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Optimization of Irrigation Level For Three Sugarcane Varieties to Harvest Their Second and Third Ratoon Successfully

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ABSTRACT

An experiment was conducted during 1994-95 and 1995-96 cropping years at Bangladesh Sugarcane Research Institute (BSRI) farm, Ishurdi, in calcareous alluvial soil of the Ganges River Flood Plain. Six irrigation levels were applied for three varieties i.e. Isd 16, Isd 20 and Isd 21 to have their performance in second and third ratooning. Irrigation was applied using irrigation water to pan evaporation ratio (PR) method, during premonsoon period only. The highest yields were obtained in both the seasons where irrigation was applied at PR=1.00. The highest yields were 90.70 t ha-1 and 72.27 t ha^{-1} in 1994-95 and 1995-96 seasons respectively applying six and five irrigations respectively (at PR = 1.00) with 10 cm water for each irrigation. Variety Isd 21 showed the highest response to this irrigation level in both the seasons. Producing a yield of 71.80 t ha-1 and 62.35 t ha-1 respectively, which were significantly higher than those of other varieties. However, all the varieties showed potentiality in second and third ratooning with the applied irrigation level.

Key words: Sugarcane variety, ratooning, irrigation level, pan ratio, technology adoption.

INTRODUCTION

Sugarcane like other perennial grass is able to regenerate shoots from stubbles producing successive crops known as ratoon crops. Ratooning has been progressively used in many sugarcane growing countries of the world as a device to cut down cost of production (Humbert,1968) . To grow plant crop followed by some ratoon crops before ploughing out the stubbles, minimize the cost of seeds, land preparation, planting etc (King *et.al.*,1965).

Ratooning ability is one of the most important characteristics of sugarcane which influence the decision to plant a particular variety (Miah *et. al.*, 1987). The number of ratoon crops that can profitably be grown varies depending on local environmental conditions and practices. At present taking of two or even more ratoons from the same plantation is a normal practice almost in all the countries where sugarcane is a major crop. In Hawaii, Mauritius, Philippines and Cuba, 4 to 6 ratoons are quite common (Majid and Alam, 1998). Ratoon crops have often failed to produce satisfactory growth and yield. Matin et. al. (1989) got the yield of 1st ratoon less than 50% of that of plant cane both in rainfed condition. They found 50 to 65 % mortality of tiller in ratoon cane. That is why only 15 - 20 % of sugarcane area is under ratoon cane in Bangladesh. The percent area is far below that in other advanced cane growing countries of the world. Majid & Alam (1998) pointed out several reasons for lower yields of ratoon than that of plant crop as recorded 75.3 to 78.9 % yield losses in the 5th ratoon crop. Among them lack of moisture and nutrient are most important. Declining of soil fertility under continuous cropping might be responsible for low ratoon yield in our country. Earlier work in India and elsewhere proved that declining soil fertility, specially low nitrogen, phosphorus and poor irrigation practice were the main causes of steadily declining ratoon yield (Majid and Alam, 1998). On the other hand following all normal practices of ratooning specially timely harvesting and stubble shaving, gap filling, fertilization, irrigation , adopting pest control measures and solving drainage problems etc. optimum yield even higher than plant cane was obtained (BSRI, 1995), but that was an exceptional case . On an average, one ratoon crop is harvested in Bangladesh especially in high and medium high lands where plant cane is not affected by pest and diseases considerably. Second and third ratoon is harvested in rare cases. Therefore present investigation was undertaken to harvest second and third ratoon successfully and economically adopting all technologies especially at optimum soil moisture level.

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MATERIALS AND METHODS

The experiment was conducted at Bangladesh Sugarcane Research Institute (BSRI) farm, Ishurdi, during 1994-95 and 1995-96 cropping seasons. Crops of second and third ratoons were established from the stubble of first and second ratoon respectively. In both the crops, stubbles were shaved just after harvesting of the standing canes. Fertilizers and intercultural operations were applied as per recommendation. Irrigations were applied as per treatment schedules. The experiment was laid down in split plot design with three replication. The treatment-combinations undertaken in the study were as follows:

A- Irrigation levels:
I_0 =Control (no irrigation)
I_1 = A light (life) irrigation within 10 days after harvesting previous crop
I_2 = I_1 + Irrigation at PR = 0.25 before monsoon
I_3 = I_1 + Irrigation at PR = 0.50 before monsoon
I_4 = I_1 + Irrigation at PR = 0.75 before monsoon
I_5 = I_1 + Irrigation at PR = 1.00 before monsoon
B = Varieties ; Isd 16 , Isd 20 and Isd 21

Where pan ratio (PR) is the ratio of irrigation water (IW) applied plus effective rainfall (ER) to cumulative open pan evaporation (CPE) from USWB class- A open pan i.e. PR= (IW + ER)/ CPE
Irrigation interval was determined using following equation: CPE = (IW + ER) / PR

RESULTS AND DISCUSSION

The effects of irrigation on yield and yield components of second and third ratoon of sugarcane varieties are shown in Table 1. It is evident from the Table 1 that irrigation had significant effects on tillers, millable cane and yield in both the cropping seasons of 1994-95 and 1995-96. It had significant effect on plant height and girth in 1994-95 but not in 1995-96. Weight per cane and sugar recovery were insignificantly affected in both the seasons.

