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EVALUATION OF HYBRIDS FOR DRY FODDER YIELD STABILITY IN PEARLMILLET

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SUMMARY

An experiment was conducted to study the stability of 30 hybrids of prearlmillet during **kharif** season at four locations. Analysis of variance for stability revealed that mean squares due to genotypes and environments + G x E interaction were highly significant, indicating that there existed significant differences among genotypes and also the environments were different from each other and genotypes reacted differently in different environments. The results also revealed that two hybrids viz., 94111A x 1250 and 96111A x (G73-107 x bsectap1) were found stable over the environments. The hybrid ICMA97444 x ICMR0/035 was suitable for poor environment.

Key words : Hybrids, environment, stability, dry fodder yield, pearlmillet

India supports nearly 20 per cent of the world's livestock and human population with only 2.3 per cent of the world geographical area. India is the leader in cattle (16%) and buffalo (55%). The deficiency in feed and fodder has been identified as one of major constraints in achieving the desired level of livestock production. The shortage in fodder could be met out by developing high fodder yielding stable hybrids/varieties of pearlmillet (Arya *et al.*, 2009). The potential of pearlmillet as an excellent forage crop is well known, particularly in arid and semi-arid regions of the world. It is a multipurpose cereal grown for grain, stover and green fodder. It is highly vigorous, drought and heat tolerant crop. It's fodder is rich in protein, calcium, phosphorus and other minerals, as well as low in oxalic acid and hydrocynic acid content. The maximum level of production and stability of yield are the two desired features in a commercial hybrid variety. Indeed, development of hybrids showing wide adaptability has received increasing attention in recent years. Considering the above facts in view, the present study was carried out to identify the stable hybrids of pearlmillet for fodder yield and its contributing traits.

MATERIALS AND METHODS

The experiment was conducted at different Research Farms of CCS Haryana Agricultural University, Hisar to study the stability of 30 hybrids of prearlmillet during **kharif** season at four locations viz., Plant Breeding Research Area (E_1), Regional Research Station, Bawal (E_2), Plant Pathology Research Area, Hisar (E_3) and Dry Land Research Area, Hisar (E_4). These hybrids were developed by Bajra Section, Department of Plant Breeding, CCSHAU, Hisar. All the 30 hybrids were grown in RBD with three replications in five rows per plot of 4 m length with spacing of 50 and 30 cm between and within rows at each location. Observations were recorded on five competitive and randomly selected plants of each genotype for days to 50 per cent flowering, plant height (cm), total tillers and dry fodder yield (g/plant). Sability analysis was carried out as per Eberhart and Russell (1966).

RESULTS AND DISCUSSION

Analysis of variance for stability (Table 1) revealed that mean squares due to genotypes and environments + G x E interaction were highly significant, indicating that there existed significant differences among genotypes and also the environments were different from each other and genotypes reacted differently in different environments. Further, the partitioning of mean squares due to G x E interaction into linear and non-linear components (Table 2) revealed that G x E (linear) was predominant for characters like days to 50 per cent flowering, plant height, and dry fodder yield and performance of genotypes for these characters could be predicted across the environments. However, for total tillers both linear and non-linear components of G x E interaction were equally important. These results are in agreement with those of Sharikant *et al.* (2000), Shinde *et al*. (2002), Yahaya *et al*. (2005) and Arya *et al*. (2009).

The results on estimates of environmental index (Table 3) revealed that E_1 (irrigated condition at Hisar) was most favourable environment for all the characters. Dry fodder yield invariably decreased under dryland condition (E_4). These results are in agreement with Sharikant *et al.* (2000), Shinde *et al*. (2002), Yahaya *et al*. (2005) and Arya *et al*. (2009).

Regression analysis of individual hybrid (Table 4) revealed that two hybrids viz., 94111A x 1250 and 96111A x (G73-107 x bsectap1) were found stable over the environments with above average dry fodder yield, unit regression coefficient and non-significant value of S^2di. The hybrid ICMA97444 x ICMR0/035 was suitable for poor environment because of high mean value, bi value less than unity and non-significant value of S^2di. Above findings were supported by Yahaya *et al*. (2005) and Arya *et al*. (2009).

