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Simultaneous selection Indices in exotic Genotypes of Italian millet [*Setaria italica* (L.) Beauv]

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Abstract: *Selection indices are useful in understanding the extent of improvement that can be effected in yield by combination of characters. It forms the basis in considering the correlated characters for higher efficiency in selection for yield. Keeping the above points in view, study on classical selection indices in 34 exotic genotypes of Italian millet carried out for 13 characters during kharif and rabi. Among exotic group of genotypes, GS 462, GS 489 and GS 488 for kharif and GS 462, GS 463 and GS 458 for rabi are to be favoured. In general, the indices, which include more than one character, gave high genetic advance suggesting the utility of selection index for simultaneous improvement of several characters. It was observed that inclusion of characters one by one in the function gave fluctuating changes in the value of genetic advance and relative efficiencies over yield. A selection index of eight characters combination i.e. grain yield per plant, days to 50% flowering , plant height, number of productive tillers per plant, ear weight, carotene, 1000 grain weight and crude protein content had recorded high genetic advance and relative efficiency over grain yield per plant alone during kharif where as selection index of nine characters combination i.e. grain yield per plant, days to 50% flowering , plant height, number of productive tillers per plant, ear length, ear weight, 1000 grain weight, crude protein content and calcium content had recorded high genetic advance and relative efficiency over grain yield per plant alone during rabi. These classical selection indices may be given due weightage for simultaneous improvement in the respective groups.*

Key words*: Italian millet, selection indices, Seteria italica, classical selection*

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I. Introduction

Selection of plants indiscriminately from a field on the basis of phenotypic expressions might lead to disappointing results. It is not the phenotypic character but the genotypic value that should be accounted to form the basis for selecting plants. Thus, index based on economic characters should give weight age to the phenotypic expression in terms of genotype by eliminating environmental variation (Panse, 1949). The adoption of discriminant function solves the problem of apportioning the total effect by discriminating environmental effect and also by assigning relative weights to each of the yield components based on its genotypic contribution (Panse,1957).

When selection is applied to the improvement of economic value of a plant, it is generally applied to several characters simultaneously and not just to one, because economic value depends on more than one character. This is usually referred to as multiple trait selection. The method that is expected to give more rapid improvement of economic value, however is to apply selection simultaneously to all the component characters together by giving appropriate weights to each character (Falconer,1964).

Foxtail millet ranks second in the world's total production of millets. It is generally raised as rain fed crop in India. It is usually cooked whole or made into meal or into beer. It can also make useful hay or silage. In addition foxtail millet is consumed as stiff porridge called sargati, or as leavened bread known as roti, after the dehulled grain has been milled into flour. Foxtail millet with a short growing period is grown extensively in diverse agro- climatic regions for grain and fodder. It is known for its drought tolerance and is an indispensable crop of vast rain fed areas in semi-arid regions of India. It is also grown in nutrient deficient soils and possesses tolerance to pests and diseases. The grain is a good source of protein and contains β-carotene. Italian millet grain possesses 12.3% protein, 4.7% fat, 60.6% carbohydrates and 3.2% ash.

II. Material And Methods:

The present investigation was undertaken at Agricultural College Farm, Bapatla, Guntur (Dt.), Andhra Pradesh with the 34 exotic genotypes of Italian millet [*Setaria italica* (L.) Beauv] procured from collections maintained at All India Co-ordinated Small Millets Improvement Project (AICSMIP), Bengaluru. The studies were carried out separately during two seasons of 2008-2009, namely k*harif* 2008 and r*abi* 2009. The genotypes

are sown separately in randomized block design with four replications. Each genotype was sown in four rows of 5mts length spaced at 25 X 10 cm apart. Data were collected on 10 randomly tagged competitive plants per genotype per replication for number of productive tillers per plant, plant height, flag leaf area, ear length, ear weight, straw weight, grain yield. However data on days to 50 %flowering, days to maturity, grain protein%, calcium content and grain β-carotene were recorded on plot basis. The genetic worth (H) of genotypes was calculated as defined by Smith (1936). The expected genetic advance, by constructing different discriminant functions was calculated and relative efficiency of each discriminant function was estimated as per Brim *et al.* (1959).

III. Results And Discussion:

The economic weights (a_i) and weighing coefficient (b_i) values given for different characters embodied in Table 1. Selection criterion values for the both seasons are presented in Table 2. Results of Selection Indices constructed using Fisher's discriminant function during both seasons presented in tables 3 and 4.

