

REGENERATION CAPACITY OF F₃ PROGENIES OF SORGHUM (SORGHUM BICOLOR)

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SUMMARY

The present investigation was undertaken with the objective to study the regeneration capacity among F₃ genotypes of cross between HC308 (single cut) and SSG59-3 (multi-cut variety). The parameters such as plant height, number of tillers, number of leaves, stem girth, leaf breadth and green fodder weight per plant were recorded in each cut. Forty one F₃ lines were found to be non-regenerated, three F₃ lines were moderately non-regenerated, six F₃ lines were moderately regenerated and sixty nine F₃ lines were highly regenerated.

Key words : Regeneration capacity, genetic variability, single cut, multicut, sorghum

Sorghum is a robust and genetically variable member of the grass genus which looks very similar to maize and sugarcane. It is the fifth major cereal crop after paddy, wheat, maize and barley. India is the second largest producer of sorghum in world after the United States having a total area of about 11 million hectares with an output of 8.7 million tons (Rai, 2000). It belongs to family Poaceae.

Being the dual purpose crop, it is grown as a grain crop for human consumption and feed and fodder for livestock in different parts of the world. It can be used for sugar, alcohol, syrup, jaggery, fodder, fuel, bedding and roofing or fencing. The quality of fodder in terms of protein content and digestibility has also been reported to be improved because of frequent cuts (Satripanan *et al* 1991). Multicut varieties find favour because, in addition, to their high yielding ability, these are capable of producing fodder at frequent intervals which mitigates the problem of frequent field preparations and reseedlings. Multicut varieties generally provide more dry matter (25-30%) than single cut varieties under the same management system. To narrow down the gap between demand and supply of fodder for the increasing livestock population the concept of breeding multi-cut varieties of sorghum has been suggested. Varieties with quick regeneration lead to early

vigour of crop which not only increases the fodder yield per unit area/time but also escapes the attack of insects and pests at initial stages (Grewal, 2005).

The present study was, therefore, undertaken to assess the regeneration capacity of F₃ progeny of cross between single cut variety (HC308) and multicut variety (SSG59-3) of sorghum.

MATERIALS AND METHODS

Plant Material

In the present investigation, a total of 120 F₃ lines of a cross HC308 (single cut variety) X SSG 59-3 (multi-cut variety) along with the parents were used for studying their regeneration capacity and genetic variability. The experiment was laid out 120 F₃ lines along with parents were grown in Farm Area of Forage Section, Department of Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar.

Regeneration Capacity

One hundred twenty F₃ lines along with the parents were grown on June 1, 2007. Data were recorded for their regeneration capacity by taking first

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TABLE 1
Data for various traits in first cut taken after 70 days of sowing.

S. No.	Plant height (cm)	No. of tillers/ plant	No. of leaves/ plant	Leaf breadth (cm)	Stem girth (cm)	Green fodder yield (g/plant)
HC308	200	1	11	3.7	3.5	300
SSG59-3	300	2	18	4.3	4.5	500
1.	225	2	25	5.5	3.8	500
2.	236	1	13	7.0	6.0	555
3.	140	2	13	3.5	4.5	175
4.	151	2	18	3.5	3.5	110
5.	162	3	28	3.0	3.8	220
6.	135	1	11	2.5	3.0	100
7.	200	1	14	5.0	6.7	500
8.	190	1	10	2.0	3.5	105
9.	166	1	10	3.5	3.8	100
10.	210	1	13	2.2	4.0	170
11.	210	1	13	4.0	6.7	410
12.	200	1	15	5.00	6.4	475
13.	127	1	9	3.00	3.5	80
14.	210	1	14	5.5	6.5	520
15.	278	1	16	5.00	5.00	450
16.	210	1	15	4.00	6.0	410
17.	147	1	7	3.00	3.6	75
18.	180	1	9	2.00	3.8	130
19.	211	1	14	7.00	6.5	475
20.	248	1	16	4.00	7.0	650
21.	228	1	16	4.5	7.0	480
22.	228	1	15	5.00	7.6	600
23.	239	1	15	5.0	5.5	400
24.	208	1	8	2.5	4.0	160
25.	227	1	17	6.0	6.2	450
26.	195	1	10	3.0	2.5	75
27.	230	1	12	5.5	5.3	300
28.	131	1	8	2.0	3.0	45
29.	205	1	10	3.5	3.0	100
30.	208	1	14	4.0	4.5	250
31.	220	1	13	5.0	7.0	550
32.	192	1	11	3.5	3.8	160
33.	197	1	11	2.5	3.6	110
34.	234	1	12	3.0	3.8	175
35.	171	1	11	2.0	3.0	60
36.	215	1	14	3.0	6.4	525
37.	217	1	16	4.5	6.0	525
38.	189	1	10	4.0	3.8	200
39.	210	1	12	6.0	8.5	350
40.	222	1	16	6.5	6.5	575
41.	185	1	11	3.0	4.8	275
42.	220	1	16	6.0	5.2	340
43.	220	1	14	4.0	4.5	260
44.	161	1	9	4.0	3.5	100

contd.