Table 1. Effect of irrigation on yield and yield components, BSRI, 1994-96.

Year	Treatment	Tiller (000/ha)	Millablecane (000/ha)	Stalk Height (m)	Stalk Girth (cm)	Stalk Weight kg/cane	Sugar Recovery (%)	Yield (t ha^{-1})
1994-95	I_0	177.5 d	81.3 d	2.55 c	2.00 c	0.66	9.00	53.5 d
	I_1	187.2 c	92.7 c	2.62 bc	2.05 bc	0.66	9.04	67.8 c
	I_2	205.9 bc	103.0 bc	2.65 bc	2.08 bc	0.69	8.87	73.4 bc
	I_3	206.6 bc	103.1 bc	2.66 bc	2.11 b	0.70	8.55	79.1 b
	I_4	225.2 b	113.4 ab	2.70 b	2.02 ab	0.70	8.77	84.9 ab
	I_5	243.9 a	123.8 a	2.75 a	2.29 a	0.76	8.54	90.7 a
LSD at 5%		19.67	12.34	0.098	0.097	ns	ns	6.5
1995-96	I_0	102.4 e	77.6 d	1.95	1.81	0.52	9.20	45.0 d
	I_1	113.0 d	80.5 d	2.17	2.00	0.61	9.00	45.6 d
	I_2	118.1 d	90.0 c	2.02	1.82	0.51	8.90	55.0 c
	I_3	128.8 c	91.0 bc	2.10	1.97	0.59	9.29	65.1 bc
	I_4	142.8 b	98.0 b	2.12	1.86	0.48	9.26	62.0 b
	I_5	151.2 a	109.0 a	2.05	2.07	0.60	9.33	72.3 a
LSD at 5%		7.59	7.91	ns	ns	ns	ns	6.27

Weather data required for the experiment i.e. rainfall, pan evaporation and the number, time and amount of irrigation water are presented in Table 2.

Table 2. Number, amount and interval of irrigation, rainfall and pan evaporation, BSRI, 1994-96

Parameter	crop year	Treatment					
		I_0	I_1	I_2	I_3	I_4	I_5
Number of irrigation	1994 -95	0	1	2	3	4	6
	1995 -96	0	1	2	3	4	5
Total amount of irrigation (cm)	1994 -95	0	10	20	30	40	60
	1995 -96	0	10	20	30	40	50
Interval of irrigation Days after ratooning (DAR)	1994 -95	0	30	30,154	30,115, 154	30,74, 115,154	30,58,97,137,154,190
	1995 -96	0	30	30,160	30,110,160	30,90, 130,160	30,77,110, 137,160
Cumulative Pan evaporation (cm) :166.29 and 126.66 respectively for 1994-95 & 1995-96 Annual Rainfall (cm): 139.70 and 120.34 respectively for 1994-95 & 1995-96							

From the Table 1 & 2 it is seen that the treatment I_5 received (10x 6) = 60 cm irrigation water applied at 30, 58, 97, 137, 154 and 190 DAR (days after ratooning) including one additional (shallow) life irrigation to achieve the highest yield of 90.7 t ha^{-1} in the season 1994-95. This was followed by the treatment I_4 with 40 cm irrigation water applied at 30, 74, 115 and 154 DAR. Yield difference was not significant during the season between I_5 and I_4. However, during 1995-96 the treatment I_5 received (10 x 5) 50 cm irrigation water applied at 30, 77, 110, 137 and 160 DAR including one additional life (shallow) irrigation to achieve the highest yield of 72.27 t ha-$_1$ (Table 1 & 2). This was followed by the treatment I_4 with 40 (4 x 10) cm irrigation water applied at 30, 90, 130 and 160 DAR with a significantly lower yield. The variation of irrigation interval was due to weather variation especially for effective rainfall. Rather, early monsoon cut off one irrigation for treatment I_5 in 1995-96 . Hence five to six irrigations at the pan ratio (PR) =1.0 including one shallow (life) irrigation may be recommended for 2nd & 3rd ratooning in case of normal rainfall during premonsoon period From the Table 3, it is clear that varieties showed significant effect on tillers, millable cane, weight per cane and yield of cane in both the seasons. Variety Isd 21 produced the highest yield in both the seasons but with lowest recovery. Isd 16 yielded the lowest in both the seasons but received the highest recovery. It is well known that Isd 16 is the best variety for high and medium land of well drained soil. It has a good ratooning potentiality. On the other hand Isd 21 and Isd 20 are well known to adapt in low laying areas. Our experimental plot was a medium land by the side of a lake, which in monsoon, remained submerged frequently. The internal drainage system was not good for the plot. That was the main reason why the varieties Isd 21 & Isd 20 yielded higher than Isd 16. In such a soil and environmental condition, it may be suggested that all the varieties are suitable for ratooning.

