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Simultaneous Selection for Nutritional and Yield Components using Classical Selection Index in Finger Millet [*Eleusine coracana* (L.) Gaertn]

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Abstract Classical selection index was used for simultaneous selection of superior genotypes among diverse finger millet genotypes for the nutritional and yield components viz., plant height, days to 50% flowering, days to maturity, number of productive tillers per plant, fingers per ear, finger length ear weight per plant, 1000-seed weight, seed protein content, seed calcium content and seed yield per plant. The genetic advance of all the eleven characters under study was estimated by assigning equal economic weights to all characters as well as by using inverse of means as economic weights. In both the cases the characters viz., seed calcium content, days to maturity and days to 50% flowering recorded higher values of genetic advance while 1000-seed weight, fingers per ear and productive tillers per plant recorded lower values. Simultaneous selection taking all characters into consideration, found that IE-2884, Ratnagiri and Srichaitanya recorded higher selection index values in both the cases i.e., when the equal economic weights were assigned as well as when inverse of means are used as economic weights for estimation of selection index scores.

Keywords Simultaneous selection, Classical selection index, Finger millet.

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Introduction

Finger millet is highly nutritious as its grain contrains the high quality protein (7-10%). It is the richest source of calcium (344 mg/100 g), iron and other minerals. It is also rich in phosphorus (283 mg/100 g) and potassium (408 mg/100 g). The carbohydrates present in finger millet have the unique property of slower digestibility and regarded as food for long sustenance. It is an ideal grain for people with diabetes because of its low glycemic index. It also contains amino acids lecithin and methionine, which help in bringing down cholesterol level. In spite of its high nutritional value and wider adaptability its productivity levels are far less than actual yield potential (10 t ha^{-1} under optimum conditions).

The aim of most breeding programs is simultaneous improvement of several characters, so that the economic value is improved. Selection carried out simultaneously on all the characters for rapid improve-

Table 1. Weighing coefficients and estimates of genetic advance for different characters in finger millet [*Eleusine coracana* (L.) Gaertn.] when equal economic weights were assigned.

Sl. No.	Characters	Economic weights (a_i values)	Weighing coefficients (b_i values)	Expected genetic advance
1.	Plant height	1.000	0.6108	2.2226
2.	Days to 50% flowering	1.000	1.0775	3.1753
3.	Days to maturity	1.000	0.9798	3.7325
4.	Productive tillers per plant	1.000	1.3745	0.2620
5.	Fingers per ear	1.000	0.3373	0.2564
6.	Finger length	1.000	0.1622	0.3152
7.	Ear weight per plant	1.000	0.7245	1.9187
8.	1000-seed weight	1.000	4.0758	0.0727
9.	Seed protein content	1.000	0.6941	0.4574
10.	Seed calcium content	1.000	1.0215	49.3979
11.	Seed yield per plant	1.000	1.0555	0.7128

ment in the economic value is also referred as multiple trait selection [1]. One way of simultaneous selection is combining all the component characters together into a score or an index in such a way that when selection is applied to that index, most rapid improvement of economic value is expected [2]. Such an index was first proposed by smith [3] based on the discriminant function of Fisher [4].

Materials and Methods

The present investigation was carried out a Agricultural College Farm, Bapatla, Guntur District, Andhra Pradesh, which is located at an altitude of 5.4 m MSL, 15°54´N latitude and 80°90´E longitude. The experimental material consisted of forty three genotypes obtained from Agricultural Research Station (ARS), Vizianagaram, Andhra Pradesh. Simultaneous selection was carried out for eleven different nutritional and yield components viz., seed protein content, seed calcium content, plant height, days to 50% flowering, days to maturity, number of productive tillers per plant, fingers per ear, finger length, ear weight per plant, 1000-seed weight and seed yield per plant using classical selection index [5]. Material was sown in randomized complete block design and observations were recorded on ten randomly selected plants per treatment per replication and their means were used for statistical analysis. However, seed protein, seed calcium content days to 50% flowering, days to maturity and 1000-seed weight were recorded on plot basis. Protein content (%) of each sample was estimated as described by Sadasivam and Manickam [6]

Table 2. Weighing coefficients and estimates of genetic advance for different characters in finger millet [*Eleusine coracana* (L.) Gaertn.] when inverse of means were assigned as economic weights.

