruning at 45 DAP
T_3 : Pruning at 60 DAP
T_4 : Pruning at 90 DAP
T_5 : Pruning at 45 and 90 DAP
T_6 : Pruning at 60 and 90 DAP
T_7 : Pruning at 45, 90 and 120 DAP
T_8 : Pruning at 60, 90 and 120 DAP

Row to row distance : 30 cm
Plant to plant spacing : 40 cm
Stevia variety : BSRI Stevia 1
Plot size : 2m × 2m
Replication : 03
Design : RCB

Date of planting : March, 2024
Gross area : 0.05 ha

Data to be collected:

1. Plant height (cm)
2. Number of branch plant^{-1}
3. Number of leaves plant^{-1}
4. Fresh weight plant^{-1} (g)
5. Dry weight plant^{-1} (g)
6. Fresh leaf yield plant^{-1} (g)
7. Dry leaf yield plant^{-1} (g)
8. Initial and post harvest soil analysis

3.4 WORK ELEMENTS:

i) Land preparation
ii) Plantation
iii) Fertilization/Irrigation
iv) Weeding
v) Data collection

3.5 TIME SCHEDULE:

Sl.No	2024									
	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov
i.	---									
ii.		---								
iii.		---	---	---						
iv.			---	---						
v.			---	---	---	---	---	---	---	

3.6 ECONOMIC IMPACT:

It is expected that stevia growers would get higher economic benefit from the results of this experiment.

3.7 EFFECT ON ENVIRONMENT:

This experiment is environment friendly and there would have no adverse effects on environment.

3.8 UTILIZATION OF RESEARCH RESULTS:

It is expected that the research results will be helpful for stevia growers. The results will also be helpful for nutrient management and getting higher economic benefit from stevia cultivation.

QUARANTINE STATION, GAZIPUR

Rationale

Sugarcane germplasm is one of the basic components for variety development especially through hybridization. The main objective of quarantine station is to remain vigilant about the entry and introduction of new pathogen or insect pests carried along with the imported varieties/clones from abroad. The Quarantine Station is located at BRRI campus, Gazipur was established in 1979-80 as an essential prerequisite for the purpose and to enrich the germplasm bank of BSRI. Since establishment, four hundred two germplasms have been imported and quarantined. Fourteen consignments such as 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd and 54th are under observation. By this time, three hundred and eight entries have been handed over to the Breeding Division, BSRI for further evaluation and one germplasm as first generation in the glass house. Besides, some exotic germplasms viz. China, Vietnam, VMC 86-550, HoCP 85 845, HoCP 91 555, HoCP 95 988, HoCP 96 540, CB 45-3, Phil 56-226 and Egypt are also maintained for seed multiplication.

At present thirteen locally collected chewing germplasms such as Q 69, Co 527, Misridana, Modhumala, Pwochadana, Pyashi, Kazla,Turpin, one unknown Sylhet, Blackruby, Dholbazary, Shinduri and one locally collected Malaysian germplasm have been maintained inside the campus of Quarantine Station for seed multiplication.

LIST OF EXPERIMENTS

PROGRAMME AREA : CROP PROTECTION

1.0 TITLE : Quarantine follow-up of imported germplasms

2.0 TITLE : Quarantine follow-up of local germplasms

PROGRAMME IN DETAILS

PROGRAMME AREA	:	**CROP PROTECTION**
1.0 TITLE	:	**QUARANTINE FOLLOW- UP OF IMPORTED GERMPLASMS**
LOCATION	:	Quarantine Station, Gazipur
INVESTIGATORS	:	S Akhter, N Islam and M A H Saddam
NATURE OF STUDY	:	Ongoing (From 1979-80)
PROJECT COMPLETION	:	To be continued
ESTIMATED COST (TK)	:	20,000.00 (Depending germplasms availability)

1.1 DEFINITION OF THE PROBLEM:

There are some limitations/ restrictions for some diseases and places where the diseases are occurred like SCMV, Fiji disease, Pineapple disease and Gummosis from different countries namely Argentina, Java, Puerto Rico, Cuba, Louisiana (USA), Queensland, West Java and Australia respectively. But provisions are there that BSRI could import sugarcane germplasms/clones for research purpose from any country provided planting materials should be grown at a recognized post-entry quarantine station for an adequate period before release for large scale planting.

1.2 OBJECTIVES:

i) To remain vigilant about the entry and introduction of new pathogens and insect pests carried along with the germplasms brought from abroad and

ii) To conserve as important genetic material and enrich the hybridization program.

1.3 METHODOLOGY:

After introduction/arrival of new germplasm/clone, the seed materials will be treated by hot water at 50°C for 3 hours or at 51°C for 2 hours (if not previously treated) and will be planted in sterilized soils in pots inside glass house. Scientists in the quarantine station and head quarter will make observation for diseases and insect pests up to 8 to 9 months age crop. If major diseases or insect pests are not found in the germplasms/clones again will be planted in pots for second generation crop inside the same glasshouse. Both plant and ratoon crops will be inspected and observed for another 8 to 9 months.

If disease(s) or insect pests are not found during inspection in the second-generation plant and in first ratoon, the germplasm/clone will be planted outside the glasshouse but inside the quarantine premises. Before planting the materials will be treated by hot water treatment at 50°C for 3 hours and by Bavistin 50 WP at 1:1000 solution. The germplasm/clone will be grown in natural condition for another year to observe for disease and insect pests. At the same time firstratoon of second-generation crop will be maintained and observed in the same manner.

Finally, the seed material will be handed over to BSRI Breeding Division for seed multiplication, inoculation test and zonal yield trial for release as variety or to preserve as genetic materials in the germplasm bank.

1.4 WORK ELEMENTS:

Depending on the arrival or availability of the germplasm from abroad the following works schedule will be followed for each and every consignment.

Act. No.	Name of Activities	Time of Activities
1.	Collection of the consignment from airport or any legal point of entry	Immediately after entry and introduction
2.	Inspection of the consignment for plant health and other documents.	Do
3.	Plant and soil treatment if required.	Do
4.	Plantation in pots inside glass house.	Do
5.	Observation for diseases and insect pests at monthly interval	1-9 months crop age
6.	Plantation of second generation crop in pots inside glasshouse	9 months crop age
7.	Maintaining ratoon of first generation crop in pots inside glasshouse	After harvesting of first generation plant crop
8.	Observation for disease and insect pests both in plant and ratoon cane at monthly interval	Up to 9 months crop age
9.	Harvesting of second generation plant and first ratoon crop	At 9 months crop age
10.	Plantation of third generation plant in trenches inside QS Campus after HWT at 50° C for 3 hours and by Bavistin 50 WP 0.1% solution. Maintenance of first ratoon of second- generation crop inside glasshouse	Up to 10-12 months after importation of crop
11.	Observation for disease and insect pests both in plant and ratoon cane at monthly interval	Up to 30 months after importation of crop
12.	Final tiller and millable cane count during peak period	21-27 months crop, 5 months after planting (tiller count), 12 months after planting
13.	Brix (%) and other agronomic characters record	At 12 months crop
14.	Harvesting of plant cane and handing over to Breeding Division of BSRI	At 30 months crop after importation of crop
15.	Maintaining ratoon of third generation plant for further observation	At 30-42 months crop after importation of crop

1.5 TIME SCHEDULE:

Ac. No.	Months														
	1	3	6	9	12	15	18	21	24	27	30	33	36	39	42
1–4	→	→													
5	→	→	→	→											
6–7				→											
8-9				→											
10							→								
11	→	→	→	→	→	→	→	→	→	→	→				
12								→	→	→					
13					→										
14										→	→				
15											→	→	→	→	→

1.6 ECONOMIC IMPACT:

Plant quarantine is internationally accepted phenomenon to control seed borne pathogens by imposing some limitations/restrictions for some diseases against some places where the disease occurs. As per 'Destructive insects and pests rules 1966, amended in 1989 by the Government of the Peoples' Republic of Bangladesh there are restrictions for some diseases and places where the disease occurred. Hence, the imposed restrictions will be helpful to protect economic loss by entry of new pathogens.

1.7 EFFECT ON ENVIRONMENT:

Imposed quarantine restrictions for the movement of plant materials will be helpful to protect our environment against introduction of new pathogen.

1.8 UTILIZATION OF RESEARCH RESULTS:

This possibly could prevent establishment and spread of foreign pests in our country through legal restriction on the movement of plants and plant products. The germplasm/germplasms that will introduce and quarantined will go for further investigation/intervention at BSRI head quarter. If germplasm/germplasms could find suitable for commercial cultivation, that will be released as variety/varieties. Besides, these will be maintained in our germplasm bank to include and enrich the hybridization program.

2.0 TITLE : QUARANTINE FOLLOW- UP OF LOCAL GERMPLASMS
LOCATION : Quarantine Station, Gazipur
INVESTIGATORS : S Akhter, N Islam and R M Saiem
NATURE OF STUDY : Ongoing (From 1979-80)
PROJECT COMPLETION : To be continued
ESTIMATED COST (TK) : 15,000.00 (Depending on germplasms availability)

2.1 DEFINITION OF THE PROBLEM:

Pathogenicity of a pathogen and strains of a pathogen react differently in different environment. For example- Red rot and SCMV may be cited whose strains are different and located in different corners of the country in different environment. Therefore, their movement should restrict by imposing quarantine regulations.

2.2 OBJECTIVE:

To remain vigilant about the entry and introduction of new pathogen or insect pests from one location to other carried along with the germplasms/clones during collection.

2.3 METHODOLOGY:

Seed materials of different germplasm/clone will be collected by the scientists of quarantine station and head quarter from different corners of the country. Then the seed materials will be treated with hot water at 50ºC for 3 hrs and by Bavistin 50 WP at 1:1000 ratio for 30 minutes and planted in trenches inside

quarantine station. The germplasms/clones will be observed closely for one plant and ratoon crop, if no new disease or insect pests observed during the period of investigation then these will be handed over to the Breeding Division for further investigation or to maintain as germplasm in the germplasm bank. Ratoon of the germplasms/ clones will be maintained for another year observation.

Germplasms: 14

Q 69	Misrimala	Dholbazary
Co 527	Pyashi	Blackruby
Misridana	Kazla	Malaysia
Pwochadana	Turpin	Shinduri
Madhumala	Unknown from Sylhet	

Method of Planting: STP (Poly bag settling); Time of Planting: December, 2024

2.4 WORK ELEMENTS:

Depending on the arrival or introduction of new local germplasms/clones at the quarantine station the following work schedule to be followed for each and every collection.

Act. No.	Name of Activities	Time of Activities
1.	Collection, inspection and characterization	Immediately after collection/ introduction.
2.	Hot water treatment at 50^0c for 3 hrs.	Do
3.	Bavistin 50 WP treatment at 1:1000 ratio	Do
4.	Plantation in trenches inside quarantine campus	Do
5.	Germination count at 30 and 60 DAP	Up to 2 months crop age
6.	Inspection for disease and insect pests at monthly interval	At 1-10 months crop age
7.	Tiller count at 150 DAP	At 5 months crop age
8.	Millable cane count in September	At 9 –10 months crop age
9.	Brix percent and cane yield at harvest	At 11 –12 months crop age
10.	Harvesting and handing over to Breeding division	At 13 months crop age
11.	Maintaining ratoon of first generation plant	Up to 12 – 13 months crop age
12.	Inspection for disease and insect pests at monthly interval	Do
13	Harvesting of ratoon	At 22-23 months crop age

2.5 TIME SCHEDULE:

Ac. No.	Months							
	1	3	6	9	12	15	18	21
1- 4	→							
5	→							
6	→	→	→	→	→			
7		→						
8				→				
9					→			
10					→			
11					→	→		
12					→	→	→	
13								→

2.6 ECONOMIC IMPACT:

Plant quarantine is internationally accepted phenomenon to control seed borne pathogens by imposing some limitations/restrictions. As per quarantine rules and regulations there are provisions to follow it for both exotic and local germplasm collection. Hence, the imposed restrictions will be helpful to protect economic loss from new pathogens.

2.7 EFFECT ON ENVIRONMENT:

Imposed restrictions on movement of seed cane or plant parts will be helpful to protect new environment against introduction of new pathogen from other regions.

2.8 UTILIZATION OF RESEARCH RESULTS:

This possibly could prevent establishment and spread of new pests at BSRI premises through legal restriction on the movement of plants and plant products.

REGIONAL SUGARCROP RESEARCH STATION, GAZIPUR

Rationale

The important objectives of this station are to develop need based appropriate technologies of sugarcane production and dissemination of recommended technologies among the farmers related to goor and chewing cane production in the non-mill zone, especially in the eastern part of the country. Considering those facts, it is needed to research different aspects of crop improvement, crop production, crop protection, and TOT & socio-economic studies.

Considering the above facts, total six experiments under crop and soil management aspects-comprehensive assessment of multi spectral, thermal and vegetation indices for drought monitoring in sugarcane using UAV imagery; evaluation of sugarcane growth and yield parameters through multi spectral, thermal and vegetation indices from UAV in waterlogged condition; effect of sugarcane bagasse biochar on soil health and sugarcane production; Yield performance of Arabian date palm at Gazipur;influence of various growing media on growth and yield of *Stevia rebaudianaand* estimation of water requirement for optimal growth and yield instevia are included as priority research.

Under TOT and Socio-economics program area regardingdissemination of BSRI matured technologies among the farmer's, severaldemonstration and training programs of SAAO and farmers have been proposed.

LIST OF EXPERIMENTS

PROGRAMME AREA : CROP & SOIL IMPROVEMENT

1.0 Title : Comprehensive assessment of multi spectral, thermal and vegetation indices for drought monitoring in sugarcane using UAV imagery

2.0 Title : Evaluation of sugarcane growth and yield parameters through multi spectral, thermal and vegetation indices from UAVS in waterlogged condition

3.0 Title : Effect of sugarcane bagasse biochar on soil health and sugarcane production

4.0 Title : Yield performance of Arabian date palm at Gazipur

5. 0 Title : Estimation of water requirement for optimal growth and yield of stevia

6. 0 Title : Influence of various growing media on growth and yield of *Stevia rebaudiana*

PROGRAMME AREA : TOT & SOCIO-ECONOMICS

7.0 Title : **DEMONSTRATION**

a. Demonstration of chewing sugarcane with intercrops
b. Demonstration of BSRI released chewing sugarcane variety
c. Varietal Demonstration of BSRI released sugarcane

8.0 Title : **TRAINING**

a. Farmer's Training
b. SAAO Training

PROGRAMME IN DETAILS

PROGRAMME AREA : **CROP & SOIL IMPROVEMENT**
1.0 TITLE : **COMPREHENSIVE ASSESSMENT OF MULTI SPECTRAL, THERMAL AND VEGETATION INDICES FOR DROUGHT MONITORING IN SUGARCANE USING UAV IMAGERY**
LOCATIONS : RSRS Farm, Gazipur
INVESTIGATORS : R M Saiem, M A H Saddam, A S Mitu, N Islam and S Akhter
NATURE OF STUDY : On going
PROJECT COMPLETION : 2023-2025
ESTIMATED COST (TK) : 40,000.00

1.1 DEFINITION OF THE PROBLEM:

Sugarcane is a cash crop and primary source of sugar production in Bangladesh. Its productivity, growth, and sugar content can be significantly compromised under drought condition. Due to climate change, Drought condition in Bangladesh have become a recurring concern, impacting agriculture, water resources, and the overall ecosystem. As such, there's a pressing need for timely, accurate and spatially detailed assessment techniques to monitor and manage drought impacts on sugarcane crops. Precision agriculture has revolutionized the way to manage crop production by integrating cutting-edge technologies and data-driven approaches. One of the key challenges in precision agriculture is the accurate estimation of crop growth and yield attributing parameters, particularly under adverse environmental conditions like drought. In the agricultural sector, 4IR technologies have opened up unprecedented opportunities to enhance productivity, sustainability, and resilience in the face of environmental challenges such as drought. One of the most promising applications of 4IR in agriculture is the use of Unmanned Aerial Vehicles (UAVs) equipped with multi spectral (MS) and thermal infrared (TI) sensors for the estimation of Vegetation Indices (VI) attributing parameters in crops under drought conditions. UAVs have an unparalleled ability to observe and analyze farmland with detail and accuracy. This study explores the potential of MS, TI, and VI derived from UAV images to evaluate drought conditions in sugarcane crops. By comparing these high-resolution aerial insights with ground-based measurements and observations, this research seeks to establish a robust framework for drought detection and assessment, facilitating timely interventions to mitigate its adverse effects. The following objectives are taken in light of the above information.

1.2 OBJECTIVES:

i) To determine drought severity in sugarcane by analyzing the variations in multi spectral, thermal and vegetation indices and
ii) To identify the relationship between drought and sugarcane yield and develop models to predict yield losses based on UAV derived data.

1.3 METHODOLOGY:

The experiment will be 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 will captured at the height of 40 m at 30 days intervals from settlings transplantation through drone with advanced sensors. The images will be processed in ENVI Software (L3Harris Geospatial, USA). The atmospheric correction will be conducted using FASH tool to eliminate the radiation errors caused by atmospheric scattering and other factors to a certain extent. The NDVI images will be calculated by simple band math. The decision tree (DT) algorithm will be used to extract the sugarcane canopy from the soil, weed, shadow and other interfering factors. Partial Least Square (PLS), Artificial Neutral Network (ANN) and Extreme Learning Machine (ELM) algorithm will be established base on different variables.