The hybrids 94222A x 1305, 94444A x 77/371, 94555A x H177/833-2, 96111A x (G73-107 x bsectcap1), 9A x G73-107 and HHB-117 were found stable over the environments because it had average mean value, bi value was less than one and S^2di equal to zero, remaining hybrids were unstable for all the environments. Similar findings have also been reported by Kumar (2006) and Arya *et al.* (2009).

Hybrids 9711A x HBL-11 and 97111A x CSSC46-2 were stable for plant height because of having high maen, bi value equal to one and S^2di equal to zero and non-significant. The hybrid 23A x G73-107 was found to be suitable for favourable environment, while two hybrids, namely, HHB67-1 and ICMA 97444A x ICMR0/035 were found responsive for poor environment. Above findings were also supported by Kumar (2006) and Arya *et al.* (2009) and Arya and Yadav (2009).

Hybrids 9411A x 1250, 97111A x CSSC46-2, ICMA97444A x H77/833-2, 94444A x 77/371, 6A 77/833-2, 18A x 1704 and ICMA97444A x ICMA97444A x ICMAR0/46 were most desirable for early flowering. Since these hybrids had below average mean, unit value of bi and S^2di equal to zero. One hybrid, namely, 94111A x 77/371 was found promising for favourable environment because of below average value of mean, bi value more than one and S^2di equal to zero. Seven hybrids were suitable for poor environment because of low value of

TABLE 1
Analysis of variance for stability for different characters

Source of variation	d. f.	Days to 50% flowering	Total tillers/ plant	Plant height (cm)	Dry fodder yield (g/plant)
Genotype	29	56.882**	0.920*	568.199**	526.610**
Env.+(G x E)	90	17.940**	3.328**	484.060**	976.523**
Env. (L)	1	1307.656**	260.739**	33394.888**	68757.359**
G x E (L)	29	10.210**	0.377	173.345**	487.247**
Pooled deviation	60	0.181	0.464**	85.726**	83.325**
Pooled error	232	0.707	0.116	12.096	8.513

TABLE 2
Magnitude (%) of linear and non-linear components of G x E interaction

S. No.	Characters	Linear	Non-linear
1.	Days to 50% flowering	98.25	1.75
2.	Total tillers/plant	42.85	57.14
3.	Plant height (cm)	68.63	31.36
4.	Dry fodder yield (g/plant)	86.48	13.51

TABLE 3
Environmental index for different characters

Character	E_1	E_2	E_3	E_4
Days to 50% flowering	3.050	-3.127	3.538	-3.461
Total tillers/plant	1.210	-2.465	0.344	0.910
Plant height (cm)	22.309	-5.650	6.582	-23.241
Dry fodder yield (g/plant)	27.802	-25.937	19.615	-21.480

TABLE 4
Distribution of 30 hybrids on basis of stability parameters

Character	Predictable		Unpredictable	
	Both bi & S^2di non-significant	Only bi significant	Only S^2di significant	Both bi & S^2di significant
Days to 50% flowering	11	19	0	0
Total tillers/plant	12	2	16	0
Plant height (cm)	2	4	24	0
Dry fodder yield (g/plant)	2	3	19	6

TABLE 5
Estimates of stability parameters of pearlmillet hybrids for grain yield and its attributes