Sl. No.	Characters	Economic weights (a_i values)	Weighing coefficients (b_i values)	Expected genetic advance
1.	Plant height	0.0101	0.0062	1.6981
2.	Days to 50% flowering	0.0126	0.0125	3.7196
3.	Days to maturity	0.0092	0.0111	3.2272
4.	Productive tillers per plant	0.2256	0.2257	0.4518
5.	Fingers per ear	0.1412	0.0890	0.5523
6.	Finger length	0.1610	0.1256	0.6651
7.	Ear weight per plant	0.0419	0.0293	2.2740
8.	1000-seed weight	0.3617	0.5914	0.2784
9.	Seed protein content	0.1098	0.1090	0.7044
10.	Seed calcium content	0.0031	0.0039	27.3830
11.	Seed yield per plant	0.0564	0.0369	2.1610

Table 3. Selection index values of 43 finger millet genotypes when equal economic weights are assigned.

Sl. No.	Genotypes	Selection index value
1	GE-3138	561.52
2	VL-149	635.72
3	IE-2884	780.03
4	GE-2941	634.29
5	GE-3434	648.31
6	GE-1126	651.20
7	IE-501	639.24
8	IE-3077	642.19
9	DHRS-1-1	593.20
10	IE-4646	585.04
11	IE-4671	565.52
12	GPU-45	713.58
13	IE-6350	709.68
14	IE-2217	554.88
15	TNAU-1214	691.91
16	IE-2323	627.47
17	GE-1382	597.06
18	GPU-67	546.75
19	IE-2093	674.78
20	Kalyani	591.42
21	GE-2770	560.75
22	GE-3777	574.47
23	KB-105	688.85
24	VR-988	703.31
25	IE-4570	571.48
26	VR-900	643.72
27	DM-1	720.49
28	VR-959	638.03
29	IE-2293	694.80
30	IE-4545	738.27
31	PR-10-14	600.26
32	Bharathi	645.34
33	Srichaitanya	715.78
34	IE-2296	518.41
35	GE-844	602.32
36	Indaf-9	711.18
37	BR-10	602.79
38	Karikeddyragi	645.27
39	IE-4795	651.16
40	IE-2652	550.03
41	Ratnagiri	730.46
42	GPU-82	707.08
43	Godavari	624.20

Table 4. Selection index values of 43 finger millet genotypes when inverse of means are assigned as economic weights..

Sl. No.	Genotypes	Selection index value
1	GE-3138	9.89
2	VL-149	10.10
3	IE-2884	13.19
4	GE-2941	10.22
5	GE-3434	10.15
6	GE-1126	10.19
7	IE-501	9.05
8	IE-3077	10.52
9	DHRS-1-1	10.70
10	IE-4646	10.35
11	IE-4671	10.35
12	GPU-45	11.57
13	IE-6350	10.95
14	IE-2217	9.38
15	TNAU-1214	11.11
16	IE-2323	9.62
17	GE-1382	9.39
18	GPU-67	10.61
19	IE-2093	10.27
20	Kalyani	9.90
21	GE-2770	9.22
22	GE-3777	10.01
23	KB-105	10.23
24	VR-988	10.87
25	IE-4570	9.70
26	VR-900	10.60
27	DM-1	11.23
28	VR-959	10.29
29	IE-2293	10.28
30	IE-4545	10.60
31	PR-10-14	10.50
32	Bharathi	12.08
33	Srichaitanya	11.71
34	IE-2296	8.85
35	GE-844	9.98
36	Indaf-9	10.79
37	BR-10	10.04
38	Karikeddyragi	10.03
39	IE-4795	10.00
40	IE-2652	10.21
41	Ratnagiri	12.09
42	GPU-82	11.06
43	Godavari	11.28

and the seed calcium content in the sample was estimated by Versenate titration method [7].

Selection index or score should be constructed by assigning appropriate economic weights to different component characters. In the present study economic weights were assigned in two different ways. First, by assuming equal weights to all the characters i.e., economic weights of all the characters under the study are considered as unity or equal to one and the second, by considering the inverse of means of respective characters as their economic weights. Both the procedures used for assigning economic weights will reduce the wide differences among the means of

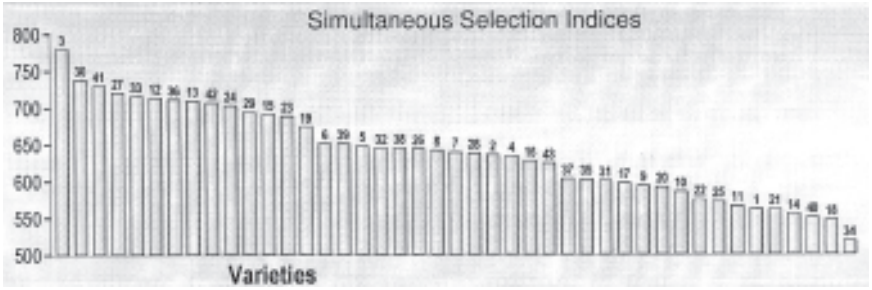

Fig. 1. Selection index values of 43 finger millet genotypes when equal economic weights are assigned.

characters and will give better validity to the estimates of genetic advance.