Data to be recorded:

i) Multi spectral, Thermal and vegetation indices through UAVs.
ii) Morpho-physiological and yield contributing data.

1.4 WORK ELEMENT

1. Raising of settlings
2. Land preparation
3. Plantation
4. Intercultural operation
5. Data collection of multi spectral imaginary, thermal indices and vegetation indices at 30 (thirty) days interval from settlings transplantation
6. Data collection of Morpho-physiological and yield contributing at harvest
7. Modeling algorithms

1.5 TIME SCHEDULE

AC No	2024		2025									
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct
1	→											
2		→										
3			→									
4				→				→				
5					→							→
6										→		
7											→	

1.6 ECONOMIC IMPACT: This study may decrease production risk and increase production of sugarcane.

1.7 EFFECT ON ENVIRONMENT: This study is eco-friendly.

1.8 UTILIZATION OF RESEARCH RESULTES: This experiment may reduce wastage of resources and increase quality and quantity of products and ultimately it will lead to higher revenue to the farmers.

2.0 TITLE : **EVALUATION OF SUGARCANE GROWTH AND YIELD PARAMETERS THROUGH MULTI SPECTRAL, THERMAL AND VEGETATION INDICES FROM UAV IN WATERLOGGED CONDITION**

LOCATIONS : RSRS Farm, Gazipur

INVESTIGATORS : R M Saiem, M A H Saddam, A S Mitu, N Islam and S Akhter

NATURE OF STUDY : On going

PROJECT COMPLETION : 2023-2025

ESTIMATED COST (TK) : 40,000.00

2.1 DEFINITION OF THE PROBLEM:

Sugarcane is a vital crop with significant economic importance, serving as a primary source of sugar. In modern agriculture, precise monitoring and management of soil water status are essential for ensuring optimal crop health and productivity. Water logging is a common issue in many parts of Bangladesh where excessive moisture in the soil can hinder root development, reduce oxygen availability, and lead to nutrient imbalances in the crop. The integration of UAVs (Unmanned aerial vehicles) with advanced sensor technology, along with the utilization of a VI-based phenology adaptation approach, offers a solution that can enhance the precision and effectiveness of monitoring sugarcane in waterlogged condition. This research is centered on the assessment of sugarcane water status variability under waterlogged conditions using UAVs equipped with multi spectral (MS), and thermal inferred (TI) sensors. These sensors provide a comprehensive view of the sugarcane fields, offering valuable insights into crop stress, and overall vegetation health. By harnessing the potential of UAVs, MI, TI, and vegetation indices (VI)-based phenology adaptation approach, this research aims to predict yield loss due to water log condition and provide a solution to overcome it. The following objectives have been chosen in light of the information provided above.

2.2 OBJECTIVES:

i) To identify the most effective multi spectral and thermal indices for monitoring and quantifying sugarcane growth under waterlogged conditions and

ii) To develop models or algorithms to predict yield based on the UAV derived data.

2.3 METHODOLOGY:

The experiment will be carried out at RSRS Farm, Gazipur with three sugarcane varieties viz.,Isd 34, BSRI Akh 41, BSRI Akh 45 and BSRI Akh 47. Multi spectral and thermal images will be captured at the height of 40 m at 30 days intervals from settlings transplantation through drone with advanced sensors. The images will be processed in ENVI Software (L3Harris Geospatial, USA). The atmospheric correction will be conducted using FASH tool to eliminate the radiation errors caused by atmospheric scattering and other factors to a certain extent. The NDVI images will be calculated by simple band math. The decision tree (DT) algorithm will be used to extract the sugarcane canopy from the soil, weed, shadow and other interfering factors. Partial Least Square (PLS), Artificial Neutral Network (ANN) and Extreme Learning Machine (ELM) algorithm will be established base on different variables.

Data to be recorded:

i. Multi spectral, Thermal and vegetation indices through UAVs

ii. Morpho-physiological and yield contributing data

2.4 WORK ELEMENT

1. Raising of settling
2. Land preparation
3. Plantation
4. Intercultural operation
5. Data collection of multi spectral imaginary, thermal indices and vegetation indices at thirty days interval from settlings transplantation
6. Morpho-physiological data collection at harvest
7. Modeling algorithms

2.5 TIME SCHEDULE

AC No	2024		2025									
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct
1	→											
2		→										
3			→									
4				→	→	→	→					
5								→	→	→	→	
6										→	→	
7											→	→

2.6 ECONOMIC IMPACT: Positive economic impact is expected.

2.7 EFFECT ON ENVIRONMENT: This study is eco-friendly.

2.8 UTILIZATION RESULT: This experiment may help to predict yield loss due to water log conditions through UAVs and advanced sensors.

3.0 TITLE	**:**	**EFFECT OF SUGARCANE BAGASSE BIOCHAR ON SOIL HEALTH AND SUGARCANE PRODUCTION**
LOCATION	**:**	RSRS farm, Gazipur
INVESTIGATORS	**:**	M A H Saddam, R M Saiem, A S Mitu, N Islam and S Akhter
NATURE OF STUDY	**:**	Ongoing (modified)
DURATION	**:**	2023- 2025
ESTIMATED COST (TK)	**:**	30,000.00

3.1 DEFINITION OF THE PROBLEM

Sugarcane (*Saccharum officinarum*) is an important agro-industrial crop which plays a vital role in the national economy. It takes about 12 months from planting to harvesting. Due to the long duration, a huge amount of fertilizer has to be used, as a result, soil health is deteriorating day by day and production has been reduced. To recover this soil health organic amendment is essential. Biochar is one of the important organic amendments which improves soil health and is an organic carbon byproduct that is generated during pyrolysis in the absence of oxygen. Because biochar is highly resistant to microbial decomposition of soils (Baldock and Sumernik, 2002), its storage in the soil is a promising approach to carbon sequestration (Glaser *et al*., 2009, Lehmann 2007). In current years, biochar has been shown as one promising means of reducing the atmospheric CO_2 concentration because biochar slows the rate at which photo synthetically fixed carbon (C) is returned to the atmosphere (Lehmann, 2007 and Sohi *et al.*, 2010).Biochar is a carbonized material produced from the waste biomass, includes sugarcane bagasse, sawdust, rice husk, rice straw, wheat straw, animal litters and so on. Sugarcane bagasse is a solid waste of the sugar industry. It has the advantages of abundant availability, high yield, simple collection procedures, relatively stable ingredients and uniform properties (Westerhoff *et al.*, 2001). Like most agricultural residues, bagasse is a carbon-rich biomass, highly abundant and suitable for biofuel or biochar production. Therefore, the experiment has undertaken to achieve the following objectives.

3.2 OBJECTIVES:

i. To find out the effect of sugarcane bagasse biochar on sugarcane production and
ii. Improving soil health as well as soil fertility

3.3 METHODOLOGY:

Biochar will be made at RSRS Farm, Gazipur on anaerobic condition and applied at row with fertilizer according to treatment.

Treatments:

T_1: RFD
T_2: RFD + Biochar @ 1.0 t/ha
T_3: RFD + Biochar @ 1.25 t/ha
T_4: RFD + Biochar @ 1.50 t/ha
T_5: RFD + Biochar @ 1.75 t/ha
T_6: RFD + Biochar @ 2.0 t/ha
T_7: RFD + Biochar @ 2.25 t/ha
T_8: RFD + Biochar @ 2.50 t/ha

Plot size	: 7m × 6m
Replications	: 3
Design	: RCB
Variety	: BSRI Akh 41
Method of sugarcane planting	: STP (soil bed settling)
Time of Planting	: December, 2024

Data to be recorded:

1. Establishment (%) of settling
2. Tiller population at 120, 150 and 180 days after planting (DAP)

4. Unit stalk weight, height, girth and internode
5. Brix (%) at harvest
6. Cane yield
7. Pre and post soil nutrient analysis
8. BCR

3.4 WORK ELEMENTS:

1 Raising of settlings
2. Land selection and preparation
3. Biochar preparation and application
4. Basal fertilizer application
5. Planting of sugarcane settlings
6. Irrigation
7. Intercultural operations
8. Earthing up and tying
9. Insect and pest control
10. Harvesting of cane
11. Data collection
12. Data tabulation, analysis and reporting

3.5 TIME SCHEDULE

Act. No.	2024			2025											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
1	→	→													
2	→	→													
3	→														
4		→													
5			→												
6			→	→	→	→									
7				→		→		→							
8							→	→	→		→	→			
9					→	→	→	→	→	→	→	→	→		
10														→	→
11								→	→	→	→	→		→	
12													→	→	→

3.6 ECONOMIC IMPACT: Positive economic impact is expected.

3.7 EFFECT OF ENVIRONMENT: There is no adverse effect on environment. It is eco-friendly

3.8 UTILIZATION OF RESEARCH RESULTES: The findings will help farmers make proper decisions about the application of sugarcane bagasse biochar.

4.0 TITLE : **YIELD PERFORMANCE OF ARABIAN DATE PALM AT GAZIPUR**
LOCATION(S) : RSRS farm, Gazipur
INVESTIGATORS : S Akhter, N Islam, A S Mitu, M A H Saddam and R M Saiem
NATURE OF STUDY : Ongoing
PROJECT COMPLETION : 2020-2025
ESTIMATED COST (TK) : 20,000.00

4.1 DEFINITION OF THE PROBLEM

The date palm (*Phoenix dactylifera* L.) tree belongs to the family Arecaceae. It is one of the most valuable domesticated fruit due to its significance in human societies, health benefits, productive capacity as well as religious importance. Date palm ecosystem is mostly of dry nature can grow from 12.7 to 27.5°C average temperature. During the period from pollination to fruit ripening, ranges from 21 to 27°C average temperature. It is affected by different factors, (Afzal *et al.*, 2011; Ata *et al.*, 2012). Trees and fruits are affected by several diseases and insect pests which damage cause heavy losses in yield and occurs economic losses. Date palm trees are dioecious in nature, so pollination is an importantcultural activity to produce high quality fruits. Through natural pollination the expected yield is relatively low, on the other hand artificial pollination is important for quality date fruits.Female trees start producing dates at 4 to 6 years of age and reach full production within 15 to 20 years (Nixon and Carpenter, 1978). After a certain age the date yields is decreasing. To know the type of increasing fruit yield pattern within productive years of date palm life cycle and to know the yield attributes this study will be undertaken.

4.2 OBJECTIVES:

i. To find out the growth pattern of Arabian date palm year to year and
ii. To find out the sequence of yield potential

4.3 METHODOLOGY:

The study will be conducted for six consecutive years of 10-15 years old date palm trees at RSRS research orchard of Gazipur. The date palm variety Barhi was planted with tissue culture seedling in 2014. Total number of tree 11. Fertilizer, insecticide and fungicide application, irrigation, sanitation and other management practices like mechanical control, pheromone trap and other tactics will be used as per requirement. Reproductive attributes will be recorded annually for consequence six years and average will be calculated.

Data on flowering characteristics –

i. Total number of spathes per tree ii. No of bunches per spathe iii. No of strands per bunch and iv. Length of each strand per bunch

Data on fruiting characteristics –

Fully ripening fruits will be picked

i. Fruit length and diameter using Vernier slide calipers ii. Weight of 10 fruits iii. Weight edible portion of 10 fruits iv. Weight of total fruits/tree and v. brix (%)

4.4 WORK ELEMENTS:

1. Collection of spathe from male tree and artificial pollination (February, 25)
2. Fertilization (4 times around the year)
3. Weeding and irrigation (when necessary)
4. Data on flowering characters (February-March, 25)
5. Data on fruiting characters (June-July, 25)
6. Analysis and interpretation (August, 25)

4.5 TIME SCHEDULE:

Act. No.	2025											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
1		→										
2	→				→				→		→	
3		→	→	→	→	→	→	→				
4		→	→	→								
5						→	→					
6								→				

4.6 ECONOMIC IMPACT: Findings of this study may help to find out the high quality Arabian date palm and farmers will be benefitted.

4.7 EFFECT ON ENVIRONMENT: It is environment friendly research.

4.8 UTILIZATION OF RESEARCH RESULTS: After completion of this study we will be got some findings regarding the optimum time of high quality and high yield Arabian date palm fruits. Also this research may be helpful for Date palm growers to take management initiative in our country.

5.0 TITLE	**:**	**IMPACT OF IRRIGATION LEVELS ON GROWTH AND YIELD PERFORMANCE OF STEVIA**
LOCATIONS	**:**	RSRS Farm, Gazipur
INVESTIGATORS	**:**	R M Saiem, M A H Saddam, A S Mitu, N Islam and S Akhter
NATURE OF STUDY	**:**	New
PROJECT COMPLETION	**:**	2024-2026
ESTIMATED COST (TK)	**:**	20,000.00

5.1 DEFINITION OF THE PROBLEM:

Stevia (*Stevia rebaudiana)* is a globally recognized natural sweetener crop, gaining increasing attention due to its low-caloric, non-sugar sweetening properties. As consumer demand for natural alternatives to synthetic sweeteners rises, the commercial cultivation of stevia has expanded worldwide. In Bangladesh, the Bangladesh Sugarcrop Research Institute (BSRI) has developed BSRI Stevia-1, a new variety specifically adapted to local environmental conditions. Successful cultivation of stevia is highly dependent on efficient water management, as the crop is sensitive to both water stress and excessive moisture. Optimizing irrigation is particularly important in Gazipur, located in central Bangladesh, which experiences a subtropical monsoon climate with distinct dry and wet seasons. Improper water supply can significantlyaffect plant growth, biomass production, and overall yield, making precise water requirement estimation essential for sustainable and profitable cultivation.

Considering the above fact, an experiment has been undertaken with the following objectives:

5.2 OBJECTIVES:

i. To estimate optimal water requirements for the growth and yield of Stevia under different irrigation levels and
ii. To assess the impact of varying irrigation levels on the physiological performance of stevia.

5.3 METHODOLOGY:

Treatments:

T_1: 10 m^3/ha
T_2: 15 m^3/ha
T_3: 20 m^3/ha
T_4: 25 m^3/ha

No of plant per pot	: 2
Replications	: 4
Design	: CRD
Method of planting	: Polybag seedling
Variety	: BSRI Stevia-1
Time of Planting	: January, 2025

Data to be collected:

1. Plant height
2. No. branch & length of branch
3. length of root
4. Leaf weight (fresh & dry basis at three times)

5. Chlorophyll content of leaf
6. Leaf Area
7. Date of flowering
8. Root weight
9. Stevioside A analysis (at BCSIR lab)

5.4 WORK ELEMENTS:

1. Pot preparation
2. Seedlings preparation and planting
3. Intercultural operations
4. Harvesting
5. Data collection
6. Data tabulation, analysis and reporting

5.5 TIME SCHEDULE:

Act. No.	2024				2025											
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
1	→	→	→													
2				→	→											
3					→	→	→	→	→							
4										→	→					
5				→	→	→	→	→	→	→	→					
6											→	→	→			

5.6 ECONOMIC IMPACT: Positive economic impact is expected.

5.7 EFFECT ON ENVIRONMENT: This experiment is environmentally friendly.

5.8 UTILIZATION RESULT: The results will optimize irrigation, improve water efficiency, enhance crop yield, and ensure higher-qualitysteviol glycoside production in Stevia.

6.0 TITLE : **INFLUENCE OF VARIOUS GROWING MEDIA ON THE GROWTH AND YIELD OF *STEVIA REBAUDIANA***
LOCATIONS : RSRS Farm,Gazipur
INVESTIGATORS : M A H Saddam, R M Saiem, A S Mitu, N Islam and S Akhter
NATURE OF STUDY : New
PROJECT COMPLETION : 2024-2026
ESTIMATED COST (TK) : Tk.25,000.00

6.1 DEFINITION OF THE PROBLEM

Stevia (*Stevia rebaudiana* Bert.) is aherbaceous perennial plant of the Asteraceae family. Leaves are the economic part of the stevia plant, with a high concentration of steviol glycosides, which are 300-400 times sweeter than table sugar but importantly with no calories. Stevia cultivation represents a new opportunity for researchers, farmers, and businessmen. However, for proper cultivation agronomic management and soil fertility an important issues. The physical, biological, and chemical properties of soil play an important role in growth enhancement and quality. Various soil combinations as treatments are applied to check the yield and growth parameters of BSRI Stevia-1.

6.2 OBJECTIVES

i. To observe the growth of stevia under the influence of various growing media and
ii. To observe the fertility status of soil under different growing media

6.3 METHODOLOGY

Treatments:

T_0 : Regular soil
T_1 : Soil + Sand (1:1)
T_2 : Soil + FYM (1:1)
T_3 : Soil + Sand + FYM (1:1:1)
T_4 : Soil + Sand + FYM+ Coco peat (1:1:1:1)
T_5 : Soil + Sand + Coco peat+Vermicompost (1:1:1:1)

Replications : 3
Design : CRD
Method of planting : Polybag seedling
Variety : BSRI Stevia-1
Time of Planting : January, 2025

Data to be recorded

1. Survival (%)
2. Plant height (cm)
3. Number of branch and leaves
4. Number of roots
5. length of roots (cm)
6. Fresh and Dry weight of plants (gm)
7. Chemical properties of leaves.