Table 3. Effect of varieties on yield and yield components, BSRI, 1994-96.

Year	Treatment	Tiller (000/ha)	Millable cane (000/ha)	Height (m)	Girth (cm)	Weight (kg/cane)	Recovery (%)	Yield (t ha^{-1})
1994-95	Isd 16	181.4 c	96.8 c	2.23	2.36 a	0.72 a	9.92	60.4 c
	Isd 20	200.4 b	103.9 b	2.40	2.04 b	0.62 b	8.95	65.6 b
	Isd 21	223.5 a	136.5 a	2.51	1.96 b	0.49 c	8.86	71.8 a
LSD at 5%		**9.85**	**11.95**	**ns**	**0.973**	**0.072**	**ns**	**7.14**
1995-96	Isd 16	121.2 c	84.5 c	2.21 a	1.99 a	0.57 a	9.75 a	48.5 c
	Isd 20	125.3 b	91.5 b	2.03 b	2.02 a	0.59 a	9.47 a	57.1 b
	Isd 21	131.6 a	97.1 a	2.0b	1.78 b	0.52 b	8.29 b	62.4 a
LSD at 5%		**3.274**	**5.083**	**0.113**	**0.121**	**0.048**	**0.310**	**3.88**

Table 4. Mortality of tillers for treatments of irrigation and varieties, BSRI, 1994-96.

Irrigation level	Mortality (%)		Year	Variety	Mortality (%)
	94 - 95	95 – 96			
I_0	54.20	24.20	1994 - 95	lsd 16	46.65
I_1	50.50	28.76		lsd 20	48.15
I_2	49.97	23.79		lsd 21	38.93
I_3	50.09	29.35	1995 - 96	lsd 16	30.28
I_4	49.63	31.37		lsd 20	27.00
I_5	49.25	27.91		lsd 21	26.22

From the Table 4 regarding mortality of tillers during monsoon and up to harvest it is seen that 49 to 54 % mortality for irrigation treatments and 39 to 48 % for varieties during the cropping season 1994-95. For the season 1995-96, the ranges are only 24-31 % and 26-30 % respectively. In both the seasons premonsoon irrigation did not show clear indication of its effect on mortality but varietal effect is obvious in both the seasons. It is evident that sugarcane irrespective of its varieties losses tillering potentiality in sequence of ratooning (Table 1). Tiller number must have a limit above which mortality increases and affects on yield. Moreover heavy and intensive rainfall in the monsoon must have positive impact on mortality because total rainfall in 1994-95 & 1995-96 were 139.70 cm & 120.34 cm respectively.

Overall, it can be recommend that the three varieties on trial have the potentiality of 2nd and 3rd ratooning when irrigation is applied at PR = 1.00 and where the land is medium high with inadequate drainage facility.

REFERENCES

BSRI, 1995. Annual Report, 1995. Bangladesh Sugarcane Research Institute. Ishurdi, Pabna, p.111-114.

Humbert, R.P.1968 . The growing of sugarcane. Elsevier Publishing Company, New York.779.p.

King , N.H.; Mungomery, R.W. and Hughes, C.G.1965. Manual of sugarcane growing.

Elsevier Publishing Company, New York.375.p.

Majid, M.A and Alam, F. 1998. Fertilizer management for sugarcane ratooning . Bangladesh. J. Sugarcane, **18**- 20: 75 - 79.

Matin, M.A; Rahman, A.B.M.M. and Ali, M.Y.1989. Performance of three sugarcane varieties as transplanted and ratoon cane under rainfed condition. Bangladesh. J.Sugarcane, **11**: 32-36.

Miah, M.A; Rahman, M; Awal, A and Karim,M.A 1987 Performance of some promising clones of sugarcane as plant and ratoon crops. Bangladesh. J. Sugarcane, **9**: 9 -13.