



Restriction Selection Indices in Indian genotypes of Italian millet [*Setaria italica* (L.) Beauv]

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ABSTRACT

The present investigation was carried out with 18 Indian genotypes to know the effect of restriction selection indices on yield in Italian millet. The restricted selection indices indicated that by restricting the quality parameters in Indian genotypes the genetic enhancement of grain yield per plant can be improved both in *kharif* and *rabi* seasons. So while aiming for genetic enhancement of yield, a balance between yield and quality parameters should be considered as they constitute staple food for poor people.

Key words : Italian millet, Restriction Selection Indices

Foxtail millet with a short growing period is grown extensively in diverse agro-climatic regions for grain and fodder. This crop is grown for human food in North Africa, Southeastern Europe, Japan and 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 a leavened bread known as roti, after the dehulled grain has been milled into flour. The grain is a good source of protein and contains β -carotene, which is a precursor of vitamin-A (Murugan and Nirmalakumari, 2006). Italian millet grain possesses 12.3% protein, 4.7% fat, 60.6% carbohydrates and 3.2% ash.

MATERIAL AND METHODS

The present investigation was undertaken at Agricultural College Farm, Bapatla, Guntur (Dt.), Andhra Pradesh with 18 Indian 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 consecutive seasons of 2008-2009, namely *kharif* 2008 and *rabi* 2009. The genotypes were sown separately in randomized block design with four replications. Each genotype was sown in four rows of 5 m 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 and grain yield. However, days to 50 %flowering,

days to maturity, grain protein%, calcium content and grain β -carotene were recorded on plot basis.

Under certain situations the breeder might like to effect change in means of some characters while keeping the means of other characters unchanged. This is the case of restricted selection *i.e.*, the breeder requires to maximize the correlation between the genetic worth value (H) of the genotype and the phenotypic performance value (I) of various characters of the genotype, such that the genetic advance in restricted character becomes zero.

A solution to this problem of index construction was given by Kempthorne and Nordskog (1959) by using log range multiplier. Restricted selection indices using single case restriction for all 13 characters were calculated and genetic advance was calculated for each character in each restriction as per Singh and Chaudhary (1977).

RESULTS AND DISCUSSION

The character wise weighing coefficients (b_i) values for Indian genotypes during *kharif* and *rabi* are presented in Table 1. The character wise genetic advance values (G_i) for Indian genotypes during *kharif* and *rabi* are embodied in Table 2 and 3.

Kharif 2008

In Indian genotypes carotene (4.0748) recorded highest b_i value followed by number of productive tillers per plant (1.0041) and ear weight (0.4881) during *kharif* where as in *rabi* carotene (2.3997) followed by 1000 grain weight (0.5375) and calcium content (0.3263). Days to

Table 1: Weighing coefficients (b_i) for different characters in Indian genotypes during *kharif* 2008 and *rabi* 2009 in Italian millet.

Character	Indian Genotypes	
	<i>kharif</i> 2008	<i>rabi</i> 2009
Days to 50% flowering	0.0385	-0.0277
Plant height(cm)	0.0141	0.0096
Days to maturity	-0.0036	0.1301
Number of productive tillers/ plant	1.0041	0.1291
Flag leaf area(cm ²)	0.0391	0.0030
Ear length(cm)	0.0742	0.0561
Ear weight (g)	0.4881	0.2363
Straw weight (g)	0.0458	0.0221
1000 grain weight(g)	0.4012	0.5375
Carotene (mg/100g)	4.0748	2.3997
Crude protein (%)	0.0740	0.2050
Calcium content (mg/100g)	0.3330	0.3263
Grain yield/ plant (g)	-0.0298	0.0107

maturity (-0.0036) and grain yield per plant (-0.0298) noted least b_i values during *kharif* where as in *rabi* flag leaf area (0.0030) and days to 50% flowering (-0.0277).

The carotene showed maximum b_i values in Indian genotypes during both the seasons. It is followed by 1000 grain weight during *rabi*.

By restricting days to 50% flowering, highest value of genetic advance was observed for plant height (7.206) and least value for days to maturity (-0.9116). By restricting plant height, highest value of genetic advance was observed for straw weight (1.6159) and least value for days to maturity (-0.1560). By restricting days to maturity, highest value of genetic advance was observed for plant height (8.5843) and least value for calcium content (-0.1540). By restricting number of productive tillers per plant, highest value of genetic advance was observed for flag leaf area (2.003) and least value for per cent crude protein (-0.0386). By restricting flag leaf area, highest value of genetic advance was observed for plant height (4.922) and least value for days to maturity (-0.8350). By restricting ear length, highest value of genetic advance was observed for plant height (7.6524) and least value for carotene (0.0068). By restricting ear weight, highest value of genetic advance was observed for straw weight (3.3852) and least value for per cent crude protein (-0.2247). By restricting straw weight, highest value of genetic advance was observed for plant height (3.5977) and least value

