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VISUAL SELECTION FOR BRIX YIELD AT SINGLE CLUMP (RATOON OF SEEDLING) STAGE IN SUGARCANE (*SACCHARUM* INTERSPECIFIC HYBRIDS)

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ABSTRACT

Three visual selection methods, viz. superior, random and poor were carried out in a ratoon crop of seedlings of three open (general) crosses of sugarcane. The selection methods were compared by evaluating the clones in the settling nursery under normal and restricted irrigation for brix yield and its component traits. Superior selection was found advantageous for increasing mean brix yield and also for identifying promising clones as compared to poor and random selection methods. The results suggested that the large population of a cross can be reduced by rejecting poor ratooned clumps on the basis of visual assessment as ratoonability is an important commercial trait in sugarcane.

Key words: Sugarcane, visual selection, ratoon.

Ratoonability of sugarcane varieties is an important commercial trait as, in general, one to five ratoon crops are grown in different parts of the world. Still testing for ratoonability of new sugarcane selections is done at later stages. The major hurdle in selection is the wide disparity encountered in the performance of hybrid populations at seedling ratoon stage and subsequent clonal settling stages, as evidenced by the non-uniformity of correlation estimates for commercial traits. Selection based on good performance in the first ratoon crop of a new hybrid could give a more reliable breeding base and allow the breeder to reject all nonperformers at the first attempt. However, this concept needs to be tested. The present study has been undertaken with this objective in views.

MATERIALS AND METHODS

One thousand seedlings of three open crosses, viz. Co 1148GC, Co 7704GC and CoH 7803GC were transplanted in augmented design of 120 blocks during June, 1993. Each block

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had 25 hybrids seedlings and 1-month-old settlings of four checks, (Co 1148, CoH 35, CoJ 64 and CoS 767). The seedlings were ratooned in March, 1994. Three selection methods were carried out in ratoon crop of seedlings during February, 1995. Selections were made for clump vigour, higher number of millable stalks (NMS), medium thick stalks, and longer stalks. Selection of the plants looking phenotypically poor was also carried out as a contrasting group. A random choice of ratooned clumps formed random selection method. Bakshi Ram [1] reported that a random sample of 200 seedling ratoon clumps was sufficient for precise estimation of population mean and variance for stalk and brix yields. On this basis, 200 clumps were taken in each selection criteria.

The ratooned seedlings (all 1000 seedlings in each cross) were evaluated simultaneously in the settling nursery (next stage of evaluation) in two environments of normal and restricted irrigations in augmented design, as in seedling nursery. Under restricted irrigation, two irrigations were skipped from the normal schedule of irrigation, which was applied after every 10 days during summer 1994.

Data were recorded on seven traits on all the clumps in three groups of plants (trials), and analysed as per Federer [2].

RESULTS AND DISCUSSION

Mean performance of clones in three selection groups showed significant differences for most of the traits in the ratoon crop (Table 1). Random and poor clones were similar in mean performance for stalk diameter in Co 7704GC and H. R. brix in CoH 7803GC. These observations suggest that visual selection based on plant vigour, NMS, stalk diameter and stalk height was effective to classify clones into different groups as also reported earlier [3].

In the settling nursery also under normal and restricted irrigation, the clones derived from poor and random clumps gave similar performance for single stalk weight (SSW) in all the crosses, for H. R. brix in Co 1148GC and CoH 7803GC and for stalk diameter in Co 1148GC and Co 7704GC (Tables 2 and 3). Mean performance of the poor and random clones was also similar for stalk and brix yield only in CoH 7803GC with normal irrigation (Table 2). A more interesting feature was that the superior clones were significantly superior to random and poor clones except for H. R. brix in three open crosses in both environments and stalk height in Co 7704GC under restricted irrigation.

For stalk and brix yields, the effect of selection in the ratoon crop and hybrid seedlings was confirmed in the settling nursery. Khairwal et al. [3] also reported the effectiveness of selection in sugarcane.

Table 1. Mean performance of clones in ratoon crop (selection stage) in open pollinated populations of sugarcane

