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Effect Of Different Irrigation Levels On Growth And Yield Of Sugarcane

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ABSTRACT

An experiment was conducted in Bangladesh Sugarcane Research Institute (BSRI) farm at Ishurdi during 2003-04 and 2004-05 cropping seasons to find out the effect of different irrigation levels on growth and yield parameters of six sugarcane varieties (Isd 16, Isd 30, Isd 31, Isd 32, Isd 33, Isd 34). The experiment was laid out in two factors split-plot design with five irrigation levels in main plots and six varieties in subplots. Irrigations at 21, 28, 35 or 42 days interval in addition to two live irrigations (i.e. irrigation for crop establishment) increased sugarcane yield from 15 to 46%. Irrigation at 21 days interval showed higher establishment, tiller, millable cane and yield of cane over irrigation at 28, 35 or 42 days interval. Varieties Isd 34, Isd 31, Isd 32 and Isd 33 showed better performance and produced significantly higher yield among the selected varieties. Hence sugarcane varieties Isd 31, Isd 32, Isd 33 and Isd 34 may be cultivated with potential yield in clay loam soil by 4 to 5 irrigations at an interval of 21 to 42 days in addition to two live irrigations at 0 and 14 days after transplanting when soil bed settlings are used as planting material.

Key words: Sugarcane, irrigation, variety, performance.

INTRODUCTION

Water is a scarce and indispensable basic input for sugarcane like other crops. Insufficient or excess water supply is invariably a constraint to growth and yield of sugarcane. For proper growth, sugarcane needs about 1260 mm of rain water or equivalent quantity of irrigation per year (Shih *et al.*,1977). In areas of low or unreliable rainfall or where the rainfall is not even throughout the year the crop is to be irrigated. Sugarcane has a high water use efficiency than other crops. It has been reported that 200-250 tons of water is required to produce one ton of sugarcane (Anon., 1987).

Sugarcane production in Bangladesh fluctuates due to poor distribution and shortage of rainfall. Annual average rainfall in the sugarcane growing zone ranges between 1200 mm and 2020 mm which is logically satisfactory for growing sugarcane. But the rainfall is not evenly distributed over the year. Yearly rainfall starts from the month of April and continues to October. However, more than 60 percent of the total rainfall concentrates in the month of June, July and August causing water stagnation in the field creating oxygen stress in the root zone and results in the loss of sugarcane yield and reduction of quality. In the rest of the months from November to March, the rainfall is very scanty and erratic. In some of these months, no rainfall occurs. But plantation, germination and tiller formation of

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sugarcane mainly take place during these dry months. Sugarcane, thus, in these months needs adequate moisture for successful germination, tillering and growth of the crop. It is reported that 2 to 3 irrigations from November to March increased sugarcane yield by 30 percent or more (Hossain, 1992)

Again, excess water use may induce leaching of valuable nutrients beyond root zone and may also create oxygen stress and, therefore, may retard normal growth of plant instead of boosting yield. Application of excess water is an economic loss for the sugarcane growers in addition to the yield loss. Sugarcane, in general, grows well up to soil moisture retention range of 0.2 –2.5 bars in arid climates and about 0.2-1.8 to 2.5 bars in humid climates (Husz,1972). Generally, the percent aeration porosity even after irrigation should not go down below 10% (Husz, 1972 as cited by Srivastava and Singh, 1987)

On the other hand, all varieties of sugarcane do not response to water deficit/stress similarly. Some varieties can withstand more water stress than others, thus producing better yield in even drought condition. In contrast, some varieties can produce better yield in water stagnation condition. Therefore, determination of performance of different sugarcane varieties at different soil moisture level is an important aspect to optimise economic yield of sugarcane at different locations of the country. Hence, the present experiment was conducted during 2003-04 and 2004-05 cropping seasons with a view to finding out the effect of different irrigation levels on growth and yield of sugarcane.

