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PHENOTYPIC STABILITY FOR SEED YIELD IN SAFFLOWER (CARTHAMUS TINCTORIUS L.)

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ABSTRACT

There was a significant variation in respect of genotype x environmental interactions for seed yield in safflower. A large portion of these interactions was accounted for by the linear regression on the environmental means, although non-linear component was also significant. The crop, in general, gave better performance when grown in closer row spacings of 30 cm under favourable moisture growing conditions. However, under moisture stress conditions, no marked yield response was observed to the different row spacings. Genotypes like C 438 and AN 1 were found to be stable with high mean yield and average responses to the changes in the environmental conditions. Hence their exploitation in a breeding programme will help in improving the productivity of the crop.

KEY WORDS : Safflower, Stability, Genotype x Environment interaction.

Safflower (*Carthamus tinctorius* L.) is a drought hardy crop and can be grown well in light to heavy textured soils. It has a strong tap root which draws water from fairly deep layers of soil profile and, therefore, can be best suited to the arid regions. In western Rajasthan, irrigation resources of an average farmer particularly in situation following drought, are so scarce that it is not possible to grow crop like wheat, which has high water requirement. Under such conditions, it may be remunerative to grow safflower which requires less water per unit of dry matter production.

Stable performance of varieties under different environments with regard to the economic characters like seed yield is of considerable significance for any varietal improvement programmes. However, information on genotype x environment interactions and stability of varieties is scanty in case of safflower. In the present article important genotypes of safflower have been evaluated for G x E interactions for identifying the high yielding stable genotypes for use in breeding programme.

MATERIALS AND METHODS

A set of 19 promising genotypes of safflower, collected from the different safflower growing region of the country, was tested under different environment created by three different row spacings *viz.*, 30, 40 and 60 cm and maintaining plant to plant distance at 20 cm apart. Separate experiments in randomized block design with four replications were carried for each of row spacing during winter season of 1982-83 and 1983-84. The net harvested plot size was kept 3.6 m^2 in all the experiments during both the years. Four and two irrigations of 5 cm each were given at the critical crop growth stages during winter season of 1982-83 and 1983-84, respectively. The crop received a basal dressing of 20 kg N/ha and 40 kg P/ha and top dressing of 20 kg N/ha at the time of first irrigation.

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Table 1. Analysis of Variances for genotype X environment interactions for seed yield in safflower.

Experiment	df	MS
Genotype	18	4.92** + +
Env. + (Genotype X Env)	90	47.35** + +
Env. (linear)	1	4087.07** + +
Genotype X Env (linear)	18	2.80**
Pooled deviation	76	1.64**
Pooled error	324	0.31

** P = 0.01 against pooled error
+ + P = 0.01 against pooled deviation

RESULTS AND DISCUSSION

Pooled analysis of variance revealed the existence of significant genetic differences among the genotypes with respect to seed yield (Table 1). The environments also appeared to be significantly different from one another as the mean square component due to environment was highly significant. Further, the genotype x environment interactions component showed that the genotypes reacted considerably with the environmental conditions. A major portion of the genotype x environment interaction variance was accounted for by the presence of linear component although non- linear component (deviation) was also significant. Similar significant G x E interactions for seed yield in safflower was also reported by Patra (1976), Ehdaie *et al.*, (1977) and Ranga Rao and Ramachandram (1979). According to Eberhart and Russell (1966), an ideally adapted variety would be the one having high mean value, unit regression coefficient (b = 1) and deviation from regression as small as possible (s^{-2} d = 0).

Mean grain yield and the two stability parameters *viz.* regression coefficient (b) and deviation from regression (s^{-2}d), for the 19 genotypes studied from 1982-83 to 1983-84 in different row spacings are given in Table 2.

In general, genotypes performed better in the winter season of 1982-83 when four irrigations were given at different critical stages of crop growth than in winter season of 1983-84 when only two irrigations were supplied. An interesting trend was observed in that among different row spacing during 1982-83, the highest mean yield of the crop was observed in row spacing of 30 cm, followed by 40 cm and 60 cm row spacings. A similar trend was also observed in winter season of 1983-84 but the differences were not very conspicuous. Sheelavantar *et al.* (1978) also reported that yield of different varieties in rows 30 cm apart were higher than those in 45 cm apart. McCormick and Thomson (1978) reported that when crop did not experience moisture stress, yield in safflower increased linearly over the population range 100 to 200/m^2. However, under moisture stress, yields were reduced by 50 per cent and no yield response was obtained to the population range of 100-200/m^2. Chauhan *et al.* (1979) reported that an inter and intra row spacings of 45 x 10 cm was optimum for safflower variety A 300. Singh and Yusuf (1981) also reported that seed yield was inversely related with spacings, giving the highest seed yield at 20 cm row spacing.

Genotypes AN 1 and C 438 were the most stable, as they had low deviation from the regression with almost unit responses to changes in environmental conditions. However, these genotypes were not the highest yielder although the mean yield over all environment was in the range of 10.13-10.38 q/ha as against the population mean yield of 9.82 q/ha. Genotypes like B263-2A and 673 were also stable as they had low deviation from the regression, however, their seed yield (9.72 and 9.1 q/ha) was lower than the population mean yield and hence were not suitable. Patra (1976) and Ranga Rao and Ramachandram (1979) also reported stable performance of

Table 2. Estimates of stability parameters (mean, b and s^{-2} d) for seed yield (q/ha) in safflower.