Results and Discussion

The economic weights (a_i values) for all the characters under study were taken as one and weighing coefficients (b_i values) were calculated, and these weighing coefficients were utilized for estimation of genetic advance of the each character. The weighing coefficients along with the corresponding estimates of genetic advances for all the characters were presented in the Table 1. Among the characters studied seed calcium content (49.3979) recorded the maximum expected genetic advance followed by days to maturity (3.7325), days to 50% flowering (3.1753), plant height (2.2226), ear weight per plant (1.9187), seed yield per plant (0.7128), seed protein content (0.4574), finger length (0.3152), productive tillers per plant (0.2620), fingers per ear (0.2564) and 1000-seed weight (0.0727).

Genetic advance of the each character was also estimated using the weighing coefficients obtained when inverse of mean of each character is taken as its economic weight. The weighing coefficients thus obtained for each character along with their expected genetic advances were presented in the Table 2. The assigned economic weights using the inverse of mean values of the respective characters were also indicated in the Table 2. When inverse of mean values were used as the economic weights, 1000-seed weight (0.3617) recorded the maximum economic weight (a_i value) followed by productive tillers per plant (0.2256), finger length (0.1610), fingers per ear (0.1412), seed protein content (0.1098), seed yield per plant (0.0564), ear weight per plant (0.0419), days to 50% flowering (0.0126), plant height (0.0101), days to maturity (0.0092) and seed calcium content (0.0031). Similar observation of maximum economic weight of 1000-seed weight was recorded by Padmaja et al. [8], both in *rabi* and *kharif* seasons. However contrasting findings were made with respect to seed calcium content in Italian millet by Prasanta et al. [9].

Among the eleven different characters studied seed calcium content (27.1750) recorded the maximum expected genetic advance when inverse of means are used as economic weights. The seed calcium content was followed by days to 50% flowering (3.7196), days to maturity (3.2272), ear weight per plant (2.2740), seed yield per plant (2.1610), plant height (1.6981), seed protein content (0.7044), finger length (0.6651), fingers per ear (0.5523), productive tillers per plant (0.4518) and 1000-seed weight (0.2784).

The traits seed calcium content, days to maturity and days to 50% flowering recorded higher values of genetic advance while 1000-seed weight, fingers per ear and productive tillers per plant recorded lower values in both the cases i.e., when the equal weights were assigned as well as when inverse of means are used as economic weights.

The simultaneous selection index values considering all the eleven component characters considered in present study were calculated for different genotypes using the weighing coefficients (b_i values) ob-

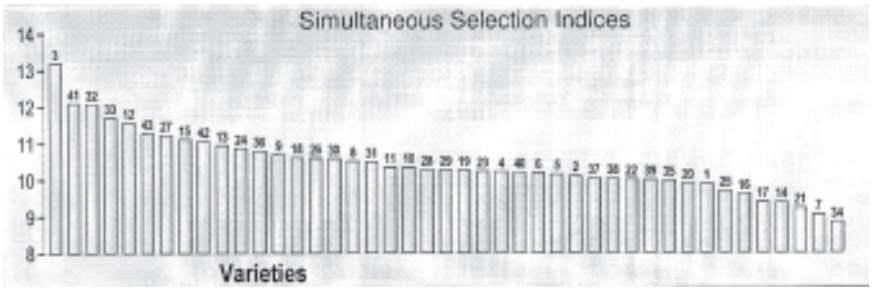

Fig. 2. Selection index values of 43 finger millet genotypes when equal economic weights are assigned.

tained by both methods and are presented in the Tables 3 and 4.

When equal economic weights were used, the genotype IE-2884 (780.03) recorded highest index value followed by IE-4545 (738.27), Ratnagiri (730.46) and DM-1 (720.49) while low index values were recorded by IE-2296 (518.41), GPU-67 (546.75) and IE-2652 ((550.03). The genotypes were arranged in the descending order of their selection index values and are presented graphically in the Fig. 1.

When inverse of means are used as economic weights, the genotype IE-2884 (13.19) recorded maximum selection index value and is followed by Ratnagiri (12.09), Bharathi (12.08) and Srichaitanya (11.71) while the low index values were recorded by IE-2296 (8.85), IE-501 (9.05) and GE-2770 (9.22). The genotypes were arranged in descending order with respect to their selection index value and a graphical representation was given in Fig. 2.

The genotypes IE-2884, Ratnagiri and Srichaitanya recorded higher selection index values in both the cases i.e., when the equal economic weights were assigned as well as when inverse of means are used as economic weights. These results indicate that these five genotypes are superior compared to all other genotypes when simultaneous selection for all the characters bis carried out.

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