MATERIALS AND METHODS

The study was carried out in Bangladesh Sugarcane Research Institute (BSRI) farm at Ishurdi with six sugarcane varieties viz. Isd 16, Isd 30, Isd 31, Isd 32, Isd 33 and Isd 34. Settlings were raised from budchips of these varieties in soil bed. At the age of 60 to 69 days the settlings were transplanted in the main field. The experiment was laid out in split-plot design with 5 irrigation levels in the main plots and 6 sugarcane varieties in the sub-plot as given in Table1 and was replicated thrice. The budchip settlings were transplanted at the rate of 25000 settlings per hectare. The soil of the experimental field was loamy to clay loam with P^H value ranged from 7.57 to 7.70. The physiochemical properties of different layers of the main field are given in Table 2.

Table 1. Main plot and sub-plot treatments of the experiment laid in split-plot design.

Main-plot treatment (Irrigation)	Sub-plot treatment (Variety)
I_1 = Live irrigation at 0 and 15 days after plantation	V_1 = Variety Isd 16
I_2 = I_1 + irrigation at 21 days interval	V_2 = Variety Isd 30
I_3 = I_1 + irrigation at 28 days interval	V_3 = Variety Isd 31
I_4 = I_1 + irrigation at 35 days interval	V_4 = Variety Isd 32
I_5 = I_1 + irrigation at 42 days interval	V_5 = Variety Isd 33
	V_6 = Variety Isd 34

Table 2. Physiochemical properties of the experimental field.

Depth (cm)	Texture	pH	Organic Matter (%)	N (%)	P (ppm)	K (meq/100g soil)	S (ppm)
0-15	Loam	7.57	1.30	0.042	10.0	0.22	27.0
16-50	Loam	7.62	0.87	0.020	5.5	0.22	25.0
51-75	Clay loam	7.70	0.62	0.019	3.0	0.23	18.0

Chemical fertilizers were applied as per BARC recommendation (BARC, 1989) and intercultural operations were done as per BSRI recommendation (Rahman et al.,1998). Number of tillers produced by different varieties in different irrigation treatments were counted during May 2004 after 6 months of transplantation. Numbers of millable canes were counted just one week before harvesting at the age of 13 months. Chemical analyses of canes were done during premature stage in the month of October and mature stage in the month of December to find the pol percentage of the cane (pol % cane). Pol % cane determined at matured stage has been included in this paper for discussion.

Number of Irrigation Applied

Number of irrigation and the day of application for different treatments during 2003-04 and 2004-05 are given in Table 3 and Table 4, respectively. Only two irrigations at 0 and 14 days after plantation (DAP) were applied in treatment I_1. During 2003-04, irrigation treatment I_1, I_2, I_3, I_4 and I_5 received 2, 7, 5, 5 and 4 numbers of irrigations, respectively. However, during 2004-05, these treatments received 2, 7, 6, 5, and 5 numbers of irrigations, respectively. During 2004-05, treatments I_3 and I_5 received one additional irrigation over that they received during 2003-04. It was due to late initiation of rainfall during 2004-05. The higher number of irrigations applied to I_2 during both 2003-04 and 2004-05 was 7. During the first two irrigations, each received a depth of 6 cm water. However, the latter irrigations received 10 cm each.

Table 3. Number and days of irrigation application for different treatments during 2003-04 (planted on December 6, 2003).

	Treatment				
	I_1 (2 live irrigations)	I_2 (21 days interval)	I_3 (28 days interval)	I_4 (35 days interval)	I_5 (42 days interval)
No. of irrigation	2	7	5	5	4
Irrigation applied after plantation (DAP)	0,14	0,14 35,56,77,98,119	0,14 42,70,98	0,14 49, 84,119	0,14 56,98

Table 4. Number and days of irrigation application for different treatments during 2004-05 (planted on December 5, 2004).