Table 1 contd.

S. No.	Plant height (cm)	No. of tillers/ plant	No. of leaves/ plant	Leaf breadth (cm)	Stem girth (cm)	Green fodder yield (g/plant)
45.	160	1	10	3.0	4.0	120
46.	164	1	12	3.5	4.5	150
47.	148	1	10	3.5	3.4	100
48.	112	1	7	3.5	3.5	50
49.	212	1	13	5.0	5.7	400
50.	212	1	13	4.5	7.00	475
51.	200	1	10	4.00	3.5	100
52.	215	1	12	4.5	7.00	500
53.	219	1	11	4.5	5.5	325
54.	158	1	13	4.00	6.00	440
55.	236	1	11	3.5	4.8	300
56.	192	1	13	5.0	5.00	300
57.	213	1	15	5.5	6.8	610
58.	240	1	8	3.5	3.5	120
59.	162	1	10	3.00	4.4	150
60.	159	1	10	4.5	4.4	175
61.	175	1	10	3.5	4.5	150
62.	171	1	16	4.00	5.4	400
63.	205	1	11	3.5	5.5	300
64.	192	1	9	3.5	3.6	75
65.	146	1	11	6.00	5.3	300
66.	205	1	9	4.00	3.5	250
67.	213	1	13	6.00	4.9	350
68.	250	1	13	4.5	3.4	550
69.	230	1	10	5.00	3.6	100
70.	182	1	9	3.5	5.7	200
71.	162	1	9	3.00	3.5	100
72.	230	1	10	5.5	4.4	250
73.	120	1	8	2.2	3.8	200
74.	165	1	7	3.4	2.9	106
72.	230	1	9	3.00	4.5	100
73.	350	1	18	4.4	3.5	550
74.	300	1	9	3.5	4.00	350
75.	162	1	12	4.00	2.5	180
76.	210	1	9	2.5	5.00	300
77.	175	1	12	5.5	3.5	250
78.	310	1	10	6.5	2.00	400
79.	260	1	8	4.00	3.5	375
80.	300	1	9	4.4	4.5	600
81.	100	1	6	2.5	2.00	60
82.	300	1	11	4.5	3.5	300
83.	220	1	30	3.5	2.5	550
84.	320	1	7	5.5	3.5	150
85.	160	1	7	3.5	5.00	200
86.	300	1	12	4.5	5.5	375
87.	350	1	12	5.5	6.5	300
88.	150	1	8	3.8	4.5	250

contd.

Table 1 contd.

S. No.	Plant height (cm)	No. of tillers/ plant	No. of leaves/ plant	Leaf breadth (cm)	Stem girth (cm)	Green fodder yield (g/plant)
89.	235	1	14	4.3	4.7	300
90.	270	1	13	3.4	5.4	325
91.	290	1	14	3.4	5.4	300
92.	340	1	17	4.3	2.7	325
93.	280	1	13	3.9	3.8	440
94.	150	1	8	3.4	4.5	185
95.	162	1	6	3.00	3.5	150
96.	270	1	9	2.00	3.00	175
97.	310	1	10	2.5	3.7	200
98.	150	1	7	3.8	2.5	180
99.	235	1	14	3.5	3.7	350
100.	325	1	11	2.00	1.9	370
101.	212	1	14	5.00	5.7	400
102.	171	1	8	3.00	2.5	60
103.	198	1	10	6.00	3.9	200
104.	146	1	7	2.5	4.3	260
105.	164	1	9	5.2	3.4	250
106.	185	1	11	2.8	4.6	275
107.	164	1	12	2.5	3.8	475
108.	148	1	10	2.2	3.5	600
109.	175	1	10	1.5	4.4	275
110.	248	1	16	4.5	7.00	150
111.	239	1	15	5.00	6.7	600
112.	208	1	7	2.5	3.8	380
113.	300	1	13	2.8	4.7	375
114.	328	1	14	2.9	3.5	389
115.	220	1	30	3.9	5.2	550
116.	172	1	9	1.9	3.2	250
117.	234	1	10	2.5	2.3	302
118.	330	1	15	5.2	3.7	500
119.	185	1	9	2.9	3.2	267
120.	175	1	13	4.7	2.3	200

cut after 70 days of sowing. Then subsequent three cuts were taken at the interval of 35 days. The forage yield was recorded in each cut. The data was recorded for various traits such as plant height, number of tillers, number of leaves, stem girth, leaf breadth and green fodder weight in each cut.