Genotype	Days to 50% flowering			Total tillers/plant			Plant height (cm)			Dry fodder yield (g/plant)		
	X	bi	S^2di	X	bi	S^2di	X	bi	S^2di	X	bi	S^2di
6A x 77/833-2	37.750	0.832	-0.061	5.657	1.127	1.221**	169.683	0.438**	-2.871	67.126	0.358	42.49**
9A x G73-107	48.833	1.923**	0.119	5.648	1.322	0.069	190.703	0.735	150.598**	89.623	1.332	467.816**
16A x HTP3/ 13	50.667	0.460*	-0.077	5.343	0.785	1.003**	182.845	1.465	139.116**	88.536	1.632	53.127**
16A x MRC	47.667	1.213*	-0.077	5.432	1.252	0.573**	181.320	1.206	19.988**	77.355	1.291	139.616**
18A x 1704	40.667	0.707*	-0.193	5.019	1.041	1.561**	175.851	1.187	33.988**	71.137	1.037	94.671**
23A x G-73-107	42.000	0.811	-0.006	5.383	1.227	0.206**	191.561	1.233	4.166	76.211	1.459	14.943**
36A x 77/371	48.083	0.988	-0.0.86	4.905	1.138	0.505	175.703	1.201*	101.692**	77.631	1.355	164.693**
843-22A x htp94 /54	38.667	0.712*	-0.227	4.857	1.127	0.163*	167.822	0.774	86.142**	86.152	1.55*	9.695*
94111A x 1250	46.583	1.393*	-0.164	4.950	0.787*	-0.032	202.839	0.810	18.885*	72.793	1.168	2.845
94111A x 77/371	43.750	1.040	-0.017	4.762	0.985	0.097	174.472	1.050	34.732**	65.241	1.172	28.737**
94222A x INB87/74-3-2	44.083	1.340**	-0.015	4.153	0.925	0.123*	167.908	0.886	14.431*	63.092	1.162	14.486**
94222A x 1305	45.750	1.542**	-0.198	4.808	0.181	1.408**	153.631	1.293	72.168**	56.002	0.535	43.192
94444A x 77/371	38.667	0.608**	-0.155	4.890	0.775	0.043	154.287	0.557	123.401**	81.941	0.928	55.253**
94555A x H77/833-2	43.000	1.217	-0.191	5.735	1.119	-0.13	169.202	1.028	34.684**	82.531	1.406	26.657**
94555A x HTP92/80	43.583	0.182**	-0.058	5.245	0.845	0.164	172.938	0.659	218.630**	97.858	1.611	75.121**
94555A x HTP3/20	49.333	1.412*	-0.027	4.744	1.148	-0.005	186.979	1.396	20.382**	84.499	1.411	29.464**
96111A x (G73-107 x bsectcp-1)	47.500	1.064	-0.088	4.596	1.176	0.103	198.354	1.385	26.324**	73.782	1.177	5.661
97111A x CSSC46-2	45.250	1.338*	-0.206	5.083	1.004	0.050	176.713	1.481	11.271	59.752	0.757*	2.158
97111A x HTP3/2	44.333	1.005	-0.084	4.384	1.124	0.309**	176.578	1.649	276.116**	73.173	0.929	28.709**
97111A x HBL-11	46.000	1.717**	-0.076	5.258	0.992	0.661**	158.254	1.295	10.128	80.469	1.319*	26.675**
ICMA97444A x H77/833-2	43.833	1.163	-0.146	5.080	1.267	0.966*	174.788	1.337	82.987**	80.641	1.517*	22.420**
ICMA97444A x ICMRO/035	42.167	1.013	-0.059	5.188	0.608	0.317**	182.284	0.629*	0.0269	73.558	0.722*	3.804
ICMA97444A x ICMRO2041	45.083	0.609*	-0.040	4.698	0.730**	-0.038	175.710	0.788	42.069**	65.145	0.561*	16.463**
ICMA97444A x icmro/46	40.833	0.535*	-0.091	4.295	0.593	0.055	164.308	0.656	205.670**	58.163	0.293**	4.482
HBB-67	37.250	0.816	-0.012	3.876	0.909	0.556**	160.742	0.690	46.766**	52.958	0.127*	48.685**
HHB-94	49.500	0.681*	-0.076	4.002	0.967	0.025	160.094	1.093	31.798**	61.118	0.727	41.378**
HHB67=11 1mpr.	49.333	0.299**	-0.131	4.694	0.711	0.028	174.939	0.026	118.084**	59.694	0.053**	16.722**
HHB-67-1	45.550	0.957	-0.155	4.851	1.072	0.452**	163.581	0.500*	7.221	68.438	0.488	93.741**
HHB117	41.667	0.207*	0.168	5.69	1.289	0.092	174.683	0.808	67.209**	80.433	0.969	50.124**
General mean	49.167	2.216**	0.309	5.222.078			174.68					

mean, bi value less than one and S^2di equal to zero. These results are in agreement with those of Yahaya *et al*. (2005) and Arya *et al*. (2009).

The distribution of 30 hybrids on the basis of different stability parameters (Table 5) revealed that days to 50 per cent flowering possessed the maximum predictable genotypes followed by total tillers, plant height and dry fodder yield. The hybrids studied in the present investigation, in general, did not exhibit uniform pattern of environmental response (linear). This attribute appears to be specific for individuals. It can, therefore, be suggested that while making selection, attention should be paid to the phenotypic stability of the characters and genotypes having average response for different characters could be used in identifying stable hybrids. Similar findings were also reported by Kumar (2006) and Yadav *et al*. (2010).

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