	Treatment				
	I_1 (2 live irrigations)	I_2 (21 days interval)	I_3 (28 days interval)	I_4 (35 days interval)	I_5 (42 days interval)
No. of irrigation	2	7	6	5	5
Irrigation applied after plantation (DAP)	0,14	0,14 35,56,77,98,119	0,14 42,70,98,126	0,14 49, 84,119	0,14 56,98,140

RESULTS AND DISCUSSION

Establishment of settling

Establishment of bud chip settlings as affected by irrigation and variety are given in Table 5 and Table 6, respectively. From the previous practice and experience it was essentially important to apply at least two irrigations at 0 and 14 days after transplantation for soil bed settlings (Hossain, 2005). However, some plant died after 14 days of transplantation due to pest infection, disease infestation and high water stress. The results presented in Table 5, shows that the establishment of settlings was significantly higher. The statistically significant highest establishment was found in the treatment I_3 (23.39 x 10^3/ha) followed by treatment I_5 (23.26 x 10^3/ha) and I_2 (23.17 x 10^3/ha) during 2003-04. The lowest establishment was found in the treatment I_1 (20.02 x 10^3/ha) where no irrigation was applied except two live irrigations.

However, during 2004-05, highest establishment was found in I_2 (22.42 x 10^3/ha) which was statistically similar with the treatment I_3 (22.39 x 10^3/ha) and I_4 (22.35 x 10^3/ha). The lowest establishment of settlings was found in I_1 (20.94 x10^3/ha).

Table 5. Contribution of irrigation to yield and other parameters of sugarcane during 2003-04 and 2004-05.

Year	Treatment	Establishment of settlings (x10^3/ha)	Tiller (x10^3/ha)	Millable cane (x10^3/ha)	Yield (t/ha)	Yield increased over control (%)	Pole% Cane	Total Sugar content (t/ha)
During 2003-04	I_1	20.02 c	104.80 b	95.22 c	68.70 c	00.0	12.749	8.759
	I_2	23.17 ab	138.11 a	128.24 a	99.97 a	45.5	12.520	12.516
	I_3	23.39 a	135.20 a	125.85 ab	97.95 ab	42.6	12.639	12.380
	I_4	21.89 b	126.17 a	107.87 c	79.33 bc	15.5	12.427	9.858
	I_5	23.26 ab	134.93 a	109.76 bc	86.98 abc	26.6	12.926	11.243
	LSD at 5%	1.473	19.89	17.74	19.03	-	ns	-

During 2004-05	I_1	20.94 c	99.259	74.938	55.37 b	00.0	12.468	6.903
	I_2	22.42 a	115.771	93.472	81.56 a	47.3	13.146	10.722
	I_3	22.39 a	105.740	85.185	79.64 a	43.8	12.656	10.079
	I_4	22.35 ab	101.698	86.497	80.84 a	46.0	12.599	10.185
	I_5	21.64 bc	98.412	82.454	76.16 a	37.5	12.029	9.161
	LSD at 5%	0.7397	ns	ns	14.33	-	ns	-

Table 6. Contribution of variety to yield and other parameters of sugarcane during 2003-04 and 2004-05.

Year	Variety	Establishment of settlings ($x10^3$/ha)	Tiller ($x10^3$/ha)	Millable cane ($x10^3$/ha)	Yield (ton/ha)	Yield increased over V_1 (%)	Pole % Cane	Total Sugar content (t/ha)
During 2003-04	V_1	21.89 b	109.76 bc	98.11 b	71.71 c	00.0	13.300 a	9.537
	V_2	19.73 c	102.42 c	81.87 c	48.91 d	-31.8	13.881 a	6.789
	V_3	23.05 ab	144.53 a	128.09 a	103.96 a	45.0	11.647bc	12.108
	V_4	23.44 a	116.27 b	107.33 b	91.77 b	28.0	11.383 c	10.446
	V_5	23.29 a	146.36 a	131.40 a	102.59 a	43.1	13.309 a	13.653
	V_6	22.67 ab	147.71 a	133.53 a	100.55 a	40.2	12.393 b	12.461
	LSD at 5%	1.261	9.438	9.852	8.315	-	0.8064	-
During 2004-05	V_1	21.76 c	81.80 c	63.15 c	54.03 b	00.0	13.82 a	7.467
	V_2	17.41 d	61.93 d	53.02 c	37.98 c	-29.7	13.61 a	5.169
	V_3	22.02 c	120.00 ab	92.43 b	86.16 a	59.5	12.33 b	10.623
	V_4	24.00 a	109.00 b	87.61 b	93.62 a	73.3	11.60 c	10.860
	V_5	23.59 a	117.60 ab	98.19 b	82.69 a	53.0	12.16 bc	10.055
	V_6	22.91 b	134.50 a	112.7 a	93.78 a	73.6	11.97 bc	11.225
	LSD at 5%	0.4667	17.17	13.13	11.88	-	0.6511	-