6.4 WORK ELEMENTS

1. Pot preparation
2. Seedling planting
3. Intercultural operations
4. Data collection
5. Harvesting
6. Leaf tissue to be analyzed for different nutrient elements at BRAC lab
7. Data tabulation, analysis and reporting

6.5 TIME SCHEDULE:

Act. No.	2024				2025											
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
1	→	→	→													
2					→	→										
3							→		→							
4								→	→	→	→	→				
5									→	→	→	→				
6										→	→	→	→			
7													→	→	→	→

6.6 ECONOMIC IMPACT: It is expected that stevia growers would get higher economic benefit out of the result of this experiment. The total cost of production will be reduced.

6.7 EFFECT ON ENVIRONMENT: There would not be any adverse effects on environment due to implementation of this experiment.

6.8 UTILIZATION OF RESEARCH RESULTS: The findings of the study will be useful for stevia growers to get higher economic benefits through upgrading the fertility status of soil under different growing media.

PROGRAMME AREA: TOT & SOCIO-ECONOMICS

7.0 DEMONSTRATION:

Nature of Demonstration	Investigator	Locations	Number
a. Demonstration of chewing sugarcane with Intercrop	S Akhter/ N Islam / R M Saiem	VawalMirzapur Kapasia RSRS farm	07
b. Demonstration of BSRI-released chewing sugarcane variety	S Akhter/ N Islam/ M A H Saddam	Gazipur Sadar Kaligonj Belabo, Narsindi	03
c. Varietal Demonstration of BSRI released sugarcane	S Akhter/ M A H Saddam R M Saiem	Kaligonj Belabo, Narsindi	03

8.0 TRAINING:

Name of Training Course	Location	Course Co-ordinator	Duration	Trainee/ Batch	No. of Batch
A. Farmer's Training	Gazipur and Valuka	S Akhter/ N Islam	01day	30	03 01
B. SAAO Training	Gazipur	S Akhter/ N Islam	02 days	30	02
				Total=	06 Batch

REGIONAL SUGARCROP RESEARCH STATION SUBARNACHAR, NOAKHALI

Rationale

The most important objectives of this station are to develop need based appropriate technologies of sugarcane production and dissemination of recommended technologies among the farmers related to chewing cane and goor variety production in the non-mill zone, especially in the salinity and coastal eastern part of the country. This region mainly covers the districts of Noakhali, Feni, Lakshmipur, Chandpur and Chattogram. Considering those facts, it is needed to research different aspects of crop improvement, crop production, crop protection, and TOT & socio-economic studies.

Considering the above facts, total five experiments under crop and soil management aspects- Nutrient requirement for sustainable chewinig cane production with intercrops in AEZ 18; Performance of winter vegetable as intercrops with sugarcane in single row system in AEZ 18; Performance of chewing sugarcane varieties under Young Meghna Estuarine Floodplain (AEZ 18); Selection of sugarcane varieties suitable for goor production under Subarnachar area; Efficacy of spacing with organic and inorganic fertilizer on growth and yield of stevia in AEZ 18 are included as priority research.

Under TOT and Socio-economics program area regarding dissemination of BSRI matured technologies among the farmer's, several demonstration and training programs of SAAO and farmers have been proposed.

LIST OF EXPERIMENTS

PROGRAMME AREA		**:**	**CROP PRODUCTION**
1.0	Title	:	Performance of winter vegetable as intercrops with sugarcane in single row system in AEZ 18
2.0	Title	:	Performance of chewing varieties with intercrops under young Meghna estuarine floodplain (AEZ 18)
3.0	Title	:	Selection of sugarcane varieties suitable for goor production under Subarnachar area

PROGRAMME IN DETAILS

PROGRAMME AREA	:	**CROP PRODUCTION**
1.0 TITLE	:	**PERFORMANCE OF WINTER VEGETABLE AS INTERCROPS WITH SUGARCANE IN SINGLE ROW SYSTEM IN AEZ 18**
LOCATIONS	:	RSRS, Subarnachar, Noakhali and Hatia
INVESTIGATORS	:	R C Kabiraj, S Islam, G M A Hossain, M A Rasel and M A R Doel
NATURE OF STUDY	:	On-going
DURATION	:	2024-26
ESTIMATED COST(TK)	:	75,000/-

1.2 DEFINITION OF THE PROBLEM:

World population is increasing exponentially and it is necessary to feed up this huge population. An important strategy for increasing labour utilization per unit area of available land and productivity is to intensify land use. Intercropping is the cultivation of two or more crops simultaneously on the same field which aims to produce a greater yield on a given piece of land by making use of resources or ecological processes that would otherwise not be utilized by a single crop. Sugarcane is location specific and long duration crop and takes about90-120 days for canopy development, which allows for growing intercrops during the early stage. Taking advantages of this, sugarcane cultivators grow various short duration crops like pulses, vegetables etc as intercrops to get interim return since small sugarcane growers cannot wait for a long time to get financial return from sole sugarcane crop. The yield of inter crops is quiet low at farmers level due to lack of use appropriate intercropping systems as well as poor management practices. Some inter crops shows adverse effect on cane yield, quality and also decrease the soil fertility. Therefore, this experiment has been undertaken to select suitable intercrops with single row sugarcane at Subarnachar region.

1.3 OBJECTIVE(S):

1. To test the suitable intercrops for sequential intercropping in single row sugarcane at Subarnachar area and
2. To identify the effect of sequential intercropping on growth yield and quality of sugarcane.

1.4 METHODOLOGY:

Treatments:

T_1 : Single Row Cane only
T_2 : SRC – Radish + Soybean
T_3 : SRC - Red Amaranth + Soybean
T_4 : SRC - Coriander + Soybean
T_5 : SRC - Spinach + Soybean

Replications : 3
Design : RCB
Planting method : End to end 2 budded setts
Date of planting : October, 2024

1.5 DATA TO BE RECORDED:

For Sugarcane

1. Germination count (%)
2. No. of tillers/ha
3. No. of millable cane/ha
4. Cane height (m) and diameter (cm)
5. Field brix (%)
6. Flowering record
7. Flowering record

For Intercrop

1. Intercrops population
2. Yield of 1st and 2nd intercrops
3. Biomass (t ha^{-1})

1.6 WORK ELEMENTS:

1. Land preparation
2. Basal fertilization and planting of sugarcane
3. Planting of intercrop
4. Irrigation, weeding and mulching for both crops as and when required
5. Insect pest management
6. Harvest (intercrop)
7. Harvest (sugarcane)

1.7 TIME SHEDULE:

Act. No.	Months														
	2024			2025											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1.	→	→	→												
2.		→	→												
3.		→	→												
4.			→	→	→	→	→	→	→	→	→				
5.						→	→	→	→	→	→				
6.					→	→	→								
7.														→	→

1.8 ECONOMIC IMPACT : Positive economic impact is expected.

1.9 EFFECT OF ENVIRONMENT : Friendly to environment.

1.10 UTILIZATION OF RESEARCH RESULTS: The result obtained from this study may help growers to know suitable intercrops with sugarcane in this location. On the basis of results will be able to take correct decision about the high yielding intercropping cultivation with sugarcane.

PROGRAMME AREA CROP PRODUCTION

2.0 TITLE : **PERFORMANCE OF CHEWING VARIETIES WITH INTERCROPS UNDER YOUNG MEGHNA ESTUARINE FLOODPLAIN (AEZ 18)**

LOCATIONS : RSRS, Subarnochar Farm

INVESTIGATORS : R C Kabiraj, S Islam, G M A Hossain, M A Rasel and M A R Doel

NATURE OF STUDY : On-going

DURATION : 2023-25

ESTIMATED COST(TK) : 40,000/-

2.1 DEFINITION OF THE PROBLEM:

Now-a-days chewing cane is high value crop in Bangladesh. It is more popular in our country. Long time it is cultivated in most of the districts. The management practices for chewing sugarcane varying from place to place and farmers to farmers. Natural disaster occurs in Bangladesh especially in coastal areas. Subarnachar is one of them. Farmers of this region practices local varieties which is not economically profited due to lower yield and economic return. So high yielding varieties are needed for this region. The present study has been taken to select suitable location specific cane varieties for chewing purpose. Chewing cane is a long duration and exhaustive crop which consumes high amount of plant nutrients. Nutrient requirement of

sugarcane differs from place to place according to soil and agro-climatic conditions over space and time. Yield potentiality of a crop would not reach a maximum unless proper fertilizer management is practiced. It is spectacular that the poor sugarcane yield is largely attributed to improper use of fertilizer. The inherent capacity of soil to supply nutrients is gradually declining over time for its nutrient mining due to intensive crop cultivation and some other manipulations. With the advancement of technology there would be a continuous need for updating the nutrient requirement of sugarcane at different Agro-Ecological Zones. In view of this, the experiment has been undertaken to determine the present nutrient requirement for Chewing cane cultivation in different AEZs that will be helpful for updating the next Fertilizer Recommendation Guide.

2.2 OBJECTIVE(S):

1. To select suitable chewing varieties in subarnachar area;
2. To select location specific chewing varieties for costal area and
3. Finding out the optimum and economic nutrient requirement for sustainable Chewing cane production in different AEZs.

2.3 METHODOLOGY:

Treatments:

T_1: BSRI Akh 41 – potato + Summer Mungbean (Recommended Fertilizer Dose (RFD)
T_2: BSRI Akh 42– potato + Summer Mungbean (Recommended Fertilizer Dose (RFD)
T_3: BSRI Akh 47– potato + Summer Mungbean (Recommended Fertilizer Dose (RFD)
T_4: Black Ruby– potato + Summer Mungbean (Recommended Fertilizer Dose (RFD)

Design: RCB; Replication: 3; Plot size: 8m x 6m;
Gross area: 0.33 acre; Planting material: 2- budded sett

2.4 DATA TO BE RECORDED:

For Sugarcane

1) Physical and chemical properties of initial and post harvest soils & Germination % of settlings
2) Tiller counting at 120, 150 and180 days after plantation (DAP)
3) Sheath and leaf blades to be analyzed for different nutrient elements at 120 DAP and at 300 DAP
4) Millable cane, cane diameter, cane height, yield and Brix at harvest

For Intercrop

1. Intercrops population
2. Yield of 1st and 2nd intercrops
3. Biomass (t ha^{-1})

2.5 WORK ELEMENT:

1. Plantation of chewing cane
2. Germination count
3. Tiller count
4. Measurement of stalk height, girth and internode length
5. No. of millable cane/ha
6. Determination of field brix (%) and chewing qualities
7. Observation on flowering habit and stalk color
8. Observation on reaction to pests and diseases

2.6 TIME SHEDULE:

Act. No.	Months														
	2024			2025											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1.	→	→	→												
2.		→	→	→											
3.			→	→	→										
4.			→	→	→	→	→	→	→	→	→				
5.						→	→	→	→	→	→				
6.					→	→									
7.														→	→

2.7 ECONOMIC IMPACT: Positive economic impact is expected.

2.8 EFFECT OF ENVIRONMENT: Friendly to environment.

2.9 UTILIZATION OF RESEARCH RESULTS: The result will help the farmers to grow suitable chewing cane variety for higher yield and economic benefit for commercial production.

PROGRAMME AREA : CROP PRODUCTION
3.0 TITLE : SELECTION OF SUGARCANE VARIETIES SUITABLE FOR GUR PRODUCTION UNDER SUBARNACHAR AREA
LOCATIONS : RSRS, Subarnachar, Noakhali.
INVESTIGATORS : R C Kabiraj, S Islam, G M A Hossain, M A Rasel and M A R Doel
NATURE OF STUDY : On -going
DURATION : 2024-26
ESTIMATED COST(TK) : 50,000/-

3.1 DEFINITION OF THE PROBLEM:

Sugarcane is location specific crop. The performance of particular sugarcane variety differs from place to place and farmers to farmers, which deserves adaptability trail. Without adaptability test, it cannot recommend a particular variety for particular location. Farmers of this region grow local varieties resulting economic return is very low. High yielding and good quality sugarcane varieties are needed for this region. Therefore, this study is needed to find out the comparative performance *gur* varieties such as Isd 16, Isd 40, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45 and BSRI Akh 46. The present study is undertaken to evaluate the performance of the BSRI released *gur* varieties at Subarnachar region.

3.2 OBJECTIVE(S):

1. To test the adaptability of BSRI released sugarcane *gur* varieties atSubarnachar, Noakhali area and
2. To identify location specific suitable variety for commercial cultivation.

3.3 METHODOLOGY:

The selected BSRI released commercial varieties such as Isd 16, Isd 37, Isd 39, BSRI Akh 43, BSRI Akh 44, BSRI Akh 45 and BSRI Akh 46 will be planted in RCB design with 3 replications. Row to row distance 1m and plant to plant distance 100 cm. Intercultural operations will be done as and when required. Recommended dose of fertilizers will be applied as required.

Treatments:

T_1 : Isd 16
T_2 : Isd 37
T_3 : Isd 39
T_4 : BSRI Akh 43
T_5 : BSRI Akh 44
T_6 : BSRI Akh 45
T_7 : BSRI Akh 46

Replications : 3
Design : RCB
Planting method : 2 budded setts

3.4 DATA TO BE RECORDED:

1) Germination count (%)
2) No. of tillers/ha (at 120 DAT, 150 DAT and 80 DAT)
3) No. of millable cane/ha
4) Cane height (m) and diameter (cm)
5) Brix (%) of cane at harvest
6) Estimated cane yield (t/ha)
7) Goor recovery after *gur* preparation
8) Physical and chemical properties of *gur*

3.5 WORK ELEMENT:

1. Plantation of *gur* variety
2. Germination count
3. Tiller count
4. Measurement of stalk height, girth and internode length
5. Observation on reaction to pests and diseases
6. Cane yield at harvest
7. Gur preparation and gur yield data collection

3.6 TIME SCHEDULE:

Sl. No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1				→												
2					→	→										
3							→	→	→							
4													→	→	→	
5						→	→	→	→	→	→	→	→	→	→	→
6																→
7																→

3.7 ECONOMIC IMPACT: Positive economic impact is expected.

3.8 EFFECT OF ENVIRONMENT: Friendly to environment.

3.9 UTILIZATION OF RESEARCH RESULTS: The result obtained from this study may help growers to know suitability of goor variety in this location. On the basis of results will be able to take correct decision about the high yielding, pest and disease tolerant *gur* varieties.

BSRI SUB-STATION, JOYPURHAT

LIST OF EXPERIMENT

PROGRAMME AREA : CROP AND SOIL MANAGEMENT

1.0 Title : Effect of three sequential intercropping on growth, yield and profitability of sugarcane cultivation

2.0 Title : Performance of some BSRI recommended sugarcane varieties as plant crop in Tista Meander Floodplain soil

PROGRAMME AREA : TRANSFER OF TECHNOLOGY AND SOCIO ECONOMICS

3.0 Title : Ratooning Potentiality of Some Popular BSRI Sugarcane Varieties in JSM zone

PROGRAMME IN DETAILS

PROGRAMME AREA : **CROP AND SOIL MANAGEMENT**
1.0 TITLE : **EFFECT OF THREE SEQUENTIAL INTERCROPPING ON GROWTH, YIELD AND PROFITABILITY OF SUGARCANE**
LOCATION : Paschim Manik, Panchbibi, Joypurhat
INVESTIGATORS : M M Hasan and M S Islam
NATURE OF STUDY : New
PROJECT COMPLETION : 2024-2025
ESTIMATED COST (Tk) : 34,828.00

1.1 DEFINITION OF THE PROBLEM

Sugarcane is a crucial cash crop in Bangladesh, contributing significantly to the agricultural economy and providing livelihoods for many farmers. However, traditional farming practices often result in under utilization of land, particularly the vacant spaces between sugarcane rows. Sequential intercropping can enhance the productivity of sugarcane cultivation by introducing additional crops that can be harvested throughout the year, thus optimizing land use and increasing farmers' income.

While sugarcane growers in Bangladesh typically cultivate one or two intercrops alongside sugarcane, the introduction of a third intercrop is less common and remains unexplored. This research proposes to investigate the growth, yield, and profitability of sugarcane when intercropped with three sequential intercrops, thereby providing an opportunity for farmers to gain additional income and improve soil health.

1.2 OBJECTIVES:

1. To evaluate the growth parameters of sugarcane when intercropped with different sequential intercrops;
2. To assess the yield and economic viability of sugarcane in conjunction with sequential intercrops and
3. To determine the land equivalent ratio (LER) and overall land utilization efficiency.

1.3 METHODOLOGY:

The experiment will be conducted in Joypurhat district under Tista Meander Floodplain soil (AEZ-3). The experiments will be set up at the farmers' field following randomized complete block design with three replications.