Selection group	No. of clones	NMS/clump	Stalk diameter (cm)	Stalk height (cm)	Single stalk weight (kg)	Stalk yield per clump (kg)	H. R. brix	Brix yield per clump (kg)
Co 1148GC								
Random	200	5.2a*	2.0a	149.0a	0.40a	2.2a	20.2a	0.46a
Superior	200	8.9(170.2)b	2.1(106.6)b	178.4(119.7)b	0.53(132.5)b	4.5(204.1)b	20.8(103.2)b	0.94(206.3)b
Poor	200	1.7(32.6)c	1.9(96.4)c	124.4(83.5)c	0.32(80.0)c	0.5(23.4)c	19.8(98.1)c	0.11(23.0)c
Co 7704GC								
Random	200	4.9a	2.0a	166.6a	0.50a	2.5a	19.5ae	0.50a
Superior	200	8.0(163.7)b	2.2(110.4)b	187.6(112.6)b	0.61(122.0)b	4.7(187.0)b	20.0(102.4)bd	0.94(190.1)b
Poor	200	2.1(41.9)c	2.0(100.5)a	144.2(86.5)c	0.42(84.0)c	0.8(32.0)c	19.2(98.3)c	0.15(30.8)c
CoH 7803GC								
Random	200	4.7a	1.9a	164.7a	0.46a	2.3a	18.6a	0.42a
Superior	200	8.7(186.3)b	2.2(110.8)b	189.9(115.3)b	0.60(130.4)be	5.0(221.7)b	19.2(103.2)b	0.95(226.5)b
Poor	200	1.7(37.3)c	1.8(93.3)c	133.6(81.1)c	0.31(67.4)c	0.5(21.7)c	18.7(100.6)a	0.09(21.5)c
C.D.		0.33	0.04	3.51	0.031	0.12	0.23	0.022

*Different letters indicate significant differences at $P = 0.05$.

Figures in parentheses indicate the percentage of values of random method.

Table 2. Character means of clones (evaluation stage) under normal irrigation in three open pollinated populations of sugarcane

Selection group	No. of clones	NMS/clump	Stalk diameter (cm)	Stalk height (cm)	Single stalk weight (kg)	Stalk yield per clump (kg)	H. R. Brix	Brix yield per clump (kg)
Co 1148GC								
Random	200	3.6a*	2.0a	201.7a	0.75a	2.7a	19.5a	0.52a
Superior	200	4.0(110.9)bd	2.1(104.5)b	207.0(102.7)bd	0.82(109.3)b	3.3(122.7)bd	19.7(101.1)b	0.65(124.5)b
Poor	200	3.3(90.5)a	2.0(98.5)a	196.7(97.6)c	0.74(98.7)a	2.4(90.3)c	19.5(100.1)ac	0.47(90.6)c
Co 7704GC								
Random	200	3.7a	2.0a	207.2a	0.71ac	2.8a	19.5a	0.54a
Superior	200	4.3(113.9)b	2.2(108.5)b	213.6(103.1)bd	0.81(114.1)bd	3.6(128.2)b	19.5(100.2)a	0.69(128.3)b
Poor	200	2.7(72.7)c	2.0(101.5)ac	200.3(96.7)c	0.69(97.2)c	2.0(70.4)c	19.3(99.1)b	0.38(70.4)c
CoH 7803GC								
Random	200	4.0a	2.0ac	201.2ac	0.67a	2.8a	19.3a	0.54a
Superior	200	4.8(116.6)b	2.1(107.2)b	202.6(100.7)ac	0.74(110.4)b	3.6(128.1)b	19.4(100.8)b	0.69(128.4)b
Poor	200	4.2(103.2)ac	1.9(98.5)c	197.6(98.2)a	0.63(94.0)a	2.8(99.6)a	19.4(100.5)ab	0.53(99.4)a
C.D.		0.19	0.04	4.51	0.044	0.20	0.16	0.04

*Different letters indicate significant differences at $P = 0.05$.

Figures in parentheses indicate the percentage of values of random method.

Table 3. **Character means of clones (evaluation stage) under restricted irrigation in three open pollinated populations of sugarcane**

Selection group	No. of clones	NMS/clump	Stalk diameter (cm)	Stalk height (cm)	Single stalk weight (kg)	Stalk yield per clump (kg)	H. R. Brix	Brix yield per clump (kg)
Co 1148GC								
Random	200	3.4(94.4)a*	2.0(99.0)ab	170.6(84.6)a	0.53(70.7)ab	1.9(70.3)a	19.3(99.4)ab	0.36(68.6)a
Superior	200	3.8(94.2)b	2.1(99.5)c	175.9(85.0)b	0.59(72.0)ce	2.3(70.3)b	19.4(98.7)ac	0.45(68.8)b
Poor	200	2.8(86.5)c	2.0(99.5)b	162.6(82.7)c	0.52(70.3)a	1.5(60.9)c	19.4(99.7)ac	0.29(61.0)c
Co 7704GC								
Random	200	3.6(97.6)a	2.0(101.0)a	180.8(87.3)a	0.55(77.5)a	2.1(76.9)a	19.6(100.6)ab	0.42(77.5)a
Superior	200	4.2(98.4)c	2.2(100.0)b	184.4(86.3)ab	0.63(77.8)cd	2.8(77.5)b	19.7(100.6)ab	0.54(77.9)b
Poor	200	2.9(105.2)e	2.0(100.0)a	175.5(87.6)c	0.53(76.8)a	1.6(82.6)c	19.6(101.3)ab	0.32(83.9)c
CoH 7803GC								
Random	200	3.7(91.8)a	1.9(99.5)a	172.1(85.5)ab	0.52(77.6)ae	2.1(74.5)a	19.8(102.7)a	0.41(76.1)ab
Superior	200	3.9(82.6)b	2.1(99.0)b	171.2(84.5)ab	0.56(75.7)bd	2.3(65.7)cd	19.9(97.4)b	0.47(67.7)ce
Poor	200	3.5(84.2)c	1.9(98.4)c	165.9(84.0)c	0.48(76.2)ce	1.8(65.0)b	19.9(102.7)ab	0.36(67.0)d
C.D.		0.15	0.03	4.08	0.038	0.17	0.15	0.04

*Different letters indicate significant differences at $P = 0.05$.