On the other hand, significantly higher establishment of settlings was found in the varieties V_4, V_5, V_6 and V_3 over varieties V_1 and V_2 during 2003-04 (Table 5). The highest establishment was found in the variety V_4 (23.44 x 10^3/ha) and the lowest establishment was found in the variety V_2 (19.73 $x10^3$/ha). During 2004-05, significantly higher establishments were also shown by V_4 (24.00 x 10^3/ha) and V_5 (23.59 x 10^3/ha) over others. The lowest establishment was shown by variety V_2 (17.41 x 10^3/ha) during 2004-05. On the basis of the establishment potential the varieties can be ranked as: lsd 32 > lsd 33 > lsd 34 > lsd 31 > lsd 16 >lsd 30.

Number of Tiller

It is evident from Table 5 that during 2003-04, the number of tiller produced in irrigation treatments I_2, I_3, I_4 and I_5 where 5, 3, 3 and 2 extra irrigations were applied respectively, varied significantly over the control treatment I_1 that received only two live irrigations. Similar effects of irrigation treatments on tiller production were also observed during 2004-05. In both the cropping seasons, the highest number of tiller was produced in the treatment I_2 (138.11 x 10^3/ha and 115.771 x 10^3 /ha, respectively) followed by treatment I_3 (135.20 x 10^3/ha and 105.740 x10^3/ha, respectively) although the differences were not statistically significant. The lowest number of tillers was produced in treatment I_1 (104.8 x 10^3/ha) during 2003-04. But during 2004-05, the lowest number of tiller was produced in treatment I_5 (98.41 x 10^3/ha) followed by treatment I_1 (99.26 x 10^3/ha). However the difference between I_5 and I_1 is insignificant. These evidences reestablished the fact that irrigation significantly increases the number of tillers.

Besides irrigation, number of tiller also depends on the variety as it is the inherent characteristics of each variety. Under the same input and environmental condition all the varieties do not usually produce same number of tillers. From Table 6 it is evident that variety V_6, V_5 and V_3 produced significantly higher number of tillers (147.71 x 10^3/ha, 146.36 x 10^3/ha and 144.53 x 10^3/ha, respectively) over variety V_1, V_2 and V_4 during 2003-04. Similarly, the highest number of tillers was also produced by the variety V_6 (134.50 x 10^3/ha) during 2004-05. The lowest number of tiller was produced by the variety V_2 during both 2003-04 and 2004-05 cropping seasons. On the basis of tiller production potentials, the varieties can be ranked as: lsd 34 > lsd 33 > lsd 31 > lsd 32 > lsd 16 > lsd 30.

Millable Cane

Millable cane is the number of canes that are used for milling/crushing. It is the number of tiller that can survive and become matured in competition with others. From the data of 2003-04 (Table 5), the highest number of millable cane was obtained from the treatment I_2 (128.24 x 10^3/ha) where irrigation was applied at 21 days interval in addition to two live irrigations at 0 and 14 DAP. The lowest millable canes were obtained from treatment I_1 (95.22 x 10^3/ha) where only two live irrigations were applied. Table 5 shows a general trend that the shorter the irrigation interval, the higher the number of millable cane.