RESULTS AND DISCUSSION

Ten plants from each line were selected randomly for studying the regeneration capability and remaining plants were grown upto seed harvesting stage.

In first cut, the green fodder yield ranged from

50 to 650 g per plant.

The maximum green fodder yield was recorded for line number 20 (650 gram per plant) and minimum for line number 83 and 115 50 g per plant. Line number 73 and 87 gave maximum height (350cm/plant) while minimum height, 100 cm/plant, was recorded for line number 81. Maximum number of tillers were observed in line number 5 (3 tillers). Maximum number of leaves (30/plant) were found in line number 83 and 115. Minimum number of leaves (6/plant) were in line number 95 and 81. Maximum leaf breadth, 7cm/plant, was observed in line number 2 and 19. Minimum leaf breadth (1.5 cm) was recorded in line number 110. Maximum

stem girth (8.5 cm/plant) was observed in line number 38. Minimum stem girth (1.9 cm/plant) was recorded in line number 100. Borad and Gungani (2007) studied the character association in 49 forage sorghum types and revealed high positive and significant association of stem girth, stem weight, leaf weight and crude protein yield with green fodder as well as dry matter yields both at phenotypic and genotypic levels.

In second cut, the green fodder yield ranged from 65 to 495 gram per plant. The maximum green fodder yield was recorded 495 gram per plant for line number 47 and minimum green fodder yield was recorded 65 gram per plant for line number 13.

In third cut, the green fodder yield ranged from 29 to 246 g per plant. The maximum green fodder yield was recorded for line number 16 (246 g per plant) and minimum for line number 9 (29 g per plant).

The green fodder yield ranged from 22 to 200 g per plant in fourth cut. The maximum green fodder yield (200 g per plant) was recorded for parent SSG59-3 and minimum for line number 58 and 8 (22 g per plant). The data recorded for various other traits such as plant height, number of tillers, number of leaves, stem

girth and leaf breadth at each cut is shown in Table 1. Pahuja *et al.* (1999) also reported the regeneration capacity in male sterile lines and pollinators. SSG 59-3 was found to be having maximum regeneration capacity among all other studied varieties.

On the basis of regeneration in these cuts, F_3 lines were categorised into 4 groups i.e. 1. Highly non-regenerating (which did not regenerate after first cut), 2. Moderately non-regenerating (which regenerated in second cut), 3. Moderately regenerating (which did not regenerate after third cut), 4. Highly regenerating (which regenerated in all the four cuts) (Table 2). It was observed that variety HC308 did not regenerate after taking the first cut, similarly forty one F_3 genotypes could not regenerate after taking the first cut while 79 lines regenerated in second cut. Seventy six F_3 lines regenerated in third cut. While 70 F_3 lines regenerated in fourth cut also along with the parent SSG59-3.

The highly regenerating F_3 lines may be used for breeding of multicut varieties of sorghum in order to meet ever increasing demand of green fodder for the live stock. The most diverse lines may be utilized for sorghum improvement programme particularly multi-cut varieties.

TABLE 2
Description of lines on the basis of regeneration

Category	Lines
Non-regenerating (Do not regenerate after first cut)	26, 31, 32, 33, 34, 38, 41, 42, 43, 44, 45, 46, 48, 49, 52, 53, 54, 55, 56, 61, 62, 68, 69, 73, 74, 76, 77, 78, 83, 84, 85, 88, 89, 95, 97, 98, 106, 107, 110, 117, 114 and parent HC308
Moderately non-regenerating (do not regenerated in second cut)	4, 10, 14
Moderately regenerating (not regenerated in third cut)	99, 101, 102, 103, 108, 109
Highly regenerating (regenerated even in fourth cut)	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 35, 36, 37, 39, 40, 47, 50, 51, 57, 58, 59, 60, 63, 64, 65, 66, 67, 70, 71, 72, 75, 79, 80, 81, 82, 86, 87, 91, 92, 93, 94, 96, 100, 105, 111, 112, 113, 115, 118, 19, 120, SSG 59-3 (Parent), 116

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