The trait carotene(4.86) recorded highest a_i value followed by 1000 grain weight(0.61) and ear weight(0.44) during *kharif* where as in *rabi* carotene(4.25) followed by 1000 grain weight(0.38) and calcium content (0.24). Least a_i value (0.01) recorded by days to maturity during *kharif* and plant height, days to maturity and flag leaf area in *rabi.*

In these genotypes, carotene(4.4713) recorded highest b_i value followed by number of productive tillers per plant (0.6715) and 1000 grain weight(0.5807) during *kharif* where as in *rabi* carotene(3.7427) followed by 1000 grain weight(0.3381)and calcium content (0.2381). Least b_i values recorded by plant height (0.0161) and days to maturity (0.0117) during *kharif* where as in *rabi* plant height (0.0082) and days to 50% flowering (0.0095).

Selection criterion during *kharif* and *rabi* are presented in Table 3. Among exotic group of genotypes, during *kharif* high values were observed for GS 462(17.66) followed by GS 489(16.38), GS 488(16.31) while during *rabi* 2009 in genotypes GS 462(16.67) followed by GS 463(16.49), GS 458(15.39).

When several traits influence the net worth of an organism it is essential to know the proportionate contribution of the characters, if maximum progress under selection is made (Hazel and Lush, 1942). It might sometimes be possible to get more rapid progress under selection for a correlated response than for selection for the desired character itself (Lerner, 1950).

In exotic genotypes, eight characters i.e. grain yield per plant, days to 50% flowering , plant height, number of productive tillers per plant, ear weight, carotene, 1000 grain weight and crude protein content during *kharif* where as nine characters *i.e.* grain yield per plant, days to 50% flowering , plant height, number of productive tillers per plant, ear length, ear weight, 1000 grain weight, crude protein content and calcium content during *rabi* together formed efficient selection indices and these traits may be useful for simultaneous improvement in the respective groups. It was observed that inclusion of characters one by one in the function gave fluctuating changes in the value of genetic advance and relative efficiencies over yield

Robinson *et al.* (1951) reported in corn that when economic characters were considered the progress measured in terms of yield alone will be greater. In the present study inclusion of characters one by one in the function gave almost the similar changes in genetic advance in both groups. Similar results were earlier reported by Shankar *et al.*(1963), Mahadevappa *et al.* (1965), Gian Singh(1974), Dhagat *et al.* (1977), Mishra *et al.* (1983), Basavaraja and sheriff (1992) Bhat and Shariff (1994).

IV. Conclusions:

Among exotic group of genotypes, GS 462, GS 489 and GS 488 for *kharif* and GS 462, GS 463 and GS 458 for *rabi* are to be favoured In general, the indices, which include more than one character, gave high genetic advance suggesting the utility of selection index for simultaneous improvement of several characters. It was observed that inclusion of characters one by one in the function gave fluctuating changes in the value of genetic advance and relative efficiencies over yield. A selection index of eight characters combination i.e. grain yield per plant, days to 50% flowering , plant height, number of productive tillers per plant, ear weight, carotene, 1000 grain weight and crude protein content had recorded high genetic advance and relative efficiency over grain yield per plant alone during *kharif* where as selection index of nine characters combination i.e. grain yield per plant, days to 50% flowering , plant height, number of productive tillers per plant, ear length, ear weight, 1000 grain weight, crude protein content and calcium content had recorded high genetic advance and relative efficiency over grain yield per plant alone during *rabi*

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Table 1 : Economic weights (a_i) and weighing coefficients (b_i) for different characters in exotic genotypes during *kharif* 2008 and *rabi* 2009 in Italian millet [*Setaria italica* (L.) Beauv]

Character	Economic weights (a_i)		Weighing coefficients (b_i)	
	kharif 2008	***rabi 2009***	***kharif 2008***	***rabi 2009***
Days to 50% flowering	0.02	0.02	0.0275	0.0095
Plant height(cm)	0.02	0.01	0.0161	0.0082
Days to maturity	0.01	0.01	0.0117	0.0259
Number of productive tillers/ plant	0.34	0.09	0.6715	0.0915
Flag leaf area(cm^2)	0.04	0.01	0.0347	0.0138
Ear length(cm)	0.11	0.05	0.1152	0.0492
Ear weight (g)	0.44	0.20	0.4883	0.2310
Straw weight (g)	0.05	0.02	0.0623	0.0262
1000 grain weight(g)	0.61	0.38	0.5807	0.3381
Carotene (mg/100g)	4.86	4.25	4.4713	3.7427
Crude protein (%)	0.14	0.11	0.1330	0.0970
Calcium content (mg/100g)	0.31	0.24	0.3132	0.2381
Grain yield/ plant (g)	0.16	0.03	0.0630	0.0282

Table 2: Selection criterion values for exotic genotypes in Italian millet [*Setaria italica* (L.) Beauv] in classical selection indices.