T_1 : Sole sugarcane
T_2 : Sugarcane + Onion
T_3 : Sugarcane + Lettuce
T_4 : Sugarcane + Onion - Chili
T_5 : Sugarcane + Lettuce - Chili
T_6 : Sugarcane + Onion - Chili - Black gram
T_7 : Sugarcane + Lettuce - Chili - Black gram
T_8 : Sugarcane + Onion - Chili - Turmeric
T_9 : Sugarcane + Lettuce - Chili - Turmeric
T_{10} : Sugarcane + Onion - Chili - Ginger
T_{11} : Sugarcane + Lettuce - Chili - Ginger

Variety: Isd 39; Planting materials: two budded sett
Plot size: 8m × 6m; Gross area: 0.33 acre;

1.4 DATA TO BE COLLECTED:

For sugarcane:

1. Germination percentage
2. Tiller population at 120, 150 and 180 days after plantation
3. Number of millable cane, cane yield, brix percent and plant height at harvest

For Intercrop:

Population and yield of 1st, 2nd and 3rd intercrops.

1.5 WORK ELEMENT:

Activity No.	Name of Activity
1	Sett preparation
2	Layout preparation and initial soil sample collection
3	Basal fertilizer application and planting sugarcane and 1st intercrop
4	Relay planting of 2nd intercrop and harvesting of 1st intercrop
5	Tiller count at 120 days after planting (DAP)
6	First top dressing of urea and MoP
7	Harvesting of 2nd intercrop & planting 3rd intercrop turmeric and ginger
8	Tiller count at 150 DAP
9	Second top dressing of urea and MoP
10	Planting 3rd intercrop black gram
11	Harvesting of 3rd intercrop
12	Brix%, millable cane and yield at harvest
13	Post harvest soil sample collection

1.6 TIME SCHEDULE

AC No.	Year	2024				2025											
	Mon.	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1			→	→													
2			→	→													
3			→	→													
4						→	→										
5								→									
6								→									
7									→								
8									→								
9									→								
10													→				
11																	→
12																	→
13																	→

1.7 ECONOMIC IMPACT:

The research programme offers a promising economic impact by enhancing land use efficiency, boosting net returns, and ensuring sustainable soil health, all while reducing production costs and creating year-round employment. These benefits make this model a potentially transformative approach to sugarcane farming, with implications for improved livelihoods, food security, and resilience in Bangladeshi farming communities.

1.8 EFFECT ON ENVIRONMENT:

The Effect of the research programme promotes environmental benefits by enhancing soil health, improving water efficiency, reducing greenhouse gas emissions, and supporting biodiversity. The reduced need for chemical inputs, coupled with the long-term sustainability of the soil and agro ecosystem, aligns this approach with environmental conservation goals. These outcomes make triple sequential intercropping a valuable, eco-friendly model for future sustainable agriculture practices in Bangladesh.

1.9 UTILIZATION OF THE RESEARCH RESULTS:

The research programme has significant implications for agricultural productivity, rural income, environmental sustainability, and economic resilience. Through the effective utilization of its findings, this

research can drive improvements in land use efficiency, resource conservation, farmer profitability, and sustainable agricultural practices in Bangladesh, benefiting farmers, policymakers, and the environment.

2.0 TITLE	**:**	**PERFORMANCE OF SOME BSRI RECOMMENDED SUGARCANE VARIETIES AS PLANT CROP IN TISTA MEANDER FLOODPLAIN SOIL**
LOCATION	**:**	Vadsa, Joypurhat
INVESTIGATORS	**:**	M M Hasan and M S Islam
NATURE OF STUDY	**:**	Ongoing
PROJECT COMPLETION	**:**	2024-2025
ESTIMATED COST (TK)	**:**	23,613.00

2.1 DEFINITION OF THE PROBLEM:

Bangladesh Sugarcrop Research Institute (BSRI) has released forty eight (48) sugarcane varieties till present. Releasing new varieties is very necessary and a continuous process to substitute old variety for higher yield of sugarcane. Before recommendation of the latest sugarcane varieties for Tista Meander Flood Plain Soil it is needed to study their performance regarding insect and diseases resistance, suitability to local climatic and soil conditions, and ability to produce higher yield. In mill zones of Bangladesh sugarcane growers generally use old varieties and yield is not encouraging. So, new sugarcane varieties are crying need to the growers for profitable production. Therefore, the experiment will be undertaken to select suitable sugarcane varieties for profitable production.

2.2 OBJECTIVES:

1. To select suitable sugarcane varieties in Tista Meander Floodplain Soil and
2. To study the comparative performance of different latest sugarcane varieties.

2.3 METHODOLOGY:

The experiment will be conducted in the farmers' field of Joypurhat district under AEZ 3 (Tista Mender Floodplain Soil). The experiments will be set up in randomized complete block design following three replications. Intercultural operations including shaving, fertilizer application and irrigation will be done as per recommendation.

T_1 : Isd 2-54
T_2 : Isd 16
T_3 : Isd 19
T_4 : Isd 26
T_5 : Isd 33
T_6 : Isd 34
T_7 : Isd 37
T_8 : Isd 39
T_9 : BSRI Akh 43
T_{10} : BSRI Akh 45
T_{11} : BSRI Akh 46
T_{12} : BS RI Akh 48

Plot size: 8m × 6m, Gross area: 0.33 acre

2.4 DATA TO BE COLLECTED:

1. Germination percentage
2. Tiller population at 120, 150 and 180 days after plantation
3. Lodging percentage count
4. Percentage of insect and disease infested canes
5. Number of millable cane, cane yield, brix percent and plant height at harvest

2.5 WORK ELEMENTS:

1. Land selection and preparation (September-November)
2. Basal fertilizer application and planting (November–December)
3. Irrigation (December–May)
4. Intercultural operations (January–June)
5. Top dressing of fertilizers (March-June)
6. Insect and pest control (February – September)
7. Sugarcane harvesting (December)
8. Data collection on number of tiller, millable cane, yield and brix etc (March-December)

2.6 TIME SCHEDULE:

Ac. No.	2024				2025											
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	→	→	→													
2			→	→	→											
3				→	→	→	→	→	→							
4					→	→	→	→	→	→						
5							→	→	→	→						
6						→	→	→	→	→	→	→	→			
7																→
8							→	→	→	→	→	→	→	→	→	→

2.7 ECONOMIC IMPACT:

This research could lead to a substantial economic uplift for farmers and rural communities by increasing yields, reducing costs, stabilizing income, and enhancing the sugarcane supply chain. Such impacts contribute to both the microeconomics of individual farming households and the macroeconomic health of the region's agricultural industry.

2.8 EFFECT ON ENVIRONMENT:

Careful management practices and monitoring are essential to mitigate the negative effects associated with monoculture, soil nutrient depletion, and local ecosystem disruption. Implementing sustainable agricultural practices will be key to ensuring that the benefits of cultivating BSRI-recommended sugarcane varieties outweigh any potential environmental risks.

2.9 UTILIZATION OF THE RESEARCH RESULT:

The effective utilization of the research results on BSRI-recommended sugarcane varieties in Tista Meander Floodplain soil can significantly improve agricultural practices, enhance farmers' livelihoods, and contribute to sustainable development in the region. By integrating research findings into practical applications, stakeholders can work together to create a thriving sugarcane sector that benefits the local economy and environment.

PROGRAMME AREA: TRANSFER OF TECHNOLOGY AND SOCIO ECONOMICS

Sl. No.	Nature of program	Number	Unit Cost	Total (Tk)
01	Ratooning Potentiality of Some Popular BSRI Sugarcane Varieties in JSM zone	09	10,050/-	90,500/-

BSRI SUB-STATION, RAJSHAHI

LIST OF EXPERIMENT

1.0	Title	:	Field performance of some newly released sugarcane varieties and their ratooning potentiality in Mill zones
2.0	Title	:	Performance of BSRI newly released sugarcane varieties in char lands of Rajshahi
3.0	Title	:	Performance of different winter crops with single row of chewing cane
4.0	Title	:	Selection of suitable genotypes for gur production in low land of Chapai Nawabganj district

PROGRAMME IN DETAILS

PROGRAMME AREA	:	**CROP PRODUCTION AND MANAGEMENT**
1.0 TITLE	:	**FIELD PERFORMANCE OF SOME NEWLY RELEASED SUGARCANE VARIETIES AND THEIR RATOONING POTENTIALITY IN MILL ZONES**
LOCATIONS	:	Rajshahi
INVESTIGATORS	:	M K Begum, H M Al-Amin, S Rasul and R Alam
NATURE OF STUDY	:	On-going
PROJECT COMPLETION	:	2023-2025
ESTIMATED COST (Tk)	:	50,000.00

1.1 DEFINITION OF THE PROBLEM :

Sugarcane is being cultivated in mills and non-mill zone areas mainly for sugar, goor 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 Rahshahi sugar mill areas are required to be studied their ability to produce higher yield, quality and their ratooning protentiality. The experiment is aimed to help the farmers of mill areas to select the high yielding and high sugar content varieties and their ratooning potentialities for commercial cultivation of this region.

1.2 OBJECTIVES :

1. To observe the suitability of BSRI recommended varieties in RJSM areas;
2. To select the good ratooner varieties for this area and
3. To study the comparative performance of different latest varieties.

1.3 METHODOLOGY :

Treatments :

T_1 = BSRI Akh 48
T_2 = BSRI Akh 46
T_3 = BSRI Akh 45
T_4 = BSRI Akh 43
T_5 = Isd 33
T_6 = Isd 34 (Check)

Design	: RCBD
Replication	: 3
Plot size	: 8m × 8m
Method of planting	: Conventional (2 budded setts),
Gross areas	: 0.15 ha.

Data to be collected:

1. Germination percent
2. Tiller population at 120, 150 and 180 days
3. Millable cane count
4. Cane yield at harvest
5. Brix percent (%)

Those data will be collected from plant cane as well as Ist and 2nd ratoon cane.

1.4 WORK ELEMENTS :

1. Land selection and preparation
2. Basal fertilizer application and planting
3. Germination count
4. Intercultural operation

5. Irrigation
6. Tiller counting at 120, 150 and 180 days
7. Fertilizer application (top dressing)
8. Insect and pest control
9. Millable cane count
10. Harvesting of cane
11. Data collection (brix %, yield)

1.5 TIME SCHEDULE:

AC No.	Year	2024					2025										
	Month	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		

1.6 ECONOMIC IMPACT: Positive economic impact is expected

1.7 IMPACT ON ENVIRONMENT:

This is environment friendly and there will not be any adverse effect on the surrounding environment for implementation

1.8 UTILIZATION OF RESEARCH RESULT :

The result of the study will help to decide farmers to select good ratooner varieties of sugarcane. Thus this study has a great value for the localization.

2.0 TITLE : **PERFORMANCE OF BSRI NEWLY RELEASED SUGARCANE VARIETIES IN CHAR LANDS OF RAJSHAHI**

LOCATION : Char land of Rajshahi District.

INVESTIGATORS : H M Al-Amin, M K Begum, S Rasul and R Alam

NATURE OF STUDY : On-going

DURATION : 2023-2025

ESTIMATED COST (TK) : 50,000.00

2.1 DEFINITION OF THE PROBLEM :

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 those varieties in char land.

2.2 OBJECTIVES

1. To find out the performance of newly released varieties in the Char land of Rajshahi and
2. To find out the economic profitability of BSRI released varieties in the Char land of Rajshahi.

2.3 METHODOLOGY :

(i) Treatments (Varieties):

T_1 : BSRI Akh 43
T_2 : BSRI Akh 45
T_3 : BSRI Akh 46
T_4 : Isd 33
T_5 : Isd 34 (Check)

(ii) Design : RCB
(iii) Replication : 3
(iv) Planting Method : Conventional 2 bud setts.
(v) Time of Planting : November, 2023
(vi) Plot size : 8m × 8m

Data to be recorded:

Sugarcane:

i. Mortality of settlings/germination/gap filling records.
ii. Tiller (March and May).
iii. Number of millable cane at harvest.
iv. Plant height at harvest.
v. Major insect and diseases.
vi. Yield of cane and
vii. Sucrose/Brix %.

2.4 WORK ELEMENTS & TIME SCHEDULE :

Activity No	Name of Activities
1	Land & farmer selection
2	Land preparation supervision
3	Planting (sugarcane)
4	Germination count.
5	Fertilizer application (Top dressing)
6	Tillering count (March and May)
7	Intercultural operation
8	Pest control
9	Millable cane count
10	Harvesting and yield record.
11	Sucrose/Brix %.

2.5 TIME SCHEDULE:

AC No.	Year	2024					2025											
	Month	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		

2.6 ECONOMIC IMPACT: Positive economic impact is expected.

2.7 EFFECT ON ENVIRONMENT: Positive effect on environment

2.8 UTILIZATION OF RESEARCH RESULTS:

The results obtained from this experiment may help growers to know suitability of varieties in Char lands. On the basis of these results growers will be able to take correct decision about the high yielding, pest and disease tolerant varieties and finally include these high yielding cane varieties in their cultivation programme in Char land.

3.0 TITLE : **PERFORMANCE OF DIFFERENT WINTER CROPS WITH SINGLE ROW OF CHEWING CANE**

LOCATIONS : Rajshahi

INVESTIGATORS : H M Al-Amin, M K Begum, S Rasul and R Alam

NATURE OF STUDY : On-going

PROJECT COMPLETION : 2023-2025

ESTIMATED COST (TK) : 61,000.00

3.1 DEFINITION OF THE PROBLEM :

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.

3.2 OBJECTIVE(S):

1. To ensure higher production and maximum profit through cultivation of intercrops with sugarcane.

3.3 METHODOLOGY:

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 + Carrot (Koruda)

Potato and Carrot will be grown in 1 line; Whereas Onion and Garlic will be grown in 3 lines between single rows of Chewing cane.

Design : RCB
Replication : 3
Plot size : 8m × 6m
Method of planting : Conventional (2 budded setts),
Gross areas : 0.13 ha.
Chewing Cane Variety : BSRI Akh 41

Data to be collected:

1. Germination percent at 60 days of planting
2. Tiller population at 120, 150 and 180 days of planting
3. Intercrop yield
4. Brix percent (%)
5. Chewable cane count at harvest
6. Cane yield at harvest

3.4 WORK ELEMENTS:

1. Land selection and preparation
2. Basal fertilizer application and planting of cane
3. Planting of first intercrop
4. Intercultural operation
5. Irrigation
6. Harvesting of intercrop
7. Fertilizer application (top dressing)
8. Insect and pest control
9. Harvesting of cane
10. Data collection (Tiller, Chewable cane, brix% and yield)

3.5 TIME SCHEDULE :

Ac. No.	2024				2025									
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1.	→	→												
2.			→	→										
3.			→	→										
4.				→	→	→	→	→	→	→				
5.			→	→	→	→	→	→						
6.						→	→	→						
7.						→	→	→	→					
8.				→	→	→	→	→	→	→	→	→		
9.												→	→	→
10.			→	→	→	→	→	→	→	→	→	→	→	→

3.6 ECONOMIC IMPACT: Positive economic impact is expected.

3.7 IMPACT ON ENVIRONMENT:

This is environment friendly and there will not be an adverse effect on the surrounding environment for implementation of these results.

3.8 UTILIZATION OF RESEARCH RESULT:

The experimental results will help the farmers to choose suitable and profitable intercrops and farmers will be benefited by getting interim income

4.0 TITLE : **SELECTION OF SUITABLE GENOTYPES FOR *GUR* PRODUCTION IN LOW LAND OF CHAPAI NAWABGANJ DISTRICT**

LOCATIONS : Sibganj, Chapai Nawabganj

INVESTIGATOR : M K Begum, H M Al-Amin, S Rasul and R Alam

NATURE OF STUDY : New

PROJECTED COMPLETION : 2024-2027

ESTIMATED COST (TK.) : 75,000/-

4.1 DEFINITION OF THE PROBLEM:

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 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. All sugarcane varieties do not perform well specially in low land. Therefore, the present study was undertaken to evaluate the performance of some varieties in low land of non-mill zones.

4.2 OBJECTIVES:

i) Evaluating the performance of sugarcane genotypes in low lands

ii) Selecting the location specific sugarcane varieties for *gur* production

4.3 METHODOLOGY:

Five BSRI released commercial varieties will be grown along with one clone which is cultivated long time in that area.

reatments:

T_1 = Isd 33
T_2 = Isd 34
T_3 = BSRI Akh 39
T_4 = BSRI Akh 45
T_5 = BSRI Akh 46
T_6 = I 291-87 (Red rot susceptable)

Design : RCB , Replication : 3, Plot size: 8m X 8m; Number of plots: 18; Method of planting: Conventional; Time of planting: October/November 2024, Intercultural operation: As and when required: Fertilizer dose: As per recommended dose to be estimated for each location.

Data to be recorded:

1. Mortality of settlings/germination/gap filling records.
2. Tiller (March and May).
3. Number of millable cane at harvest.
4. Plant height at harvest.
5. Major insect and diseases.
6. Yield of cane and
7. Sucrose/Brix %.
8. Amount of *gur* production and colour of *gur*

4.4 WORK ELEMENTS & TIME SCHEDULE:

Activity No	Name of Activities
1	Land & farmer selection
2	Land preparation supervision
3	Planting (sugarcane)
4	Germination count.
5	Fertilizer application (Top dressing)
6	Tillering count (March and May)
7	Intercultural operation
8	Pest control
9	Millable cane count
10	Harvesting and yield record.
11	Sucrose/Brix %.