Figures in parentheses indicate the percentage of mean values under normal irrigation.

The reduction in mean performance under restricted irrigation was independent of selection methods. The maximum reduction in mean values under restricted irrigation was observed for brix yield, followed by stalk yield and single stalk weight (Table 3). Stalk diameter and H. R. brix showed minimum variation in the two environments, indicating the reliability of these traits as selection criteria.

The results on the performance of ratoon seedling hybrids reported here can be explained by a wide variability created through open pollination. The system of cross provides equal chance of pollination with pollens of different varieties, including the pollen of the female parent (selfing). In wheat, Mc Neal et al. [4] also reported that selection in early generation would be effective in crosses between parents with wide genetic variation.

The superior selections for brix yield gave much higher values as compared to the clones derived from other methods even in respect of number of significantly superior clones to the best check CoH 35 (Table 4). However, it is worth mentioning that poor selection produced high proportion of low yielding clones.

Table 4. Number of significantly superior clones to CoH 35 for brix yield at clonal stage under two conditions of irrigation

Selection group	No. of clones	No. of superior clones under different conditions of irrigation					
		Co 1148GC		Co 7704GC		CoH 7803GC	
		normal	restricted	normal	restricted	normal	restricted
Random	200	35	35	28	32	34	40
Superior	200	49	39	54	58	54	50
Poor	200	28	17	13	20	31	24
Population	1000	125	98	112	142	150	140

Ten top brix yielding clones were taken from three populations (1000 clumps in each population) and their origin was traced back to different selection criteria. It was observed that superior selection method was the best (Table 5). Though the superior selection method was the best, but this was not efficient to identify all top ten clones in three populations. For instance, clones 1619 and 1378 in Co 1148GC, clones 2585 and 2736 in Co 7704GC, and clone 3821 in CoH 7803GC were not represented in any of the three selection methods. This clearly indicated that 25% selection intensity, as in present study, was not enough. In other words, the selection should be more liberal. Therefore, the selection intensity in ratoon crop of seedlings should be more than 25%. The occurrence of superior clones in the poor group (Table 5) indicated that some high brix yielding clones have poor ratoonability. This indicates the importance of selection in seedling ratoon.

Table 5. Performance of ten top yielding clones in three open pollinated populations (out of 1000 clones) of sugarcane under normal irrigation and their origin (X) from different selection criteria

Population	Clone no.	Brix yield per clump (kg)	Stalk yield per clump (kg)	Selection criteria		
				RS	SS	PS
Co 1148GC	1490	2.400	12.00	X	X	
	1392	2.268	10.80		X	
	1175	2.120	10.00			X
	1228	1.939	9.60		X	
	1619	1.781	8.40	Not Selected		
	1419	1.746	9.00		X	
	1378	1.620	9.00	Not Selected		
	1330	1.600	8.00			X
	1184	1.555	7.20		X	
	1648	1.536	8.00		X	
		Total		1	6	2
Co 7704GC	2385	2.587	13.20	X	X	
	2585	2.225	10.80	Not Selected		
	2161	2.140	10.00	X	X	
	2661	1.872	10.40		X	
	2561	1.848	8.40	X		
	2312	1.843	9.50		X	
	2456	1.728	9.60		X	
	2736	1.714	8.40	Not Selected		
	2512	1.600	8.00		X	
	2075	1.540	7.00		X	
		Total		3	7	0
CoH 7803GC	3350	2.565	13.50			X
	3730	2.470	12.60		X	
	3565	2.020	10.20		X	
	3821	1.840	9.20	Not Selected		
	3480	1.800	9.00	X		
	3590	1.755	9.75			X
	3216	1.728	9.00		X	
	3330	1.728	9.60			X
	3459	1.674	9.20			X
	3383	1.632	9.60		X	
		Total		1	4	4
Grand Total				5	17	6

In conclusion, the results indicate that the visual selection for superior clumps on the basis of clump vigour, NMS, stalk diameter and stalk height has clear advantage over poor selection for all the characters, but not for H. R. brix. However, the selection intensity should be more than 25%. Thus, rejection of poor clumps in the first ratoon crop of hybrid seedlings would help in reducing the population and make selection more effective on the basis of ratoonability.

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