S.No	Genotypes	*kharif 2008*	*rabi 2009*
1	GS 454	13.46	13.74
2	GS 455	14.31	11.17
3	GS 456	14.01	11.84
4	GS 457	13.72	13.11
5	GS 458	14.93	15.39
6	GS 459	14.54	14.88
7	GS 461	14.90	14.19
8	GS 462	17.66	16.67
9	GS 463	14.81	16.49
10	GS 464	14.24	12.12
11	GS 465	14.29	11.03
12	GS 467	14.52	11.67
13	GS 469	11.79	14.08
14	GS 470	13.22	12.06
15	GS 472	13.27	11.19
16	GS 473	14.11	12.38
17	GS 474	11.73	12.11
18	GS 475	13.74	15.01
19	GS 476	13.26	12.99
20	GS 477	16.17	12.22
21	GS 478	14.46	12.72
22	GS 479	13.13	14.80
23	GS 480	14.13	14.74
24	GS 481	11.57	13.45
25	GS 482	12.18	14.43
26	GS 484	11.36	11.57
27	GS 485	12.30	11.78
28	GS 486	15.32	14.17
29	GS 487	15.75	14.23
30	GS 488	16.31	13.88
31	GS 489	16.38	13.35
32	GS 490	14.67	11.74
33	GS 491	13.59	11.56
34	GS 492	11.84	12.79

Table 3: Selection indices for different character combinations in exotic genotypes of Italian millet [*Setaria italica* (L.) Beauv] during *kharif* 2008.

S.No.	Character Combination	Genetic Advance	Relative efficiency over grain yield/plant
1	Grain Yield per plant (g) (X_1)	2.92	100.00
2	Days to 50% flowering (X_2)	1.65	56.76
3	Plant height (cm)(X_3)	5.07	173.75
4	Number of productive tillers per plant(X_4)	0.52	17.90
5	Ear length (cm)(X_5)	1.74	59.70
6	Ear weight (g)(X_6)	0.46	15.86
7	Carotene (mg/100g)(X_7)	0.39	13.35
8	1000 grain weight (g)(X_8)	0.07	2.42
9	Crude protein percent (mg/100g)(X_9)	1.07	36.71
10	Calcium content (mg/100g) (X_{10})	1.29	44.10
11	X_3X_4	7.13	244.45
12	$X_2X_5X_6$	8.35	286.44
13	$X_2X_3X_5X_6$	8.78	301.29
14	$X_2X_3X_4X_6X_7$	9.11	312.54
15	$X_2X_3X_4X_6X_7X_8$	9.38	321.59
16	$X_1X_2X_3X_4X_6X_7X_8$	9.58	328.48
17	$X_1X_2X_3X_4X_6X_7X_8X_9$	9.62	330.07
18	$X_1X_2X_3X_4X_6X_7X_8X_9X_{10}$	9.61	329.81
19	$X_1X_2X_3X_4X_5X_6X_7X_8X_9X_{10}$	9.58	328.70

Table 4: Selection indices for different character combinations in exotic genotypes of Italian millet [*Setaria italica* (L.) Beauv] during *rabi* 2009.

S.No	Character Combination	Genetic Advance	Relative efficiency over grain yield/plant
1	Grain Yield per plant (g) (X_1)	12.14	100.00
2	Days to 50% flowering (X_2)	1.59	13.10
3	Plant height (cm)(X_3)	5.81	47.88
4	Number of productive tillers per plant(X_4)	2.90	23.90
5	Ear length (cm)(X_5)	1.73	14.22
6	Ear weight (g)(X_6)	1.47	12.08
7	Carotene (mg/100g)(X_7)	0.38	3.17
8	1000 grain weight (g)(X_8)	0.09	0.74
9	Crude protein percent (mg/100g)(X_9)	1.16	9.55
10	Calcium content (mg/100g) (X_{10})	1.55	12.73
11	X3X4	16.27	134.03
12	$X_1X_3X_4$	17.15	141.29
13	$X_1X_2X_4X_5$	19.11	157.41
14	$X_1X_2X_3X_5X_6$	20.02	164.92
15	$X_1X_2X_3X_4X_6X_7$	21.19	174.55
16	$X_1X_2X_3X_4X_5X_7X_8$	21.38	176.13
17	$X_1X_2X_3X_4X_5X_6X_8X_9$	21.39	176.19
18	$X_1X_2X_3X_4X_5X_6X_8X_9X_{10}$	21.86	180.09
19	$X_1X_2X_3X_4X_5X_6X_7X_8X_9X_{10}$	21.67	178.56