4.5 TIME SCHEDULE:

AC	Year	2024					2025										
No.	Month	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		

4.6 ECONOMIC IMPACT: Positive economic impact is expected.

4.7 EFFECT ON ENVIRONMENT: Positive effect on environment.

4.8 UTILIZATION OF RESEARCH RESULT:

The results obtained from this experiment may help growers to know suitability of variety in those locations. On the basis of these results growers will be able to take correct decision about the high yielding, pest and disease tolerant varieties and finally include these high yielding cane varieties in their cultivation programme.

BSRI SUB-STATION, CHUADANGA

LIST OF EXPERIMENTS

1.0 Title : Exploring the Suitability of BSRI Akh 41 as sugar producing variety in Carew & Company (Bangladesh) Ltd. Sugar mill area.

2.0 Title : Efficacy of different insecticides against sugarcane rootstock borer (*Emmalocera depressella*) in Carew & Company (Bangladesh) Ltd. Sugar mill area.

PROGRAMME IN DETAILS

PROGRAMME AREA : **CROP PRODUCTION AND MANAGEMENT**

1.0 TITLE : **EXPLORING THE SUITABILITY OF BSRI Akh 41 AS SUGAR PRODUCING VARIETY IN CAREW & COMPANY (BANGLADESH) Ltd. SUGAR MILL AREA**

LOCATION : Chuadanga (2 locations)

INVESTIGATORS : M O Khaiyam, M I Hossain and M O Sheikh

NATURE OF STUDY : On-going

PROJECT COMPLETION : 2023-2025

ESTIMATED COST (TK.) : 42,624/-

1.1 DEFINITION OF THE PROBLEM:

Sugarcane is cultivated both mill and non-mill zone mainly for sugar, gur and chewing purpose. Bangladesh Sugarcrop Research Institute developed forty eight (48) cane varieties of which only few varieties are occupying a major part of total cane growing area. The yield of cane of the existing cultivated varieties in mill zone of Bangladesh is not satisfactory. BSRI Akh 41 is well known chewing and gur variety which have higher yield potentiality than other BSRI bred sugar and gur variety. Yield potentiality of BSRI Akh 41(average yield: 139 ton/ha) is higher than any sugar producing variety developed by BSRI. However the potentiality of BSRI Akh 41 as sugar producing variety never tested. Considering above facts, the present study has been proposed with the following objectives.

1.2 OBJECTIVE:

i. Observing the suitability of BSRI Akh 41 in sugar mill areas.

1.3 METHODOLOGY:

Treatments: 5 (sugarcane variety)

T_1 : Isd 37 (Standard)
T_2 : BSRI Akh 41
T_3 : BSRI Akh 43
T_4 : BSRI Akh 45
T_5 : BSRI Akh 46

Plot Size : 8m × 6m
Replication : 3
Design : RCB
Planting Method : Conventional (Two bud setts)

Data to be recorded:

i. Tiller count at 120, 150 and 180 days after planting
ii. Millable cane count
iii. Brix percent
iv. Disease and incidence
v. Cane yield at harvest

1.4 WORK ELEMENTS:

1. Field preparation
2. Basal fertilizer application
3. Intercultural operation
4. Irrigation
5. Tiller count at 120,150 and 180 DAP
6. Fertilizer application (top dressing)
7. Insect and pest control
8. Millable cane count
9. Harvesting of cane
10. Data collection (brix %, height, girth, yield

1.5 TIME OF SCHEDULE:

Ac No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1.				→	→											
2.					→	→	→									
3.						→	→	→	→	→	→	→				
4.							→	→	→	→	→	→				
5.								→	→	→	→					
6.							→	→	→	→						
7.							→	→	→	→	→	→	→	→		
8.														→	→	
9.															→	→
10.															→	→

1.6 ECONOMIC IMPACT: Positive economic impact is expected.

1.7 EFFECTS ON ENVIRONMENT:

This is environment friendly and there will not be any adverse effect on the surrounding environment for implementation of this trial.

1.8 UTILIZATION OF RESEARCH RESULTS (OUTPUTS):

The result of the study will give a clear idea to the growers and extension workers for selection of cane varieties in Chuadanga under AEZ-11. In cane cultivation the growers will also be obtained higher yield of cane and sugar.

PROGRAMME AREA : **CROP PROTECTION**
2.0 TITLE : **EFFICACY OF DIFFERENT INSECTICIDES AGAINST SUGARCANE ROOTSTOCKBORER (*EMMALOCERA DEPRESSELLA*) IN CAREW & COMPANY (BANGLADESH) Ltd. SUGAR MILL AREA**
LOCATION : Chuadanga (2 locations)
INVESTIGATORS : M O Sheikh and M N Alam
NATURE OF STUDY : New
PROJECT COMPLETION : 2024-2025
ESTIMATED COST (TK.) : 49,124 .00

2.1 DEFINITION OF THE PROBLEM:

Rootstock borer, *Emmalocera depressella* Swinhoe (Lepidoptera:Pyralidae) is one of the major insect pests of sugarcane causing significant losses of 8.55% (Miah *et al.*, 1986). Rootstock borer is a serious pest causing damage to the underground portions of cane stalks. Infestation by rootstock borer in the early stages of cane was observed in reducing cane yield upto 68% (Miah *et al.*, 1986). The larvae bore into the underground basal portion of the plant and feed there showing the dead heart symptom. The dead heart cannot be easily pulled out and it does not give any offensive smell. The pest is active at high temperatures and low humidity. Drying up 3rd/4th leaf is sometimes observed with the yellowing of the whole plants attack. In mature cane, the stock portion is badly damaged, tissues are macerated and food material cannot be translocated. Leaf becomes pale yellow resulting the death of the cane. Miah *et al.* (1986) found 68.0% infestation and 8.6% reduction in yield. Infestation may reach upto 100.0% in some canes in prone areas. Rootstock borer in its first brood affects cane by 52% of which produce no tiller, 30% produce only one tiller and 18% two tillers (Cheema,1953). During harvest, upto 10% yield decrease and reduction in sucrose in juice by about 0.3 unit have been observed by Gupta and Avasthy (1952).

2.2 OBJECTIVE:

1. To determine the efficacy of the different insecticides against sugarcane rootstock borer.

2.3 METHODOLOGY:

The experiment will be conducted at Carew & Co. (Bangladesh) Limited, Sugar Mill area under Chuadanga district. The sugarcane variety Isd 40 will be conventionally planted with two budded setts. The proposed insecticides are granular and have EC formation. The granular will be applied at the root zone in the trenches on both sides of cane rows while EC formulation will be applied by sprayer. The chemicals will be applied in July+ August+ September. Thereafter, insecticides were covered with soils using spades. Field soils were made moist through irrigation before insecticide application. For the collection of data (level of infestation), five clumps per plot were uprooted randomly and were compared with the control plot.

Treatments: 7

T_0 : Control (Untreated)
T_1 : Applying Pyriban 15G (Chlorpyrifos) @ 15 kg ha^{-1} (July+ August+ September)
T_2 : Applying Actara 25WG (Thiamethoxam) @ 0.6gm/L (July+ August+ September)
T_3 : Applying Regent 3GR (Fipronil) @ 16.6 kg ha^{-1} (July+ August+ September)
T_4 : Spraying Shobicron 425 EC (Profenofos (40%) + Cypermethrin (2.5%) @ 2ml/L of water (July+ August+ September)
T_5 : Spraying Nitro 505EC (Chlorpyrifos (50%) + Cypermethrin (5%) @ 2ml/L of water (July+ August+ September)
T_6 : Spraying Marshal 20EC (Carbosulfan) @ 3ml/L of water (July+ August+September)

Plot Size	:	8m × 6m
Replication	:	3
Design	:	RCB
Planting Method	:	Conventional (Two bud setts of Isd 40)

Data to be recorded:

1. Germination (%)
2. No. of Tillers
3. (%) RSB infestation and efficiency
4. Brix% and Millabe cane
5. Cane yield

2.4 WORK ELEMENTS:

1. Field preparation
2. Basal fertilizer application
3. Intercultural operation
4. Irrigation
5. Fertilizer application (top dressing)
6. Germination count at 60 DAP & Tiller counts at 120,150 and 180 DAP
7. Spraying insecticides (July+ August+ September)
8. (%) RSB infestation and efficiency
9. Millable cane count
10. Harvesting of cane
11. Data collection (brix (%), yield)

2.5 TIME OF SCHEDULE:

Ac No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1.				→	→											
2.					→	→	→									
3.						→	→	→	→	→	→	→				
4.							→	→	→	→	→	→				
5.							→	→	→	→						
7.								→	→	→						
8.											→	→	→			
9.											→	→	→	→		
10.														→	→	→
11.															→	→

2.6 ECONOMIC IMPACT: A positive economic impact is expected.

2.7 EFFECTS ON THE ENVIRONMENT:

This is environmentally friendly, and the implementation of this experiment will not adversely affect the surrounding environment.

2.8 UTILIZATION OF RESEARCH RESULTS (OUTPUTS):

The result of the study will help the farmers of Carew & Co. (Bangladesh) Ltd. to choose suitable insecticides against sugarcane rootstock borer.

BSRI SUB-STATION, JAMALPUR

LIST OF EXPERIMENTS

1.0	Title	:	Effect of intercropping on enhancing sugarcane productivity and soil fertility
2.0	Title	:	Effect of vermicompost on sugarcane yield and carbon accumulation in soils
3.0	Title	:	Evaluation of yield and yield attributes of sugarcane varieties under waterlogged condition

PROGRAMME IN DETAILS

PROGRAMME AREA : **CROP AND SOIL MANAGEMENT**
1.0 TITLE : **EFFECT OF INTERCROPPING ON ENHANCING SUGARCANE PRODUCTIVITY AND SOIL FERTILITY**
LOCATION : Ghugurakandi, Sherpur
INVESTIGATORS : K M Alam, A M S Rahman and T Alam
NATURE OF THE STUDY : On-going (modified)
PROJECTED COMPLETION : 2024-2025
ESTIMATED COST (TK.) : 33,356/-

1.1 DEFINITION OF THE PROBLEM:

Sugarcane intercropping is a profitable practice. Yield and nutrient acquisition advantages are frequently found in intercropping system. Sugarcane intercropping has been practiced in worldwide to create income generating and to acquire more production. Vegetables, pulses, cereals and spices crops are cultivated as intercrops with sugarcane covering about 30-35% sugarcane area. Due to lack of knowledge, farmers are not more interested to cultivate intercrops with sugarcane in Bangladesh. The yield of intercrops is quiet low at farmer's level due to lack of appropriate intercropping systems as well as poor fertilizer and soil management. A few reports have been published on soil fertility in intercropping with sugarcane relative to sole cropping. Therefore, an experiment has been undertaken to studying the effect of intercropping on sugarcane and to maintain soil fertility level.

1.2 OBJECTIVES:

i) To studying the effect of sequential intercropping on growth, yield and quality of sugarcane.
i) To investigate soil chemical properties for maintaining soil fertility level.

1.3 METHODOLOGY:

Treatments:

T_1 : Single row cane only
T_2 : SRC + Potato
T_3 : SRC + Spinach
T_4 : SRC + Red amaranth
T_5 : SRC + Onion
T_6 : SRC + Garlic
T_7 : SRC + Tomato

2nd intercrop mungbean

Plot size	: 8m×6m
Replications	: 3
Design	: RCBD
Method of sugarcane planting	: 2-eyed setts
Cane Variety	: BSRI Akh 42
Gross Area	: 0.33 ac.

Data to be recorded:

1. Establishment % of setts
2. Tiller population at 120, 150 and 180 days after planting (DAP)
3. Millable cane at harvest
4. Unit stalk weight, height, girth, internode
5. Cane yield
6. Brix % of cane at harvest.
7. Pre and post soil analysis as pH, organic C, total N, available P, S, Zn Exchangeable K, Mg and B
8. Yield of intercrops

1.4 WORK ELEMENTS:

1. Raising of settlings
2. Basal fertilization, transplanting of cane and sowing of 1st intercrops
3. Weeding and Mulching
4. Harvesting of 1st intercrops
5. Sowing of 2nd intercrop
6. Irrigation
7. Fertilizer top dressing
8. Insect and pest management
9. Harvesting of 2nd intercrop
10. Harvesting of cane
11. Initial and post harvest soil analyses as pH, organic C, total N, available P, S, Zn, Exchangeable K, Mg and B
12. Soil analysis after 1st and 2nd intercrops harvesting
13. Data collection
14. Data tabulation, analysis and reporting

1.5 TIME SCHEDULE:

AC No.	Year	2024				2025											
	Month	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1		→	→														
2			→	→													
3					→	→	→	→	→	→							
4,5							→	→									
6					→	→	→	→	→								
7					→	→			→	→							
8					→	→		→	→	→	→						
9						→	→	→	→	→	→	→	→	→			
10																→	→
11		→	→													→	→
12					→	→				→	→						
13						→	→	→	→	→	→	→	→	→	→	→	
14																→	→

1.6 ECONOMIC IMPACT: Positive economic impact is expected.

1.7 EFFECT OF ENVIRONMENT: There will be no adverse effect on the environment.

1.8 UTILIZATION OF RESEARCH RESULTES:

The findings of the study will be helpful for sugarcane farmers to improve soil fertility and productivity of sugarcane.

2.0 TITLE : **EFFECT OF VERMICOMPOST ON SUGARCANE YIELD AND CARBON ACCUMULATION IN SOILS**

LOCATION : Melandaha, Jamalpur

INVESTIGATORS : K M Alam, A M S Rahman and T Alam

NATURE OF THE STUDY : On-going

PROJECTED COMPLETION : 2024-2025

ESTIMATED COST (TK.) : 23,118/-

2.1 DEFINITION OF THE PROBLEM:

Sugarcane is a long duration and nutrients exhausted crop. It depletes considerable amount of nutrients from soil causing soil degradation. Vermicompost is a nutrients rich organic compost. The use of vermicompost improves soil conditions and crop yields. Adoption of vermiculture not only helps in improving soil fertility on a sustainable basis, it is also helps in minimizing the use of chemical fertilizers to the extent of 25 to 50 percent and increase the crop yield by 15 to 20 percent due to increasing supply of all essential elements. In Bangladesh, there is a low reserve of carbon and plant nutrients due to cropping intensity, higher rates of organic matter decomposition and prevailing hot and humid climate, little or no use of organic matter and green manure practices. There is a critical need for best management practices to sequester carbon in soils (Russell *et al.*, 2005). Carbon accumulation is essential to improve soil quality, crop productivity, and use efficiency of production inputs. Vermicompost has been appeared as a miracle soil improver and plant growth promoter to keep soil alive and increase crop yield. Therefore, this experiment has been undertaken to study the effect of vermicompost on sugarcane yield and carbon accumulation of soil.

2.2 OBJECTIVES:

i) To quantify the effect of vermicompost on sugarcane growth and yield.
ii) To determine the carbon accumulation in soils from vermicompost application.

2.3 METHODOLOGY:

The experiment will be conducted at Melandaha, Jamalpur. The vermicompost will be prepared at the office yard from cow dung by using earthworm *Eisenia fetida* in Chari system. In field experiments, eight (8) treatments will be considered.

Treatments:

T_1: Control
T_2: Recommended Fertilizer Dose (RFD)' 2024
T_3: Recommended Fertilizer Dose (RFD)' 2024 + Vermicompost @ 1.5 t/ha
T_4: Recommended Fertilizer Dose (RFD)' 2024 + Vermicompost @ 3 t/ha
T_5: 75% Recommended Fertilizer Dose (RFD)' 2024 + Vermicompost @ 1.5 t/ha
T_6: 75% Recommended Fertilizer Dose (RFD)' 2024 + Vermicompost @ 3 t/ha
T_7: 50% Recommended Fertilizer Dose (RFD)' 2024 + Vermicompost @ 1.5 t/ha
T_8: 50% Recommended Fertilizer Dose (RFD)' 2024 + Vermicompost @ 3 t/ha

Design: RCBD; Replications: 3; Plot size: 6m×8m; Gross area: 0.33 acre; Variety: Isd 30; Planting method: Conventional (Two eyed setts)

Data to be recorded:

1. Nutrient composition of vermicompost for moisture (%), pH, organic C, N, P, K, S, Mg, Zn and B
2. Initial soil nutrient statuses as pH, organic C, total N, available P, S, Zn, Exchangeable K, Mg, Zn and B
3. Percent germination in cane at 90 DAP
4. Tiller dynamics across the growing period (at 120, 150, 180 DAP)
5. Plant and leaf tissue analyses for different nutrient elements at 150 DAP
6. Millable cane, cane yield, cane height, cane girth and sucrose content of sugarcane at harvest
7. Post harvest soil analyses as pH, organic C, total N, available P, S, Zn Exchangeable K, Mg and B

2.4 WORK ELEMENTS:

Act. No.	Name of activity
1	Preparation of vermicompost
2	Determination of moisture (%), pH, organic C, N, P, K, S, Mg, Zn and B in vermicompost
3	Initial soil nutrient statuses for pH, organic C, total N, available P, S, Zn, exchangeable K, Mg and B
4	Field lay out preparation, basal fertilizer application; and planting sugarcane setts
5	Percent germination in cane
6	Intercultural operation of cane
7	Top dressing of fertilizer
8	Tiller dynamics across the growing period (at 120, 150, 180 DAP)
9	Leaf tissue analyses for different nutrient elements at 150 DAP
10	Mill able cane, cane yield, cane height, cane girth and sucrose content of sugarcane at harvest
11	Post harvest soil analyses for pH, organic C, total N, available P, S, Zn, exchangeable K, Mg and B
12	Data tabulation, analysis and reporting

2.5 TIME SCHEDULE:

AC No.	Year	2024				2025											
	Month	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1																	
2,3																	
4																	
5,6																	
7, 8																	
9																	
10																	
11																	
12																	

2.6 ECONOMIC IMPACT:

The use of vermicompost will be reduced the excessive use of chemical fertilizers which will be minimized the cost of sugarcane production.