for 1000 grain weight (-0.0765). By restricting 1000 grain weight, highest value of genetic advance was observed for plant height (9.3138) and least value for calcium content (-0.1716). By restricting carotene content, highest value of genetic advance was observed for plant height (9.2819) and least value for calcium (-0.1337). By restricting crude protein percentage, highest value of genetic advance was observed for plant height (9.2357) and least value for calcium content (-0.0832). By restricting calcium content, highest value of genetic advance was observed for plant height (8.6856) and least value for carotene (0.0026). By restricting grain yield per plant, highest value of genetic advance was observed for straw weight (2.3394) and least value for per cent crude protein (-0.0713).

In Indian genotypes during *kharif* maximum genetic gain was observed for yield per plant by restricting 1000 grain weight, carotene, and days to maturity, crude protein per cent and calcium content where as minimum genetic gain was observed for yield per plant by restricting number of productive tillers per plant and ear weight.

Rabi 2009

By restricting days to 50% flowering, highest value of genetic advance was observed for flag leaf area (5.7739) and least value for plant height (-0.2294). By restricting plant height, highest value of genetic advance was observed for grain yield per plant (9.1241) and least value for per cent crude

Table 2. Genetic advance values in case of restricted selection indices in Indian genotypes of Italian millet during *kharif* 2008.

Character	Days to 50% flowering	Plant height(cm)	Days to maturity	Number of productive tillers/ plant	Flag leaf area(cm ²)
Days to 50% flowering	-	0.2655	0.5151	0.5913	0.0020
Plant height(cm)	7.2066	-	8.5843	0.7217	4.9224
Days to maturity	-0.9116	-0.1560	-	0.9969	-0.8350
Number of productive tillers plant ⁻¹	0.6696	0.1548	0.7657	-	0.4835
Flag leaf area(cm ²)	2.5523	1.5833	3.5291	2.0037	-
Ear length(cm)	0.3159	0.4398	0.7641	0.1783	0.2634
Ear weight (g)	0.8507	0.3310	0.9369	0.1877	0.6331
Straw weight (g)	4.5802	1.6159	5.2507	1.6191	3.2164
1000 grain weight(g)	0.1127	0.0630	0.0761	0.1371	0.1260
Carotene (mg/100 g)	-0.0033	0.0222	-0.0014	0.0275	0.0062
Crude protein (%)	0.2366	0.1898	0.2399	-0.0386	-0.0645
Calcium content (mg/100 g)	-0.1529	0.3439	-0.1540	0.4507	-0.1542
Grain yield/ plant (g)	4.6147	1.0964	5.2451	0.0196	3.3138

Ear length(cm)	Ear weight (g)	Straw weight(g)	1000 grain weight(g)	Carotene (mg/100 g)	Crude protein(%)	Calcium content (mg/100g)	Grain yield plant ⁻¹ (g)
0.3402	0.9450	0.5454	0.9794	0.9445	0.9564	0.9430	0.6899
7.6524	3.1533	3.5977	9.3138	9.2819	9.2357	8.6856	1.1783
0.0270	2.0269	0.5403	1.1124	1.0788	1.1737	1.0989	1.3678
0.6175	0.2119	0.3509	0.7917	0.7796	0.7521	0.7297	0.0355
3.0413	2.6764	2.2039	4.3170	4.2281	3.9323	4.2348	2.1397
-	0.7813	0.3255	1.0833	1.0190	0.9133	0.9213	0.4019
0.8096	-	0.5899	0.9363	0.9135	0.8462	0.8808	0.1203
4.2641	3.3852	-	5.2964	5.5049	5.3617	5.1420	2.3394
0.1136	0.2133	-0.0765	-	0.0692	0.1343	0.0839	0.1931
0.0068	0.0026	0.0100	-0.0020	-	0.0001	0.0026	0.0236
0.0505	-0.2247	0.0958	0.3005	0.2040	-	0.1531	-0.0713
0.0239	0.0883	0.2411	-0.1716	-0.1337	-0.0832	-	0.3498
4.3329	0.9288	2.7510	5.3891	5.2512	5.0313	-	-

Table 3. Genetic advance values in case of restricted selection indices in Indian genotypes of Italian millet during *rabi* 2009.