Similar contribution of irrigation was also observed during 2004-05. The highest number of millable cane was also produced in the treatment I_2 (93.472 x 10^3/ha) and the lowest number of millable cane was produced in the treatment I_1 (74.938 x 10^3/ha) (Table 5). Therefore, it is revealed that irrigation increases the number of millable cane as it increases the number of tiller.

In case of variety, the highest number of millable cane was produced by the variety V_6 (133.53 x 10^3/ha) and the lowest by the variety V_2 during 2003-04 (Table 6). However, varieties V_3, V_5 and V_6 produced significantly higher number of millable cane over varieties V_4, V_1 and V_2. It is also evident that variety that produced higher number of tiller, also produced higher number of millable cane.

Similar results were also observed during 2004-05. The highest number of millable cane was also produced by the variety V_6 (112.70 x 103/ha) during 2004-05. Therefore, it is evident from Table 6 that during both the cropping seasons the variety V_6 produced the highest number of millable cane followed by the varieties V_3 and V_5. Thus on the basis of the millable cane production potential the varieties can be ranked as: lsd 34 > lsd 33 > lsd 31 > lsd 32 > lsd 16 > lsd 30.

Cane Yield

Yield of sugarcane is the final output from the field for the farmers. It is evident from Table 5 that irrigation has a positive impact on the yield of sugarcane. During 2003-04, the highest yield of sugarcane (99.97 t/ha) was produced in the treatment I_2 where irrigation was applied at 21 days interval. However, yield difference among the treatments I_2, I_3, and I_5 are statistically insignificant. Treatment I_4 produced significantly lower yield than that of treatment I_3 due to lower establishment of settlings. Such settlings resulted in lower number of millable cane producing lower yield. Moreover, yield difference between treatment I_4 and I_5 was statistically insignificant.

Similar contribution of irrigation to increase yield was also found during 2004-05. The highest yield of sugarcane was produced in the same treatment, I_2 (81.56 t/ha) while the lowest was in the treatment I_1 (55.37 t/ha). However, the differences in yield among treatments I_2, I_3, I_4 and I_5 were statistically insignificant. It is important to mention that the average yield in all treatments during 2004-05 were lower than that of 2003-04. It was due to high weed infestation of the crop field in the months of February and March during 2004-05. It is apparent from Table 5 that additional irrigations over two live irrigations increased the yield of sugarcane up to 46% over control.

Considering varietal aspect, it is evident from the Table 6 that during 2003-04, variety V_3 produced the highest yield of 103.96 t/ha, which was statistically similar with the variety V_5 (102.59 t/ha) and V_6 (100.55 t/ha). The lowest yield was produced by the variety V_2 (48.91 t/ha). However, during 2004-05, the highest yield was produced by the variety V_6 (93.78 t/ha). But this yield was statistically similar to that produced by the varieties V_3 (86.16 t/ha), V_4 (93.62 t/ha) and V_5 (82.69 t/ha). Thus, on the basis of yield performance the varieties can be ranked as: lsd34 > lsd 31 > lsd 32 > lsd 33 > lsd 16 > lsd 30.

Pol Percentage of Cane (Pol%Cane)

Irrigation did not have any significant effect on pol percentage of cane. Differences in pol percentage of cane among the treatments are statistically insignificant and ranged from 12.427 to 12.926% and 12.029 to 13.146% during 2003-04 and 2004-05, respectively (Table 5). However, pol percentage of cane varied widely from variety to variety and differences were statistically significant (Table 6). The highest pol percentage of cane (above 13 %) was found in the variety V_1 and V_2 during both 2003-04 and 2004-05 cropping seasons although their cane yields were lower. The lowest pol percentage of cane was found in the variety V_4 (11.383%) and 11.600% (during 2003-04 and 2004-05, respectively). On the basis of pol percentage of cane, varieties can be ranked as: lsd 30 > lsd 316 > lsd 33 > lsd 34 > lsd 31 > lsd 32.