2.7 EFFECT OF ENVIRONMENT:

This technology will be environment friendly which will be improved soil health though improving biological properties of soil.

2.8 UTILIZATION OF RESEARCH RESULTS:

The findings of the study will be helpful for sugarcane farmers to improve soil fertility and productivity of sugarcane.

PROGRAMME AREA : **VARIETAL IMPROVEMENT**
3.0 TITLE : **EVALUATION OF YIELD AND YIELD ATTRIBUTES OF SUGARCANE VARIETIES UNDER WATERLOGGED CONDITION**
LOCATION : BSRI Substation and Melandaha, Jamalpur
INVESTIGATORS : T Alam, K M Alam and A M S Rahman
NATURE OF THE STUDY : New
PROJECTED COMPLETION : 2024-2025
ESTIMATED COST (TK.) : 55,636/-

3.1 DEFINITION OF THE PROBLEM:

The particular regions of Bangladesh are frequently experiencing waterlogging during rainy season. Jamalpur district is also affected by waterlogging because of its proximity to the Brahmaputra and Jamuna rivers. The stress of waterlogging drastically reduces the growth, yield and survival of sugarcane. The extent of injury due to water logging depends upon the varieties, environmental conditions, stage of development and the duration of stress. Improved understanding of the physiological responses of sugarcane to these conditions could help to develop strategies to sustain high yields under waterlogging condition. Therefore, this experiment has been undertaken to identify the appropriate sugarcane cultivars and their performances under waterlogged condition.

3.2 OBJECTIVES:

i) To determine yield and yield attributes of sugarcane varieties under waterlogged condition.

3.3 METHODOLOGY:

Some selected varieties (Isd 33, Isd 34, Isd 37, Isd 40, BSRI Akh 46) of sugarcane will be tested under waterlogged and normal condition (Treated as control). A randomized complete block design with at least three replications will be followed for this experiment. Normal cultural practices for sugarcane cultivation including land preparation, planting, fertilizer application, and weed control etc. will be maintained as and when required.

Treatments:

T_1 : Isd 33
T_2 : Isd 34
T_3 : Isd 37
T_4 : Isd 40
T_5 : BSRI Akh 46

Design: RCBD; Replications: 3; Plot size: 8m x 6m; Gross area: 0.33 acre; Planting method: Conventional (Two eyed setts)

Data to be recorded:

1. Cane height and cane diameter
2. No. of green leaves per plant and dry leaves per plant
3. Tiller, millable cane and cane yield
4. % Brix at harvest.

3.4 WORK ELEMENTS:

Act. No.	Name of activity
1	Land preparation
2	Planting of 2-budded setts to main field
3	Irrigation.
4	Weeding/Mulching.
5	Fertilizer application
6	Tiller count
7	Earthing up
8	Tying of cane
9	Green and dry leaves count
10	Millable cane, cane height and cane diameter count
11	Yield and %Brix data collection and analysis at harvest

3.5 TIME SCHEDULE:

AC No.	Year	2024				2025											
	Month	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1																	
2,3																	
4																	
5,6																	
7, 8																	
9																	
10																	
11																	

3.6 ECONOMIC IMPACT:

The outcomes of this experiment will provide sugarcane growers with greater financial benefit and help sugarcane farmers to choose water-logging tolerant varieties, thereby expanding the scope of sugarcane cultivation to low-lying marginal land that is susceptible to waterlogging.

3.7 EFFECT OF ENVIRONMENT:

It is environmentally friendly and there will not be any adverse effects on the environment due to implementation of this experiment.

3.8 UTILIZATION OF RESEARCH RESULTS:

The findings of this study will be helpful for sugarcane farmers to select the best types of sugarcane varieties for their regions.

BSRI SUB-STATION, RAHMATPUR, BARISHAL

LIST OF EXPERIMENTS

1.0	Title	:	Selection of sugarcane varieties suitable for gur production in saline belt under Southern Region
2.0	Title	:	Performance of chewing varieties in saline belt under Southern Region
3.0	Title	:	Collection and Conservation of Nipa palm Germplasms
4.0	Title	:	Sugarcane based integrated farming in SORJAN system under Southern Region
5.0	Title	:	Management of saline soil in sugarcane field by biochar and chemical fertilizer

PROGRAMME IN DETAILS

PROGRAMME AREA : **VARIETAL IMPROVEMENT**
1.0 TITLE : **SELECTION OF SUGARCANE VARIETIES FOR GUR PRODUCTION IN SALINE BELT UNDER SOUTHERN REGION**
LOCATION(S) : BJRI Sub-station, Pakhimara, Kalapara, Patuakhali
INVESTIGATORS : R K Ganapati, M N Morshed and M A Rahman
NATURE OF STUDY : Ongoing (Modified)
DURATION : Continuous.
ESTIMATED COST (Tk) : 50,000/-

1.1 DEFINITION OF THE PROBLEM:

Sugar cane is a major source of sugar used in the food industry today. In southern belt, especially Barishal region farmers produce gur from sugarcane after chewing sugarcane. Being near to coast, sugarcane growth impacted adversely by soil salinity and to some extend plant cane uptake salt in juice and make gur salty. Thus, it is necessary to determine the sodium content of the soil in areas where sugar cane crops are being grown as well as varieties those are not uptaking excess sodium ion to juice is important.

Salinity tolerance is a complex genetic trait. Selection of tolerant for the saline prone areas is economically viable rather than management practice against salinity. So, combat against salinity stress tolerant variety development is a prerequisite. Strategically it is a long-term assignment to develop a new salt tolerant sugarcane variety. Therefore, adaption of already developed varieties to the saline prone area might be an opportunity.

BSRI already developed a number of gur producing varieties. It is not clear that all varieties uptalking salts or not. Adaptive research assists in finding out salt tolerant gur variety(s) for the Barishal region.

1.2 OBJECTIVE(s) :

1. Selection of salt tolerant sugarcane varieties.
2. Selecting utmost adapted variety for saline affected area.

1.3 METHODOLOGY:

Treatments: 12 (Twelve)

T_1 = Isd 16	T_7 = BSRI Akh 43
T_2 = Isd 24	T_8 = BSRI Akh 44
T_3 = Isd 37	T_9 = BSRI Akh 45
T_4 = Isd 39	T_{10}= BSRI Akh 46
T_5 = Isd 40	T_{11}= BSRI Akh 48
T_6 = BSRI Akh 41	T_{12}= Madhumala

Plot Size : 8m ×6m, Design : RCBD, Replication : 2, Gross Area : 0.18 ha (each)

Space Transplanting (STP) method with soil bed settlings will be followed for raising good crop. Intercultural operation will be done as per recommendation. Tiller count will be taken after 120, 150 and 180 days of planting and soil salinity will be recorded at two months interval. Brix % of cane juice will be taken before harvest. Data on millable cane and yield will be taken at harvest.

1.4 WORK ELEMENTS:

1. Land selection.
2. Raising of settlings.
3. Layout of the field experiments.
4. Basal fertilizer application and transplanting of settlings in the field.
5. Application of urea and MoP after 20 days of transplanting.
6. Irrigation.
7. Tiller count at 120 & 150 days after transplanting and soil salinity will be recorded at two months interval.

8. Top dressing of rest Urea and MoP.
9. Insecticides use and Earthling up.
10. Salinity data will be recorded at 30 days interval after planting.
11. Brix % record before harvest
12. Millable cane count and Yield will be recorded at harvest
13. Gur data will be recorded in accordance to varieties.

1.5 TIME SCHEDULE:

AC No.	Month																		
	2024				2025												2026		
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1.	→																		
2.	→	→																	
3.		→	→																
4.			→	→															
5.			→	→	→														
6.			→	→	→	→	→												
7.					→	→	→	→	→	→									
8.					→	→	→	→	→	→	→								
9.										→	→								
10.													→	→					
11.																→	→		
12.																→	→	→	
13.																→	→	→	

1.6 ECONOMIC IMPACT:

The experiment will be helpful to select suitable location specific high yielding sugarcane varieties for gur production in Barishal region.

1.7 EFFECTS ON ENVIRONMENT: No adverse effect on environment.

1.8 UTILIZATION OF RESEARCH RESULTS:

Selected gur producing sugarcane varieties will be distributed to local farmers for commercial production of gur.

PROGRAMME AREA : VARIETAL IMPROVEMENT
2.0 TITLE : PERFORMANCE OF CHEWING VARIETIES IN SALINE BELT UNDER SOUTHERN REGION
LOCATION : Hazipur, Kalapara, Patuakhali
INVESTIGATORS : R K Ganapati, M N Morshed and M R Alam
NATURE OF STUDY : On going (Modified)
DURATION : Continuous
ESTIMATED COST (Tk) : 45,000/-

2.1 DEFINITION OF THE PROBLEM:

In Barishal Region sugarcane cultivation is generally practiced for chewing and gur purposes. Farmers of this region grow local varieties. So their yield and economic return form sugarcane cultivation are very low. High yielding and good quality of chewing sugarcane varieties are needed for this saline region. Therefore, the present study has been undertaken to select suitable variety for chewing in Barishal region.

2.2 OBJECTIVES:

1. To select suitable cane varieties for chewing in saline area of southern region.
2. To popularize chewing varieties in saline area of southern region.

2.3 METHODOLOGY:

Treatments : 4 (Four) T_1 = BSRI Akh 41 T_2 = BSRI Akh 42
T_3 = BSRI Akh 47 T_4 = Local variety (Bombay)

Plot Size : 8m ×6m, Design : RCB, Replication : 3 , Gross Area : 0.18 ha (each)
Method of Planting : STP (Soil bed)

2.4 WORK ELEMENTS:

1. Land selection
2. Raising of settlings
3. Layout of the field experiment
4. Basal fertilizer application and transplanting of settings in the field
5. Irrigation
6. Tiller count at 120 and 150 days after transplanting (DAT)
7. Top dressing of rest Urea and MP
8. Insecticides use
9. Earthing up
10. Sucrose/Brix
11. Millable cane count at harvest
12. Yield of cane at harvest

2.5 TIME SCHEDULE:

AC No.	Month																	
	2024				2025												2026	
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1.	→																	
2.	→	→																
3.		→	→															
4.			→															
5.			→	→														
6.																		
7.			→	→	→	→	→											
8.					→	→	→	→	→	→								
9.										→	→							
10.													→	→				
11.															→	→	→	→
12.															→	→	→	→

2.6 ECONOMIC IMPACT:

The experiment will be helpful to select suitable location specific high yielding sugarcane varieties for chewing purpose in Barishal region.

2.7 EFFECT ON ENVIRONMENT: No adverse effect on the environment.

2.8 UTILIZATION OF RESEARCH RESULTS:

Selected chewing varieties of sugarcane will be distributed to local farmers for commercial production.

PROGRAMME AREA : GERMPLASM MANAGEMENT
3. 0 TITLE : COLLECTION AND CONSERVATION OF NIPA PALM GERMPLASM
LOCATION(S) : Dhulashar, Kalapara, Patuakhali
INVESTIGATORS : R K Ganapati, M N Morshed and M S Hossain
NATURE OF STUDY : New
DURATION : 3 years
ESTIMATED COST (TK) : 50,000/-

3.1 DEFINITION OF THE PROBLEM:

Genetic variability is very important in breeding as well as adaptation to a changing environment by environmental stressors like rising salinity, climate change, and coastal erosion which also a big challenge for coastal ecosystem. Nipa palm as a mangrove flora inhabitant to Sundarban from ancient time and dispersed across the coast of Bengal delta. On time being and varying salinity and environmental inter reference variability developed and adapted to particular environments. And utilizing this variability in breeding is crucial. Therefore, collecting genotypes from different region of the country and conserve them is prerequisite to develop new varieties through breeding.

Depending upon the garden phenotype and geographic distribution the genotypes of Nipa palm will be collected and planted in tidal flash able river side near coast to establish garden in future use as genetic resources.

3.2 OBJECTIVE(s) :

1. To establish Nipa palm garden by the genotypes/biotype collected from different territories and
2. Evaluating and utilizing as parent materials in future breeding program.

3.3 METHODOLOGY:

Treatment(s):

NP_1 = Genotype collected from Satkhira (Shyamnagar) district
NP_2 = Genotype collected from Khulna district
NP_3 = Genotype collected from Bagerhat district
NP_4 = Genotype collected from Barguna district
NP_5 = Genotype collected from Patuakhali district
NP_6 = Genotype collected from Bhola district
NP_7 = Genotype collected from Hatiya district
NP_8 = Genotype collected from Cox-bazar district

Locations: Dhulasher, Kalapara, Patuakhali
Plot Size :10m x 10m, Replication: 2

3.4 WORK ELEMENTS:

i. Establish seedlings will be count 120, 150 and 180 days of planting.
ii. Expanded leaves will be recorded at 90,120,150and180 DAP
iii. Seedling vigor will be assesssed at 90, 120, 150 and180 DAP

3.5 TIME SCHEDULE:

AC No.	2025												
	1	2	3	4	5	6	7	8	9	10	11	12	1
1.		→	→	→									
2.					→	→	→	→	→	→	→	→	→
3.						→	→	→	→	→	→	→	→

3.6 ECONOMIC IMPACT:

Nipa palm is a environmentally friendly plant protect land from river erosion, use as wind break in cyclone, réclame saline affected soil and support in rural livelihood in coastal area.

3.7 EFFECTS ON ENVIRONMENT: No adverse effect on environment.

3.8 UTILIZATION OF RESEARCH RESULTS: Collected germplasm will be used in Nipa palm breeding.

4.0 TITLE : **SUGARCANE BASED INTEGRATED FARMING IN SORJON SYSTEM UNDER SOUTHERN REGION**

LOCATION(S) : Rahmatpur Substation, Barishal

INVESTIGATORS : R K Ganapati and M N Morshed

NATURE OF STUDY : On going (Modified)

DURATION : 3 years

ESTIMATED COST (TK) : 1, 20,000/-

4.1 DEFINITION OF THE PROBLEM:

Bangladesh is recognized worldwide as the most climate vulnerable country. The southern region once deemed as "granary of Bengal" has now turned to a low productive agricultural region in the country. The integrated farming system consists of resource saving practices that aim to achieve acceptable profit and high sustain production levels. Therefore, this program should be focused on Sorjan based integrated farming system for improving the food and nutritional security of the vulnerable people of the tidal flooding eco-system in the southern region of Bangladesh.

4.2 OBJECTIVE(s):

1. Increasing sugarcane productivity through Sorjan system
2. To popularize sugarcane based Sorjan farming under southern region

4.3 METHODOLOGY:

Treatments:

T_1= BSRI Akh 42 + Vine crops+ Fish*
T_2= BSRI Akh 42 + Tomato + Vine crops + Fish*
T_3= BSRI Akh 42 + Cauliflower + Vine crops + Fish*
T_4= BSRI Akh 42 + Onion + Vine crops+ Fish*

*Telapia:short cycle species
Plot Size : Sorjan bed : 21m ×6m×1m
Canal : 21m ×6m×2.5 m ,
Design : RCBD, Replication : 3, Gross Area : 0.18 ha (each)

Planting system/spacing: Seeds and/or seedlings will be sown in the line maintaining recommended spacing. Sugarcane, vegetables both will be planted on sorjan bed. Vine crops will be planted in rows on the edge of the bed. Fertilizer dose and method of application will be used as per recommendation of the specific crop species.

4.4 DATA TO BE RECORDED:

1. Tiller count will be taken after 120, 150 and 180 days of planting
2. Brix % of cane juice will be taken at harvest
3. Data on chewable cane and yield will be taken at harvest
4. Yield of cultivated crops and fishes

4.5 WORK ELEMENTS:

1. Land selection.
2. Monitoring of land preparation and planting date fixation. Raising of settlings
3. Supervision of irrigation, mulching, weeding and insect management
4. Evaluation of growth performance
5. Tiller count (March, April, May and June)
6. Millable cane count at harvest
7. Yield of Cane and Brix at harvest
8. Yield of cultivated crops and fishes

4.5 TIME SCHEDULE:

AC No.	2024				2025											
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1		→														
2			→													
3			→													
4				→	→	→	→									
5								→								
6									→							
7										→	→	→				
8												→	→	→	→	→

4.6 ECONOMIC IMPACT:

Year-round production of vegetables, sugarcane and fish in sorjan system will increase farmer's income that uplift the living standard. This study will provide a guideline about economic combination of crops cultivate in a dynamic pattern in low land experiment will be helpful to select a standardization of sorjan bed and suitable cropping system for the economic improvement of the farmers as well as of the country.