Genotypes	1982 – 83			1983 – 84			Mean	'b'	s^{-2} d
	30X20 cm	40X20 cm	60X20 cm	30X20 cm	40X20 cm	60X20 cm			
NA 21	14.0	14.5	11.0	3.7	2.1	2.5	7.97	0.88	0.67*
NS 38	19.1	16.3	13.5	6.3	2.9	3.1	10.20	1.06	0.73**
NS 115–1	17.9	13.1	12.1	4.9	3.7	3.7	9.23	0.90	0.66*
NSR 209	17.2	17.3	14.8	3.1	5.2	2.8	10.10	1.06	1.93**
NC 802–65	20.3	14.2	12.9	5.2	4.5	3.4	10.10	1.01	1.86**
NS 1016	19.4	17.2	10.8	6.7	3.2	4.3	10.27	1.00	3.40**
EC 32012	18.3	17.2	11.0	5.2	3.6	3.5	9.80	1.01	1.75**
NS 115–2	19.0	18.1	12.9	4.0	1.9	2.3	9.70	1.20	0.86**
673	17.4	14.7	13.5	3.4	2.4	3.7	9.18	1.02	0.24
K 1	16.7	11.8	13.4	3.4	3.8	4.2	8.88	0.86	1.86**
AN 1	19.6	16.3	14.2	5.0	4.2	3.0	10.38	1.09	-0.15
C 438	17.3	17.2	14.0	4.2	4.2	3.9	10.13	1.02	0.27
S 144	15.1	15.1	13.8	5.4	4.4	5.5	9.88	0.79	0.81**
S 4	19.5	15.2	15.9	4.7	5.1	4.0	10.73	1.04	0.92**
B 263–2A	18.5	17.0	14.2	3.1	2.8	2.7	9.72	1.16	0.05
No. 83	14.3	14.4	15.4	2.9	2.7	2.4	8.68	0.97	3.75**
JL 28–7	22.0	15.1	13.4	5.6	6.8	5.1	11.33	0.99	9.93**
Tara	22.2	17.0	15.1	6.6	4.6	4.3	11.63	1.13	1.01**
WA 300	13.9	15.4	11.2	4.2	4.4	3.2	8.72	0.81	1.26**
Mean	17.98	15.64	13.32	4.61	3.82	3.56	8.82	1.00	
SE m±	0.88	0.72	0.68	0.23	0.25	0.15			
CD 5%	2.43	1.99	1.87	0.63	0.69	0.41			
CV %	10.00	9.22	10.16	9.96	13.13	8.41			

* P = 0.05; ** P = 0.01

C 438 and AN 1 respectively, for seed yield per plant under fluctuating environmental conditions. Genotype Tara gave the highest mean yield (11.63 q/ha) and found to perform better under favourable growing conditions (bi), but it had large deviation from regression, hence it was unstable. Genotypes JL 28-7, NS 38, NRS 209, NC 802-65 and NS 1016 were also with high mean yield and indicated unit responses but had large deviation from regression and were unstable genotypes. All other genotypes had low mean seed yield as against the population mean and had large deviation from regression and hence were unstable.

The present study revealed that genotypes C 438 and AN 1 were found stable with high mean yield and had average responses to the changes in environmental conditions. Since genotypes like Tara, JL 28-7 and S-4 had high yield potential among all the genotypes, their stability in performance can be improved upon by crossing these genotypes with stable ones so as to have consistent higher productivity. The crop, in general, gave markedly better performance when grown in closer spacing of 30 cm in favourable moisture growing conditions. However, under moisture stress conditions no

marked yield response was observed to the different row spacings.

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COMBINING ABILITY STUDIES IN BLACKGRAM (VIGNA MUNGO (L.) HEPPER)

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ABSTRACT

A line x tester analysis was made in blackgram with five ovule parents and four pollinator parents so as to identify suitable general and specific combiners for breeding programme. Additive type of gene action was observed for plant height, number of clusters, number of pods and seed yield per plant. Parents T 9 and DU 1 were good general combiners for seed yield, number of clusters and number of pods per plant. The cross combinations Co 5 x NPRB 1 and TMV 1 x NPRB 2 were the best specific combiners for seed yield per plant. Co 5 x NPRB 1 was the best combination for number of clusters, number of pods, pod length and seed yield per plant. Since both additive and non additive gene actions were responsible for different characters, breeding systems involving intermating of F_2 or delayed selection in later generation may help to harness all the desirable genes.

KEY WORDS : Blackgram, Combining ability.

Blackgram (*Vigna mungo* (L.) Hepper) is one of the important grain legumes grown in India. India being primarily a vegetarian country, most of the protein in diet is being substituted by grain legumes and among them, the blackgram is one of the important crops. The information on combining ability elucidates the genetic behaviour of the parental material. It is desirable to select the parents for hybridization on the basis of their combining ability *per se*. Therefore, the present study was carried out with five lines and four testers to derive information on general and specific combining ability for eight quantitative characters.