Total Sugar Content

Total Sugar Content is the amount of total sugar that is contained with the total produced cane. Considering the irrigation treatments highest amount of total sugar was obtained from treatment I_2 during both 2003-04 and 2004-05 (12.516 and 10.722 t/ha respectively) (Table 5). However, considering varietal performance, it is evident from the Table 6 that the highest total sugar content was obtained from the variety V_5 (13.653 t/ha) during 2003-04 while the same was obtained from the variety V_6 (11.225 t/ha) during 2004-05. During both the seasons the least total sugar content was obtained from variety V_2. Thus, on the basis of the total sugar content, the varieties can be ranked as: Isd 33 > Isd 34 > Isd 31 > Isd 32 > Isd 16 > Isd 30.

Interaction Effect

The interaction effects of irrigation and variety on establishment of settlings, tiller, millable cane, yield and pol percentage of cane are given in Tables 1 and 2 in the Appendix for cropping seasons 2003-04 and 2004-05, respectively. Interaction effects of irrigation and variety on all these cases were statistically insignificant during 2003-04. However, during 2004-05 only establishment of settlings showed significant differences in interaction effect. Variety V_4 and V_5 showed the highest establishment in all the treatment combinations. Variety V_3 and V_6 also showed significantly higher establishment in some other treatment combinations. An exceptionally high yield of 122.13 t/ha was produced by I_5V_3 treatment combination during 2003-04 while it was 121.14 t/ha by I_2V_4 treatment combination during 2004-05. However, comparatively higher yields were produced by I_2V_{1-6} and I_3V_{1-6} treatment combinations during 2003-04, and I_3V_{1-6} and I_4V_{1-6} treatment combination during 2004-05.

CONCLUSION

On the basis of the above mentioned results and discussion it is apparent that there was no statistical evidence of interaction effect between irrigation and variety. But both irrigation and variety showed their individual effect on establishment of settlings, tiller and millable cane production, and cane yield. However, irrigation did not have any effect on pol percentage of cane. The evidence obtained from the experiment lead to the following specific conclusions:

Irrigation at an interval of 21 days in addition to two live irrigations at 0 and 14 days after transplantation (DAP) of bud chip settlings can produce the highest yield over only two irrigations at 0 and 14 DAP. With the increase in irrigation frequency (i.e. the shorter interval) the yield of sugarcane is increased in the domain of 21 to 40 days intervals in addition to irrigation at 0 and 14 DAP. In view of maximizing cane yield, the selection of varieties for cultivation may be as: Isd 34 > Isd 31 > Isd 32 > Isd 33 > Isd 16 > Isd 30. But, from the view point of maximizing total sugar content, the varieties may be selected as: Isd 33 > Isd 34 > Isd 31 > Isd 32 > Isd 16 > Isd 30.

Therefore, for cultivation of sugarcane by raising settlings from budchip in soil bed, the variety Isd 31, Isd 32, Isd 33 and Isd 34 may potentially be practiced with 4 to 5 irrigations at an interval of 21 to 42 days in addition to two live irrigations at 0 and 14 days after transplantation (DAP).

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Appendix Table 1. Interaction effect of irrigation and variety on yield and other parameters of sugarcane during 2003-04.