4.7 EFFECTS ON ENVIRONMENT: No adverse effect on environment.

4.8 UTILIZATION OF RESEARCH RESULTS:

The research results will be communicated to the DAE for extension. The growers may be communicated through class room training. Finally, the farmers will adopt the technology upon satisfaction. The result will be published in annual reports, national and international journals through which end users will be benefited.

5.0 TITLE : **MANAGEMENT OF SALINE SOIL IN SUGARCANE FIELD BY BIOCHAR AND CHEMICAL FERTILIZER**
LOCATION(S) : Kalapara, Patuakhali
INVESTIGATORS : R K Ganapati, S Islam and M A Rahman
NATURE OF STUDY : New
DURATION : 3 years
ESTIMATED COST (TK) : 50,000/-

5.1 DEFINITION OF THE PROBLEM:

Global worming push coastal livelihood in danger. Every year saline water increasingly engulfs the coastal agriculture. Hectors of land left flow due to soil salinity. Sugarcane a moderate saline tolerant crop still under danger. Cane yield is drastically fall and *gur* from sugarcane becoming salty these days resulting cane growers become disappointed. So, managing salinity affected soil in sugarcane field is important to grow sugarcane in sustainable way in this region.

A biochar and Gypsum management practice to saline soil is designed with several treatments. Biochar is suggested as a conditioner for salt-affected soils for various crops and Gypsum also considered to manage saline soil. The best combination will be adopted to réclame saline soil in sugarcane field.

5.2 OBJECTIVE(s):

1. Suitable treatment Combination will amend to control soil salinity and
2. To assess the improvement of soil property of sugarcane field.

5.3 METHODOLOGY:

Treatment(s):

T_0 = Recommended fertilizer Dosage-2024 (RFD)
T_1 = RFD + Biochar @ $2tha^{-1}$

T_2 = RFD + Biochar @ 4tha^{-1}
T_3 = RFD + Biochar @ 6tha^{-1}
T_4 = RFD + Biochar @ 2tha^{-1}+ Gypsum 200Kg/ha
T_5 = RFD + Biochar @ 4tha^{-1}+ Gypsum 250 Kg/ha
T_6 = RFD + Biochar @ 6tha^{-1}+ Gypsum 300 kg/ha

Locations: Kalapara, Patuakhali
Plot Size :4m x 5m, Design: RCB, Replication:3 variety: BSRI Akh 41

5.4 WORK ELEMENTS:

i. Tiller count will be taken after 120, 150 and 180 days of planting.
ii. Leaf sample will be taken to estimate Na^+ & K^+ concentration at 90, 120, 150 and 180 DAP
iii. Chlorophyll data will be recorded at 90, 120, 150 and 180 DAP
iv. Cane Juice sample will be collected to estimate Na^+ & K^+ at 240, 270 and 300 days of age
v. Brix % of cane juice will be taken before harvest.
vi. Data on millable cane and yield data will be taken during harvest.
vii. Soil salinity (CEC) and pH measurement at 15 days of interval.

5.5 TIME SCHEDULE:

AC No.	2025												
	1	2	3	4	5	6	7	8	9	10	11	12	1
1		→	→	→									
2		→	→	→	→								
3		→	→	→	→								
4			→	→	→	→	→	→					
5											→	→	
6											→	→	
7		→	→	→	→	→	→	→					

5.6 ECONOMIC IMPACT:

Sugar is very important for our daily diet. A best management practice to controls saline soil and bring under cultivation will promote to become sufficient sugarcane production in coastal area. Beside sugarcane other crop production might be benefited and ultimately huge amount of land will undergo for crop production again.

5.7 EFFECTS ON ENVIRONMENT: No adverse effect on environment.

5.8 UTILIZATION OF RESEARCH RESULTS: Aneffective management practice will repatriate farmer to sugarcane production in the saline affected coastal areas and increase sugarcane and gur production.

6.0 PROGRAMME AREA: SOCIO-ECONOMIC AND TECHNOLOGY TRANSFER

Demonstration	Location	Number	Unite Cost (Tk.)	Total (Tk.)
Demonstration of profitability of sugarcane intercropping	southern area	10	12,000/-	1,20,000/-
Demonstration of latest BSRI bread sugarcane(Chewing) varieties	Seven Districts	5	12,000/-	60,000/-
Seedlings Production				
Palmyra palm	On station	4000	-	30,000/-
Nipa Palm (Golpata)	Sea shore	10,000	7.5/-	75,000/-
Arabian Date Palm	On station	2000	5/-	10,000/-
Local Date palm	On station	5000	5/-	25000/-
Stevia	On station	500	5/-	2500/-
Gur Preparation Technique Demonstration/Field Day				
Field day on Golpata Gur Preparation and preservation		1	30,000/-	30,000/-
Field day on Sugarcane Gur preparation and preservation		1	30,000/-	30,000/-
Training				
Farmers training on Application of modern Technology in Sugarcrop Production		6 batch	15,000/-	90,000/-
Total				**4,72,500/-**

BSRI SUB-STATION, SIRAJGANJ

LIST OF EXPERIMENTS

1.0	Title	:	Production of sugarcane with different intercrops for Increasing the livelihood of char land people in sirajganj
2.0	Title	:	Selection of sugarcane varieties suitable for gur production in aez 4

PROGRAMME IN DETAILS

PROGRAMME AREA	:	**CROP PRODUCTION**
1.1 TITLE	:	**PRODUCTION OF SUGARCANE WITH DIFFERENT INTERCROPS FOR INCREASING THE LIVELIHOOD OF CHAR LAND PEOPLE IN SIRAJGANJ**
LOCATIONS	:	i) Charpara, Sirajganj ii) Gupirpara, Sirajganj and iii) Dobirganj, Ullapara, Sirajganj
INVESTIGATORS	:	M A R Doel, F H Shanta, T A Apon, R R Rajib and A K M R Islam
NATURE OF STUDY	:	Ongoing modified
DURATION	:	2022 – 2025
ESTIMATED COST (Tk.)	:	1,38,000/-

1.2 DEFINITION OF THE PROBLEM:

World population is increasing exponentially and it is necessary to feed up this huge population. Bangladesh is an overpopulated country. The agricultural land is decreasing gradually day by day. An important strategy for increasing labor utilization per unit area of available land and productivity is to intensify land use. Intercropping is the cultivation of two or more crops simultaneously on the same field which aims to produce a greater yield on a given piece of land by making use of resources or ecological processes that would otherwise not be utilized by a single crop. Sugarcane is location specific and long duration crop and takes about 90-120 days for canopy development, which allows for growing intercrops during the early stage. Taking advantages of this, sugarcane cultivators grow various short duration crops like pulses, vegetables etc. as intercrops to get interim return since small sugarcane growers cannot wait for a long time to get financial return from sole sugarcane crop. The yield of inter crops is quiet low at farmer's level due to lack of use appropriate intercropping systems as well as poor management practices. Some inter crops shows adverse effect on cane yield, quality and also decrease the soil fertility.

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. Flood is that natural calamity which damages completely about all the crops except sugarcane. In this condition sugarcane can be the best crop for these lands. Because sugarcane is only crop which can survive after the heavy flood stress. In Sirajganj district, farmers are cultivating sugarcane in large amount at char lands. Bangladesh Sugarcrop Research Institute has developed 48 varieties. All are not suitable for Jamuna char lands. That's why it is necessary to evaluate the suitable varieties which are appropriate at char lands. Here some intercrops are being practiced by farmers which are high valued. By cultivating sugarcane with intercrops farmers can be benefitted because some sugarcane line can be destroyed due to severe flood stress condition. These losses can be minimized by cultivating intercrops. To maintain high yielding and existence character, it is necessary to replace varieties every few years with newly released varieties. Hence an experiment has been undertaken to study the sugarcane production with high value intercrops at char land in Sirajganj.

1.3 OBJECTIVE (S):

i. Identifying the suitable intercrop with sugarcane for Jamuna char land and
ii. Popularizing the intercrops which can be practiced with sugarcane among the farmers to increase their livelihood at char land in Sirajganj

1.4 METHODOLOGY:

Treatments:

T_1V_1 : Sole Isd 37	T_1V_2 : Sole BSRI Akh 42
T_2V_1 : Isd 37 + Carrot-Onion	T_2V_2 : BSRI Akh 42 + Carrot-Onion
T_3V_1 : Isd 37+ Radish-Onion	T_3V_2 : BSRI Akh 42 + Radish-Onion
T_4V_1 : Isd 37 + Cabbage-Onion	T_4V_2 : BSRI Akh 42 + Cabbage-Onion

T_5V_1 : Isd 37 + Cauliflower-Onion
T_6V_1 : Isd 37 + Potato-Onion
T_5V_2 : BSRI Akh 42 + Cauliflower-Onion
T_6V_2 : BSRI Akh 42 + Potato-Onion

Plot size : 8m × 8m
Design : RCB
Replication : 3 (Three)
Cane variety : Isd 37 and BSRI Akh 42
Locations : Two locations
Fertilizer : As per recommendation
Irrigation and cultural practices : As and when required

1.5 DATA TO BE COLLECTED:

For Intercrops:

i. Intercrop population
ii. Intercrop yields (t ha^{-1})

For sugarcane:

i. Tiller population at 90, 120, 150 and 180 DAP
ii. Millable canes (×10^3 ha^{-1}) and chewable cane (×10^3 ha^{-1}) at harvest
iii. Unit stalk height (m) at harvest
iv. Cane yield (t ha^{-1})
v. Brix % of cane

1.6 WORK ELEMENTS:

1. Land preparation, Plantation of sugarcane with basal fertilizer dose
2. Planting of intercrops
3. Irrigation
4. Harvesting of intercrops
5. Irrigation
6. Weeding and mulching
7. Top dressings
8. Insect and pest control
9. Observing flood stress condition
10. Data collection (millable cane, brix, weight, height etc.)
11. Yield of cane at harvest

1.7 TIME SCHEDULE:

Sl. No	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1				→												
2				→												
3				→												
4						→	→									
5						→	→		→	→						
6						→	→	→	→	→	→					
7							→	→	→	→						
8									→	→	→	→				
9										→	→	→				
10														→	→	
11														→	→	

1.8 ECONOMIC IMPACT:

It is expected to get suitable high value intercrop with suitable variety which would expand the scope of cultivation of sugarcane to marginal land and sugarcane growers would get higher economic benefit from the result of this experiment.

1.9 EFFECT ON ENVIRONMENT: No adverse effect on the environment.

1.10 UTILIZATION OF RESEARCH RESULTS:

The result will help the farmers to select suitable intercrops with suitable variety for increasing the net income.

PROGRAMME AREA : CROP PRODUCTION
2.1 TITLE : SELECTION OF SUGARCANE VARIETIES SUITABLE FOR *GUR* PRODUCTION IN AEZ 4
LOCATIONS : Ghorachora, Sirajganj
INVESTIGATORS : M A R Doel, M S Islam and M S Arefin
NATURE OF STUDY : New
DURATION : 2024-2025
ESTIMATED COST (TK) : 35,000/-

2.2 DEFINITION OF THE PROBLEM:

Sugarcane is location specific crop. The performance of particular sugarcane variety differs from place to place and farmers to farmers, which deserves adaptability trail. Without performance test, we cannot recommend a particular variety for particular location. Farmers of this region grow local varieties resulting economic return is very low. High yielding and good quality sugarcane varieties are needed for this region. Therefore, this study is needed to find out the comparative performance goor varieties such as Isd 16, Isd 33, Isd 37, BSRI Akh 41 and Local variety. The present study is undertaken to evaluate the performance of the BSRI released *gur* varieties at AEZ 4.

2.3 OBJECTIVE(S):

i. To test the performance of BSRI released sugarcane *gur* varieties at AEZ 4 and
ii. To identify location specific suitable variety for commercial cultivation.

2.4 METHODOLOGY:

Treatments:

T_1: Isd 16
T_2: Isd 33
T_3: Isd 37
T_4: BSRI Akh 41
T_5: Local Variety

Method of Planting	: Two budded setts
Plot size	: 8m × 6m
Design	: RCBD
Replication	: 3 (Three)
Cane variety	: Isd 16, Isd 33, Isd 37, BSRI Akh 41 and Local variety
Locations	: One
Fertilizer	: As per recommendation
Irrigation and cultural practices	: As and when required

2.5 DATA TO BE RECORDED:

i. Germination count (%)
ii. No. of tillers/ha (at 90 DAT, 120 DAT, 150 DAT and 180 DAT)
iii. No. of millable cane/ha

iv. Cane height (m) and diameter (cm)
v. Brix (%) of cane at harvest
vi. Estimated cane yield (t/ha)
vii. Gur yield

2.6 WORK ELEMENT:

1. Plantation
2. Germination count
3. Tiller count
4. Measurement of stalk height, girth and internode length
5. Determination of field brix (%)
6. Observation on flowering habit
7. Observation on reaction to pests and diseases
8. Cane yield at harvest
9. Gur preparation and gur yield data collection

2.7 TIME SCHEDULE:

Sl. No.	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1					→											
2						→	→									
3							→	→	→	→						
4													→	→	→	
5															→	→
6															→	→
7						→	→	→	→	→	→	→	→	→	→	→
8																→
9																→

2.8 ECONOMIC IMPACT: Positive economic impact is expected.

2.9 EFFECT OF ENVIRONMENT: Environment friendly.

2.10 UTILIZATION OF RESEARCH RESULTS:

The result obtained from this study may help to identify suitable sugarcane varieties for gur production. On the basis of results will be able to take correct decision about the high yielding sugarcane varieties for gur production in AEZ 4.

BSRI SUB-STATION, CHUNARUGHAT

LIST OF EXPERIMENTS

1.0	Title	:	Performance of winter crop as intercrops on sugarcane cultivation in wider row system
2.0	Title	:	Performance of newly released sugarcane varieties suitable for gur production in akhaura terrace soil

PROGRAMME IN DETAILS

PROGRAMME AREA	**:**	**VARIETAL IMPROVEMENT**
1.0 TITLE	**:**	**PERFORMANCE OF WINTER CROP AS INTERCROPS ON SUGARCANE CULTIVATION IN WIDER ROW SYSTEM**
LOCATION	**:**	Two Locations (Chunarughat) i) Cotabari Bongaon, Ahmmedabad, Chunarughat and ii) Bongaon, Chunarughat
INVESTIGATORS	:	M M Rahman, M S Islam, M N A Siddiquee, M N Alam, M M Hossain, A K M R Islam and K M R Karim
NATURE OF THE STUDY	**:**	Ongoing
PROJECTED COMPLETION	**:**	2022-2025
ESTIMATED COST (TK.)	**:**	70,000

1.1 DEFINITION OF THE PROBLEM:

Sugarcane, (*Saccharum officinarum*) occupies an area of 20.42 million hectares worldwide. Sugarcane varieties become the earliest production industries, which have high sucrose content (Bakker 1999). Their production is about 1.333 million tons and suporting more than 50% demand of sugar over the world (Monique Hunziker *et al.*, 2009). In Bangladesh, sugarcane has been growing for a long time throughout the country. However, there are many reasons such as cultivation techniques, varieties, planning, investment that make yield and income of the sugarcane are unstable in recent years. Not only the impact of supply and demand, but also limited techniques of the majority of farmers. High investment costs, productivity, inadequate quality make the cost of sugarcane production higher, therefore, it is hard to compete with other countries in the regional area and in the world. However, the traditional methods of producing, scattered acreage, yield and quality of sugarcane are not yet improved, therefore, economic efficiency is not really stable. During the World Trade Organization system, the competition of agricultural products increases fiercely. Therefore, application of scientific techniques is a requirement for the farmers to improve productivity, quality and to reduce production costs in order to achieve the highest economic efficiency. The aim of this experimental research is to make the increasing productivity and quality of sugarcane, as well as improve economic efficiency for producers and contribute to sustainable development of sugarcane production with intercropping. Therefore, it is important to introduce farmers with wider row system for higher yield of sugarcane as well as gur production and intercropping from plant cane in Akhaura Terrace.

1.2 OBJECTIVES:

i) To find out suitable intercrops for sequential intercropping in wider system in Akhaura Terrace area and

ii) To evaluate the potentiality of sequential intercropping.

1.3 METHODOLOGY:

Treatments:

T_1 : Wider Row Cane (WRC) only
T_2 : Wider Row Cane (WRC) + Tomato-Mugbean
T_3 : Wider Row Cane (WRC) + Chilli – Yardlong bean
T_4 : Wider Row Cane (WRC) + Tomato - Yardlong bean
T_5 : Wider Row Cane (WRC) + Chilli – Mungbean

Plot size	:	8m × 6m
Variety	:	BSRI Akh 48
Replications	:	3
Design	:	RCBD
Method of sugarcane planting	:	Conventional (two eyed setts)
Time of Planting	:	December, 2024
Harvesting	:	November/December, 2025
Gross Area	:	0.33 Ac

1.4 Data to be recorded:

1. Germination % of setts
2. Tiller population at 120,150 and 180 days after Planting (DAP)
3. Millable cane at harvest
4. Unit stalk weight, hight, girth, and internode.
5. Brix % cane at harvest.
6. Cane Yield.
7. Gur yield after gur preparation.

