https://doi.org/10.29321/MAJ.10.A02874

Madras agric. J. 67. (9) 567–571 September 1980

Phenotypic Stability and Adaptability of Newly Developed Cultivars of Bengalgram

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A set of eight bengalgram cultivars was tested at a number of locations in peninsular India during *rabi* 1977-78. stability parameters were worked out for yield (q/ha) and two yield components, seeds/plant and seed size. Cultivar, BDN 9-3, was found to possess general adaptability for the peninsular zone for yield as well as for its primary components. However, there is need to improve its seed size.

In North India, crop season of bengalgram is longer and relatively cooler temperatures prevail during this period. But in the south, the growing period of the crop becomes shorter and its productivity shows a downward trend. In recent years, some varieties of bengalgram have been evolved which promise better yields than the locally grown cultivars in this region. Unless the adaptability of these superior strains in the region is established, it would be difficult to motivate the farmers to take up the new varieties.

In the present study, the phenotypic stability and adaptability of eight *elite* bengalgram cultivars, tested under All-India Coordinated Research Pulse Improvement Programme at eleven locations during 1977-78 *rabi* season in peninsular India, were investigated.

MATERIAL AND METHODS

During *rabi* 1977-78, a common set of eight newly developed bengalgram cultivars including a standard check were tested at eleven locations in peninsular India. The list of locations along with their indices is given in Table I. A uniform plot size was adopted at all locations and trials were laid out in a randomised block design with four replications at each of these locations. At harvest' data on yield/plot, seed size (100-seed weight) and average number of seeds per plant were recorded.

The data of individual locations were statistically analysed and have been reported be Bahl and Mehra, (1978.) The pooled data from eleven locations were subjected to analyses for genotype x environment interaction and for stability following the procedure of Eberhart and Russell (1966).

RESULTS AND DISCUSSION

The environmental index for yield ranged from -9.27 to 12.54 q/ha (Table I), showing wide differences in the environmental potentials. For seed size, the index ranged from -3.35 to 1.76 g/100

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seed and for seeds per plant from -39.20 to 34.99. For these two characters also, there were considerable differences in environmental potentials. Hence the sampled environments were adequate for measuring the stability parameters.

Table II gives the analysis of variance for stability for yield (q/ha) and two of its components, seeds/plant and seed size. For yield, genotype x environments (G x E) interaction mean square was found significant when tested against pooled error. For the other two characters, pooled replicated data were not available. The magnitude of G x E linear component of interaction was non-significant when tested against pooled deviations mean square for all the three characters, showing thereby that none of the cultivars differed in their response to environment stimuli.

Table III gives the three parameters namely, the mean over locations (ū); the response measured by regression coeffi cient (b_i) and the stability of performance measured by magnitude of mean squared deviations (s^2d_i). In testing the significance of s^2d_i values, pooled error mean square was utilized for yield (q/ha) but for seeds/plant and seed size the individual s^2d_i values were tested against the pooled deviations mean square.

An adaptable variety is one having a high mean value (u_i) greater than general mean ($\bar{u}_i$); regression coefficient (b_i) of the order of unity and possessing a non-significant value for mean squared deviations (s^2d_i). For yield, only one variety, BDN 9-3, was found to possess these qualifications. For seeds/plant, BDN 9-3 was statistically at par with the top ranker, Phule G 1, and was stable ($b=1$; $s^2d=0$). However, this cultivar had seed size significantly smaller then the check Annegiri, though it was stable ($s^2d=0$) for this character with an average response ($b=1$). In general, BDN 9-3 possessed wide adaptability. Phule G 2, BEG 482 and the check Annegiri were unstable in their yield performance. For Phule G 2, s^2d_i value was significantly large for seed size as well as for number of seeds/plant. For check Annegiri, seed size appeared to be a stable character but the number of seeds/plant had a comparatively large s^2d_i value (though non-significant) in comparison to pooled mean squared deviations.

It appears that the reason for low yields in peninsular zone may be the low number of seeds/plant rather than the seed size. Seeds/plant is a product of number of seeds/pod and number of pods/plant. Number of seeds/pod being more or less stable, the emphasis must be laid on increasing the pods/plant and stabilising it for improving the yield potential of bengalgram cultivars in this zone.

ACKNOWLEDGEMENT

The data reported in this study were recorded by the cooperating scientists who conducted the trials at their respec-

tive locations under AICORPIP. We are grateful to Project coordinator (Pulses) for permitting us to use the date.

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TABLE I Locations and their Indices in peninsular India

Location	Index		
	Yield (q/ha)	Seeds/plant	Seed size
Akola	−0.70	−	−0.26
ICRISAT	−3.83	−28.54	−3.28
Warangal	−9.27	−39.20	−3.35
Nagpur	+1.09	−	+0.93
Coimbatore	−3.72	−	−0.70
Badnapur (I)	+3.16	− 0.70	+1.56
Parbhani	−1.89	+34.99	−
Badnapur (R)	+0.20	+7.69	+1.66
Rahuri	+12.54	−	+1.68
Dhulia	+ 3.34	−	−
Rajendranagar	− 0.89	+25.60	+1.76

I=irrigated, R=Rainfed

TABLE II ANOVA fot G×E Interaction and for stability analysis based on Eberhart and Russell (1966) model

Source of variation	Yield (q/ha)		Seeds/plant		Seed size	
	d. f.	M. S.	d. f.	M. S.	d. f.	M. S.
Genotypes (G)	7	9 845*	6	717.662	6	126.735
Environments (E)	10	239.048*	4	7459.194	8	30.147
GXE interaction	70	5.231*	24	337.968	48	10.125
E (Linear)	1	2390.480*	1	29836 678*	1	241.338*
GXE (Linear)	7	6 045	6	395 358	6	6.463
Pooled deviations	72	4.498	21	273.290	49	9.127
Pooled error	495	2.318	−	−	−	−

Significant at P=00 5

TABLE III Stability parameters for bengalgram cultivars tested in peninsular India

Variety	Yield (q/ha)				Seeds/plant				Seed size			
	Mean yield (u_i)	RK	Regression coefficient (b_i)	Mean squared deviation (s^2d_i)	Mean (u_i)	RK	Regression coefficient (b_i)	Mean squared deviation (s^2d_i)	Mean (u_i)	RK	Regression coefficient (b_i)	Mean squared deviation (s^2d_i)
Annegiri (Check)	14.26	5	0.874	5.227*	71.42	4	1.355	206.74	18.37	2	0.656	3.462
JG 62	14.31	4	0.969	2.371	73.96	2	0.850	890.72	14.01	7	0.942	0.613
JG 221	14.63	2	0.938	3.513	72.93	3	1.224	172·40	15.78	4	0.736	3.204
JG 74	13.30	7	0.972	2.216	69.39	5	1.041	222.95	15.69	5	0.687	4.499
BDN 9-3	16.24	1*	0.986	1.295	66.95	6	0.757	25·76	14.19	6	0.420	4.206
Phule G 1	14.44	3	0.966	2.662	73.99	1	1.253	41.90	16.72	3	0.520	21.690**
Phule G 2	14.08	6	0.870	13.477**	40.48	7	0.518	352.56**	24.91	1*	0.613	26.214**
BEG 482	12.99	8	0.922	5.227**	—		—	—	—	—	—	—
S. E.	0.67		0.123		8.27		0.253		1.07		0.515	
CD (P=0.05)	1.80		NS		22.91		NS		2.96		NS	

— Underlined figures at par with check value.

* Significantly superior to check.

** s^2di value significant when tested against pooled error/deviation mean squares.

RK = Rank