Character	Days to 50% flowering	Plant height(cm)	Days to maturity	Number of productive tillers plant ⁻¹	Flag leaf area(cm ²)	Ear length (cm)
Days to 50% flowering	-	1.5951	-0.0315	0.9125	1.9368	1.6889
Plant height(cm)	-0.2294	-	0.1075	2.8807	4.7372	2.7062
Days to maturity	0.2591	2.0702	-	1.2737	2.4558	2.2068
Number of productive tillers plant ⁻¹	0.4260	1.7599	0.4205	-	2.1047	1.633
Flag leaf area(cm ²)	5.7739	6.5138	6.4929	7.7587	-	1.8706
Ear length(cm)	0.8900	1.1272	1.0472	1.3216	0.8139	-
Ear weight (g)	0.9443	1.1082	0.7781	0.9757	0.8132	0.8706
Straw weight (g)	3.2512	7.1882	2.4786	4.8769	9.2408	8.6033
1000 grain weight(g)	0.0741	0.1168	0.0963	0.0816	0.0124	0.1092
Carotene (mg/100 g)	0.0001	0.0211	0.0025	0.0183	0.0298	0.0227
Crude protein (%)	0.0765	-0.1196	0.1484	0.1080	-0.1735	-0.0880
Calcium content (mg/100 g)	0.7076	0.3527	0.7052	0.5024	0.1683	0.0728
Grain yield plant ⁻¹ (g)	4.9287	9.1241	3.1627	5.3555	10.434	10.2626

Ear weight (g)	Straw weight(g)	1000 grain weight(g)	Carotene (mg/100 g)	Crude protein(%)	Calcium content (mg/100 g)	Grain yield plant ⁻¹ (g)
1.8601	0.9535	2.0281	1.5387	2.0057	2.2128	1.1268
6.3834	0.7698	5.2841	3.3280	4.8291	5.1068	4.2935
2.0511	1.1727	2.5479	2.0183	2.4825	2.7152	1.1343
1.9152	0.9185	2.0122	1.7426	1.9442	2.1466	0.8759
2.5554	7.1804	5.3780	6.8948	6.8219	5.7478	9.8602
1.0918	1.3554	1.5528	1.2863	1.4801	1.2792	1.9137
-	0.7748	0.8820	1.1519	0.9900	0.9865	0.3152
7.1223	-	9.5321	9.6357	9.3307	9.8412	2.3422
-0.0876	0.1377	-	0.1031	0.0759	0.1041	0.0261
0.0404	0.0354	0.0300	-	0.0277	0.0234	0.0342
0.1228	-0.1958	-0.0769	-0.0509	-	-0.0786	0.0562
0.1776	0.5707	0.3517	0.1126	0.2788	-	0.5584
4.3224	3.2097	9.1651	9.7708	9.3478	10.0715	-

protein (-0.1196). By restricting days to maturity, highest value of genetic advance was observed for flag leaf area (6.4929) and least value for days to 50% flowering (-0.0315). By restricting number of productive tillers per plant, highest value of genetic advance was observed for flag leaf area (7.7587) and least value for carotene (0.0183). By restricting flag leaf area, highest value of genetic advance was observed for grain yield per plant (10.4348) and least value for per cent crude protein (-0.1735). By restricting ear length, highest value of genetic advance was observed for grain yield per plant (10.2626) and least value for per cent crude protein (-0.0880). By restricting ear weight, highest value of genetic advance was observed for straw weight (7.1223) and least value for 1000 grain weight (-0.0876). By restricting straw weight, highest value of genetic advance was observed for flag leaf area (7.1804) and least value for per cent crude protein (-0.1958). By restricting 1000 grain weight, highest value of genetic advance was observed for straw weight (9.5321) and least value for per cent crude protein (-0.0769). By restricting carotene content, highest value of genetic advance was observed for grain yield per plant (9.7708) and least value for per cent crude protein (-0.0509). By restricting crude protein percentage, highest value of genetic advance was observed for grain yield per plant (9.3478) and least value for carotene (0.0277). By restricting calcium content, highest value of genetic advance was observed for grain yield per plant (10.0715) and least value for per cent crude protein (-0.0786). By restricting grain yield per plant, highest value of genetic advance was observed for flag leaf area (9.8602) and least value for 1000 grain weight (0.0261).

In Indian genotypes, during *rabi* maximum genetic gain was observed for yield per plant by restricting flag leaf area, ear length and calcium content where as minimum genetic gain was observed for yield per plant by restricting days to maturity and straw weight.

Padmaja *et al.*, (2007) reported that during both *kharif* and *rabi*, single restriction cases of days to 50% flowering, fingers per ear, yield per plant, 1000 seed weight and protein per cent gave highest genetic advance values in finger millet.

Construction of selection indices will be helpful for making selection on seeral characters (Venkateswara Rao, 1985; Basavaraj and Sheriff, 1992).

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