1.5 WORK ELEMENTS:

1. Land selection
2. Land preparation
3. Basal fertilization
4. Cane plantation
5. Irrigation
6. Weeding and mulching
7. Fertilizer top dressing
8. Insect and pest Management
9. Earthing up and tying
10. Milliable cane count
11. Brix% of cane
12. Cane yield at harvest.
13. Gur preparation & goor yield data collection

1.6 TIME SCHEDULE:

Ac. No.	2024			2025												2026
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1.	→															
2.	→															
3.	→															
4.	→	→														
5.		→	→	→	→	→	→									
6.		→	→	→	→	→	→									
7.					→	→		→	→							
8.					→			→	→	→						
9.								→	→	→						
10.													→			
11.														→		
12.															→	→
13.															→	→

1.7 ECONOMIC IMPACT: Positive economic impact is expected.

1.8 EFECT OF ENVIRONMENT: There is no adverse effect on environment. It is eco-friendly.

1.9 UTILIZATION OF RESEARCH RESULTES:

1. The findings will help farmers to choose suitable planting system of sugarcane production with intercropping in this area.
2. Farmers will be economically benefited through cultivation of high yielding and quality gur producing sugarcane with intercropping winter vegetables

PROGRAMME AREA	**:**	**VARIETAL IMPROVEMENT**
2.0 TITLE	**:**	**PERFORMANCE OF NEWLY RELEASED SUGARCANE VARIETIES SUITABLE FOR GUR PRODUCTION IN AKHAURA TERRACE SOIL**
LOCATION	**:**	Two Locations of Chunarughat (Habiganj). i) Cotabari Bongaon, Ahmmedabad, Chunarughat and ii) Chaganagor, Gazipur, Chunarughat
INVESTIGATORS	**:**	M S Islam, M N A Siddiquee, M N Alam, M M Hossain, A K M R Islam, K M R Karim and M M Rahman
NATURE OF STUDY	**:**	New
DURATION	**:**	2024-2026
ESTIMATED COST (TK.)	**:**	80,000/-

2.1 DEFINITION OF THE PROBLEM :

In Akhaura Terrace soil, sugarcane cultivation is generally practiced for gur production and chewing purposes. Farmers of this region grow local varieties. So their yield and economic return from sugarcane cultivation is very low. High yielding and good quality sugarcane varieties are needed for this region. BSRI bred sugarcane varieties viz. Isd 37, Isd 40, BSRI Akh 41, BSRI Akh 46 and BSRI Akh 48 are recommended for good/better quality of gur production. But this varieties are not known to farmers of this region. Therefore, the present study has been under taken to select suitable BSRI bred sugarcane varieties for gur production in Akhaura Terrace soil/Sylhet region.

2.2 OBJECTIVE :

To select suitable cane variety (s) with high yield and recovery for gur production.

2.3 METHODOLOGY :

(i) Treatments :

T_1 : Isd 37
T_2 : Isd 40
T_3 : BSRI Akh 41
T_4 : BSRI Akh 46
T_5 : BSRI Akh 48
T_6 : Local variety (Standard)

(ii).	Design	: RCB
(iii)	Replication	: 3
(iv)	Planting Method	: 2 budded setts.
(v)	Time of Planting	: November, 2024.
(vi)	Plot sige	: 8m × 6m.
(vii)	Gross area	: 0.195 ha.
(viii)	Net area	: 0.1152 ha.

Conventional planting method (Two budded sett) will be followed for raising good crop. Intercultural operation will be done as per recommendation. Tiller count will be taken after 120, 150 and 180 days of planting. Brix percentage of cane juice will be taken before harvest. Data on millable cane and yield will be taken at harvest. Gur will be prepared in the month of January and variety wise data on gur production will be taken.

2.4 WORK ELEMENTS

1. Land preparation
2. Plantation and fertilizer application
3. Irrigation
4. Tiller count at 120, 150 & 180 days after transplanting (DAT)
5. Top dressing (1st)
6. Weeding, mulching, Irrigation.
7. Top dressing (2nd)
8. Earthing up
9. Sucrose content before harvest
10. Millable cane count at harvest
11. Gur preparation
12. Yield of cane at harvest

2.5 TIME SCHEDULE:

Activity no.	Months																
	2024				2025											2026	
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
1,2	→	→															
3			→	→	→	→											
4					→	→	→	→									
5					→	→	→										
6					→	→	→	→	→								
7						→	→	→									
8									→	→	→	→					
9														→	→	→	
10														→	→	→	
11															→	→	
12																→	→

2.6 ECONOMIC IMPACT

The experiment will be helpful to select suitable location specific high yielding sugarcane varieties for gur production in Akhaura Terrace soil.

2.7 EFFECT ON ENVIRONMENT: No adverse effect on the environment.

2.8 UTILIZATION OF RESEARCH RESULTS :

Selected gur producing sugarcane varieties will be distributed to local farmers for commercial production of *gur*.

BSRI SUB-STATION, GAIBANDHA

LIST OF EXPERIMENTS

1.0	Title	:	Evaluation of chewing sugarcane genotypes at Tista meander floodplain soils in Bangladesh
2.0	Title	:	Evaluation of BSRI bred sugarcane varieties under water-logging condition at active Tista floodplain soils in Bangladesh
3.0	Title	:	Performance of newly released milling sugarcane varieties at active Tista floodplain soils in Bangladesh

PROGRAMME IN DETAILS

PROGRAMME AREA	:	**SUGARCANE VARIETAL IMPROVEMENT**
1.0 TITLE	:	**EVALUATION OF CHEWING SUGARCANE GENOTYPES AT TISTA MEANDER FLOODPLAIN SOILS IN BANGLADESH**
LOCATION	:	Bogura and Rangpur
INVESTIGATORS	:	Z H Sabuj, M R Islam, M M Rashid and M M Alam
NATRURE OF STUDY	:	On-going
PROJECT COMPLETION	:	2022-
ESTIMATED COST	:	50,000

1.1 DEFINITION OF THE PROBLEM:

The demand of chewing sugarcane varieties is increasing day by day and the popularity of chewing cane is also growing all over the country. There are some released varieties of chewing cane cultivated along with some local varieties in Tista Meander Floodplain Soils in Bangladesh. Hence, the present study is undertaken to select suitable chewing cane varieties in case of yield and chewing quality for AEZ 3.

1.2 OBJECTIVES:

i. To select suitable cane varieties with high yield for chewing in AEZ 3 and
ii. Increasing farmers' income through chewing cane cultivation

1.3 METHODOLOGY:

Treatments:

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
T_7: Shung (local)

Planting material	: Two budded setts
Plot size	: 8m × 6m
Replication	: 3
Design	: RCB
Date of planting	: December, 2024
Gross area	: 0.20 ha

1.4 DATA TO BE COLLECTED:

i. Germination (%) of setts
ii. Tiller population at 90, 120, 150 and 180 Days after planting (DAP)
iii. Chewable cane count
iv. Brix % of cane juice
v. Yield of cane at harvest

1.5 WORK ELEMENTS:

1) Land selection and farmer selection
2) Supervision of land preparation
3) Cane planting and basal fertilizer application
4) Germination count
5) Fertilizer application (Top dressing)
6) Tiller count

7) Intercultural operation and pest control
8) Harvesting and yield record
9) Brix % record

1.7 TIME SCHEDULE:

AC. No.	Months																	
	2024			2025												2026		
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
1.	→																	
2.		→																
3.		→	→															
4.			→	→	→	→	→	→	→	→	→							
5.					→	→	→	→										
6.							→	→	→	→								
7.							→	→	→	→	→							
8.															→	→	→	
9.																	→	→

1.7 ECONOMIC IMPACT: Positive economic impact is expected.

1.8 EFFECT ON ENVIRONMENT:

This is environment friendly and there will be no adverse effect on surrounding environment for implementation.

1.9 UTILIZATIUON OF RESEARCH RESULTS:

The result of the study will help to decide farmers to select suitable cane varieties with high yield for chewing purpose. This study has a great value for the localization.

PROGRAMME AREA : **SUGARCANE VARIETAL IMPROVEMENT**
2.0 TITLE : **EVALUATION OF BSRI BRED SUGARCANE VARIETIES UNDER WATER-LOGGING CONDITION AT ACTIVE TISTA FLOODPLAIN SOILS IN BANGLADESH**
LOCATION : BSRI Sub-station, Gaibandha
INVESTIGATORS : Z H Sabuj, M M Rashid, M R Islam and M A Habib
NATRURE OF STUDY : On-going
PROJECT COMPLETION : 2023
ESTIMATED COST : 25,000.00

2.1 DEFINITION OF THE PROBLEM

Due to being an overpopulated country and some of the infrastructural development work, the cultivable area of land in Bangladesh is decreasing day by day. Due to the increasing demand for vegetables and cereal crops, sugarcane is gradually pushed into marginal and low-lying areas. Water-logging stress is one of the most important reasons behind the low yield of sugarcane. This experiment will evaluate the best possible yield of BSRI bred sugarcane varieties under water-logged conditions.

2.2 OBJECTIVES:

1) To select suitable cane varieties with tolerance to water-logging condition in AEZ 3 and
2) To find out morphological and physiological changes due to prolonged wet condition

2.3 METHODOLOGY:

Treatments:

T_1 = Isd 20
T_2 = Isd 34
T_3 = Isd 37
T_4 = Isd 39
T_5 = BSRI Akh 45
T_6 = BSRI Akh 46

Planting material : Two budded sett
Plot size : 8m × 6m
Replication : 3
Design : RCB
Date of planting : December, 2024
Gross area : 0.20 ha

2.4 DATA TO BE COLLECTED:

1) Germination (%) of setts
2) Tiller population at 90, 120, 150 and 180 Days after planting(DAP)
3) Millable cane count
4) Brix% of cane juice
5) Yield of cane at harvest
6) Pol (%) of cane

2.5 WORK ELEMENTS:

1) Land selection
2) Monitoring of land preparation & planting date fixation
3) Basal fertilizer application and cane planting
4) Irrigation, weeding, mulching and pest control
5) Top dressing (1st & 2nd) of Urea and MoP
6) Leaf sample collection
7) Growth performance evaluation during grand growth period (grading of cane)
8) Cane harvest
9) Reporting

2.6 TIME SCHEDULE:

AC. No.	Months																	
	2024			2025												2026		
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
1.	→																	
2.		→																
3.		→																
4.			→	→	→	→	→	→	→	→	→							
5.					→	→	→	→										
6.							→	→	→	→								
7.							→	→	→	→	→							
8.															→	→	→	
9.																	→	→

2.7 ECONOMIC IMPACT: Positive economic impact is expected.

2.8 EFFECT ON ENVIRONMENT:

This is environment friendly and there will be no adverse effect on surrounding environment for implementation.

2.9 UTILIZATIUON OF RESEARCH RESULTS:

The result of the study will help to decide farmers to select suitable cane varieties with tolerance to water-logging condition. This study has a great value for the localization.

PROGRAMME AREA	**:**	**SUGARCANE VARIETAL IMPROVEMENT**
3.0 TITLE	**:**	**PERFORMANCE OF NEWLY RELEASED MILLING SUGARCANE VARIETIES AT ACTIVE TISTA FLOODPLAIN SOILS IN BANGLADESH**
LOCATION	**:**	Farmers field, Gaibandha
INVESTIGATORS	**:**	Z H Sabuj, M R Islam, M A Habib and M M Rashid
NATRURE OF STUDY	**:**	On-going
PROJECT COMPLETION	**:**	2023
ESTIMATED COST (Tk)	**:**	24,975.00

3.1 DEFINITION OF THE PROBLEM:

A number of sugarcane varieties were released by the Bangladesh Sugarcrop Research Institute. Some of them, along with some local varieties, have been cultivated since the very old days in different parts of the country, mostly following local and inappropriate methods of cultivation, resulting in poor yields and quality. The production of the latest cane varieties varies from place to place and even from farmer to farmer. The present experiment has been undertaken to select suitable latest milling sugarcane varieties for Active Tista Floodplain Soils for higher yield and economic benefit.

3.2 OBJECTIVES:

i. To select suitable latest milling sugarcane varieties for higher yield in AEZ 2 and
ii. To increase farmers' earning through cultivating latest milling sugarcane varieties

3.3 METHODOLOGY:

Treatments:

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
T_7 = BSRI Akh 48

Planting materials	: Two budded setts
Plot size	: 8m × 6m
Replication	: 3
Design	: RCB
Date of planting	: December, 2024
Gross area	: 0.20 ha

3.4 DATA TO BE COLLECTED:

1) Germination (%) of setts
2) Tiller population at 120, 150 and 180 Days after planting(DAP)
3) Unit stalk weight, height, diameter & internodes
4) Millable cane count (at harvest)
5) Brix (%) of cane juice

6) Yield of cane at harvest

3.5 WORK ELEMENTS:

1) Land selection and farmer selection
2) Land preparation supervision
3) Cane planting and basal fertilizer application
4) Germination count
5) Fertilizer application (Top dressing)
6) Tiller count
7) Intercultural operation and pest control
8) Harvesting and yield record
9) Brix % record

3.6 TIME SCHEDULE:

AC. No.	Months																	
	2024			2025												2026		
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
1.	→																	
2.		→																
3.		→																
4.			→															
5.					→													
6.							→											
7.							→											
8.															→			
9.																	→	

3.7 ECONOMIC IMPACT: Positive economic impact is expected.

3.8 EFFECT ON ENVIRONMENT:

This is environment friendly and there will be no adverse effect on surrounding environment for implementation.

3.9 UTILIZATIUON OF RESEARCH RESULTS:

The result of the study will help to decide farmers to select suitable latest milling sugarcane varieties for higher yield. This study has a great value for the localization.

BSRI SUB-STATION, BANDARBAN

LIST OF EXPERIMENTS

1.0 Title : Selection of suitable sugarcane varieties for gur production under Bandarban Hill tracts of Bangladesh

PROGRAMME IN DETAILS

PROGRAMME AREA	:	**VARIETAL IMPROVEMENT**
1.0 TITLE	:	**SELECTION OF SUITABLE SUGARCANE VARIETIES FOR GUR PRODUCTION UNDER BANDARBAN HILL TRACTS OF BANGLADESH**
LOCATION(S)	:	Gualiakhola, Bandarban sadar
INVESTIGATORS	:	A Chakraborty, M K Begum, M S Arefin, M A Habib and M M Rashid
NATURE OF STUDY	:	On-going
DURATION	:	2023-25
ESTIMATED COST (TK)	:	40,000/-

1.1 DEFINITION OF THE PROBLEM:

Cultivation of chewing sugarcane varieties is already established and quite popular in Bandarban Hill Tracts. Besides chewing sugarcane, the hill dwellers of Bandarban can develop their self-social development by producing gur from profitable and suitable gur varieties. The selection of suitable sugarcane varieties for gur (unrefined sugar) production in the Bandarban Hill Tracts of Bangladesh is a critical agricultural practice aimed at enhancing local sugarcane farming. Bandarban characterized by its hilly terrain and specific climatic conditions, requires tailored sugarcane varieties that can thrive in its unique environment.

1.2 OBJECTIVE:

1. To identify the suitable sugarcane varieties with high yield potential and quality gur production and
2. To assess the adaptability of different sugarcane varieties to the Hill Tracts specific climatic and soil conditions.

1.3 METHODOLOGY:

Treatments: 4

T_1 = VMC 86-550 (Clone)
T_2 = BSRI Akh 41
T_3 = BSRI Akh 45
T_4 = BSRI Akh 48

Plot Size	: 8m × 6m
Design	: RCB
Replication	: 3
Planting method	: 2 budded setts

Data to be recorded:

1. Germination count (%)
2. No. of tillers/ha (at 120 DAT, 150 DAT & 180 DAT)
3. No. of millable cane/ha at harvest
4. Cane height (m) and diameter (cm)
5. Brix (%) of cane at harvest
6. Estimated cane yield (t/ha)
7. Gur recovery after gur preparation
8. Physical and chemical properties of gur

1.4 WORK ELEMENTS:

1. Plantation of gur variety
2. Germination count (%)
3. Tiller count
4. Measurement of stalk height, girth and internodes length
5. Observation on reaction to pests and diseases

6. Cane yield at harvest
7. Gur preparation and gur yield data collection

1.5 TIME SCHEDULE:

AC No.	Month															
	2024				2025											
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1			→													
2					→	→										
3							→	→	→							
4													→	→	→	
5				→	→	→	→	→	→	→	→	→	→	→	→	→
6																→
7																→

1.6 ECONOMIC IMPACT: Positive economic impact is expected.

1.7 EFFECTS ON ENVIRONMENT: No adverse effect on environment. It is eco-friendly

1.8 UTILIZATION OF RESEARCH RESULTS:

The result obtained from this study may help growers to know suitability of gur variety in this location. On the basis of results will be able to take correct decision about the high yielding, pest and disease tolerant gur varieties.

Website: www.bsri.gov.bd