Sl. No	Treatment combination (irrigation+variety	Establishment of settling (x103/ha)	Tiller (x103/ha)	Millable cane (x103/ha)	Yield (ton/ha)	Pol % cane
1	I1V1	19.67	85.00	81.00	56.90	14.303
2	I1V2	15.33	87.56	68.22	41.77	14.447
3	I1V3	21.22	123.56	117.11	77.00	11.623
4	I1V4	22.89	103.33	93.67	77.20	10.937
5	I1V5	21.33	111.45	103.22	89.57	12.917
6	I1V6	19.67	117.89	108.11	69.77	12.270
7	I2V1	21.89	117.78	106.78	87.57	12.533
8	I2V2	22.33	113.22	101.67	56.13	13.817
9	I2V3	23.11	144.33	143.22	114.00	11.660
10	I2V4	23.55	123.11	125.22	104.43	10.957
11	I2V5	24.33	158.89	148.67	119.67	13.223
12	I2V6	23.78	153.89	143.89	105.90	12.930
13	I3V1	23.99	124.55	117.33	86.43	13.790
14	I3V2	21.00	99.22	80.22	52.77	13.393
15	I3V3	24.11	157.11	143.78	117.37	11.613
16	I3V4	23.44	124.00	116.56	105.67	11.283
17	I3V5	24.33	165.89	150.56	118.00	13.730
18	I3V6	23.44	157.89	146.67	119.57	12.023
19	I4V1	20.23	108.78	91.56	61.43	12.040
20	I4V2	19.89	101.67	76.67	44.47	13.867
21	I4V3	23.22	135.44	115.00	89.33	11.680
22	I4V4	22.78	111.33	96.78	87.90	11.857
23	I4V5	22.56	144.22	130.44	87.87	14.123
24	I4V6	22.67	155.56	136.78	105.00	10.997
25	I5V1	23.66	112.67	93.89	66.23	13.833
26	I5V2	20.11	110.44	82.55	49.43	13.880
27	I5V3	23.56	162.22	121.33	122.13	11.660
28	I5V4	24.56	119.55	104.44	83.67	11.880
29	I5V5	23.89	151.33	124.11	97.87	12.553
30	I5V6	23.78	153.33	132.22	102.53	13.747
Interaction effect		ns	ns	ns	ns	ns

Appendix Table2. Interaction effect of irrigation and variety on yield and other parameters of sugarcane during 2004-05.

Sl. No.	Treatment combination (irrigation+variety	Establishment of settling (x103/ha)	Tiller (x103/ha)	Millable cane (x103/ha)	Yield (ton/ha)	Pol % cane
1	1V1	20.09 c	3.33	40.93	33.52	13.78
2	I1V2	16.67 e	74.81	65.65	37.67	12.84
3	I1V3	18.89 d	135.10	70.74	54.20	12.60
4	I1V4	24.17 a	101.30	87.41	73.64	11.67
5	I1V5	23.52 a	94.17	71.85	53.78	12.75
6	I1V6	22.31 b	126.85	113.06	79.40	11.17
7	I2V1	22.22 b	94.81	76.02	59.96	14.67
8	I2V2	18.15 c	62.04	52.50	32.42	14.79
9	I2V3	21.76 b	126.48	102.96	79.11	12.22
10	I2V4	24.72 a	136.57	95.56	121.14	11.57
11	I2V5	23.89 a	134.44	117.69	96.70	13.17
12	I2V6	23.80 a	140.28	116.11	88.51	12.46
13	I3V1	22.31 c	88.05	66.02	61.67	14.01
14	I3V2	17.87 d	51.76	40.00	36.05	13.58
15	I3V3	23.42 ab	123.70	95.28	97.39	12.72
16	I3V4	24.17 a	111.57	91.39	93.86	11.93
17	I3V5	23.61 ab	119.81	104.54	91.65	11.87
18	I3V6	22.96 bc	139.54	113.89	104.42	11.82
19	I4V1	23.15 a	84.26	72.78	59.68	13.56
20	I4V2	17.41 b	62.50	47.04	40.97	14.24
21	I4V3	23.15 a	92.97	98.61	88.64	11.93
22	I4V4	23.70 a	98.52	77.96	97.82	11.29
23	I4V5	23.71 a	119.17	100.28	92.20	12.04
24	I4V6	22.96 a	152.78	122.32	110.04	12.55
25	I5V1	21.02 b	78.52	60.00	55.34	13.09
26	I5V2	16.94 c	58.52	59.91	42.81	12.59
27	I5V3	22.87 a	121.95	94.54	111.48	12.17
28	I5V4	23.24 a	97.87	85.74	81.65	11.55
29	I5V5	23.24 a	120.46	96.57	79.13	10.95
30	I5V6	22.50 a	130.15	97.96	86.55	11.83
LSD at 5%		1.044	ns	ns	ns	ns