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STABILITY OF FIVE SUNFLOWER GENOTYPE OVER DIFFERENT ENVIRONMENTS

M. RANGASWAMY[1], R. BALASARASWATHY[2], R. APPADURAI[3] and R. MOHAMED SHERIFF[4]

Five sunflower genotype tested under 10 different environments exhibited significant differences among themselves for grain and oil yield per hectare. With reference to environments also the character expression differed significantly. Variety x Environment [Linear] interaction was however non-significant. All the varieties behaved uniformly with reference to different environments exhibiting unit regression coefficient with estimates of $\bar{S}d^2$ not different from zero and thus proved stable over all the environments tested In yield of grain and oil, EC. 68415 was the most superior followed by EC 68414. On per day productivity basis however SUF. 2 proved superior over a variety of environments.

Sunflower, a newly introduced crop has spread over an area of about 1.5 lakh hectares both irrigated and rainfed under varied agro-climatic conditions in various soil types of Tamil Nadu. However, there is need to identify sunflower genotypes which exhibit least fluctuations to changes in the environment with reference to yield and oil content. Investigations were therefore taken up from 1931 at the Tamil Nadu Agricultural University, Coimbatore to study the genotype environment interaction in five sunflowervarieties and to identify the most stable variety.

MATERIALS AND METHODS

Five sunflower varieties viz, EC 68414 (V_1); EC 68415 (V_3); SUF. 1 (V_5); SUF 2 (V_4) and K2 (V_2) were raised in five cent plots each with two replications during *Kharif* 1979, *Rabi* 1979, Summer 1980, *Rabi* 1980 and Summer 1981 under irrigated (E_1 to E_5) as well as rainfed conditions (E_6 to E_{10}). Oil analysis was done by Soxhlet extraction procedure (AOAC 1975). Grain yield, oil content per 100 gm of seeds and oil yield for net plot size of 10x8 m were estimated in each replication Stability parameters for the above characters were estimated over the 10 environments. The mean, regression of the genotypes on the environmental index 'b' and the mean squared deviation (Sd-2) from the regression were obtained for each variety by the method of Eberhart and Russell (1966). The results are presented and discussed hereunder.

RESULTS AND DISCUSSION

Analysis of variance for individual varieties and pooled analysis (Table 1 and 2) indicated that each variety differed significantly from one another for both grain yield and oil yield thus giving scope for selection. In respect of environments also significant differences were observed for all the three traits.

1, 3 & 4 — School of Genetics, Tamil Nadu Agricultural University, Coimbatore-641 003.
2 — Department of Biochemistry, Tamil Nadu Agricultural University, Coimbatore-641 003.

Table 1. Analysis of variance for mean data

Source	DF	MSS		
		Grain yield per plot (kg)	Oil content per 100 gm (gm)	Oil yield per plot (kg)
Varieties	4	12.8422**	23.1239 NS	3.1305**
Environments	9	96.0702**	181.1443**	15.0424**
V x E	36	2.9048**	18.0284 NS	0.5961 NS
Rep. within environments	10	2.5400*	11.1091 NS	0.7436 NS
Error pooled	40	1.2160	12.7538	0.4275

** Significant at 0.01 * Significant at 0.05 NS -- Not significant

Table 2. Pooled analysis of variance of five sunflower cultures experimented in five environments.

Source	DF	MSS		
		Grain yield per plot (kg)	Oil yield 100 gm (gm)	Oil yield per plot (kg)
Total	49	10.41	24.20	1.72
Varieties	4	6.42**	11.56 NS	1.56**
Env + (V + E)	45	10.76	25.32	1.74
Environment (Linear)	1	432.31**	815.14**	67.69
V x E (Linear)	4	1.60 NS	3.77 NS	1.17 NS
Pooled deviation	40	1.14 NS	7.73 NS	0.25 NS
V_1 (EC. 68414)	8	0.85 NS	8.51 NS	0.22 NS
V_2 (EC. 68415)	8	1.27 NS	9.78 NS	0.29 NS
V_3 (SUF. 1)	8	2.17 NS	3.83 NS	0.35 NS
V_4 (SUF. 2)	8	0.74 NS	9.80 NS	0.25 NS
V_5 (K2)	8	0.68 NS	6.74 NS	0.11 NS
Error pooled	40	1.21	12.75	0.42

** Significant at 0.01 * Significant at 0.05 NS — Not significant

Environment (linear) mean squres were significant for all the three chaacters but variety x environment (linear) mean squres were not significant. The mean squares due to pooled deviations (non-linearity) were also non-significant. The linear component revealed the presence of stability of varieties for all the three characters. A low genotype x environment for characters has a practical significance for breeders. Those varieties can be widely cultivated in all parts of the State.

Eberhart and Russell (1966) defined that a stable genotype was one which showed 1) a high mean yield, 2) a regression coefficient ('b') around unity and 3) a mean square deviation from regression near to zero. According to Langer *et al.* (1979) the regression coefficient is a measure of response to varying environments. The mean square for deviation from linear regression is a true measure of production stability. In the present study V_3 (EC. 68415) followed by V_1 (EC 68414) had high mean (10.1645 and 9.9295 kg) values with unit regression around one and also with least $\bar{S}d^2$ (Table 3). The other varieties were also however stable over different environment, recordihg regression coefficients not different from unity with $\bar{S}d^2$ approximating zero. with reference to stability for grain yield the varieties ranked in the order of 1) V_4 (SUF 2); 2) V_5 (k2); 3) V_1 (EC. 68414); 4) V_3 (EC. 68415) and 5) V_4 (SUF 1). For oil yield the order was 1) V_5 (SUF 1); 2) V_3 (EC 68415); 3) V_4 (SUF 2); 4) V_1 (EC 68414) and 5) V_2 (K2).

Chaudary (1978) studied a number of exotic lines and varieties of sunflower from the germplasm. He observed characters such as diameter of head seed yield and 1000 seed weight had consistant and stable performance over different agro-climatic conditions. Sharma and Chopde (1979) from the study of sunflower varieties observed that most of the varieties had average responsiveness with good stability. Sivaram (1981 unpublished) has compared the four synthesized population [A. C. D & E] with the standard varieties (EC 68413 and EC 101495) and found them to be stable in different environments for different economic characters.

Table 3. Stability parameters for grain yield and oil yield in five sunflower cultivars

Varieties	Grain yield per plot (kg)			Oil yield per 100 gm (gm)			Oil yield per plot (kg)		
	Mean	b	$\bar{S}d^2$	Mean	b	$\bar{S}d^2$	Mean	b	$\bar{S}d^2$
V_1 (EC. 68414)	9.92	1.18**	0.11	35.60	1.11*	-4.23	3.55	1.10**	-0.20
V_3 (EC. 68415)	10.16	0.96**	0.53	35.60	0.95*	-2.97	3.67	0.99**	-0.13
V_5 (SUF. 1)	9.00	1.01**	1.43	33.02	1.13*	-8.91	2.97	1.06**	-0.06
V_4 (SUF. 2)	8.19	0.80**	0.00	34.64	1.03*	-2.95	2.76	0.80**	-0.16
V_2 (K2)	8.93	1.02**	0.05	34.85	0.75*	-6.01	3.02	1.03**	-0.30
Mean	9.24	1.00	—	34.76	1.00	—	3.20	1.00	—
SE	0.34	0.11	—	1.29	0.21	—	0.20	0.13	
CD	0.70	—	—	—	—	—	0.41	—	—

b = Regression coefficient
$\bar{S}d^2$ = Mean suqure deviation
** = Significant at 0.01
* = Significant at 0.05 Deviation from Zero
NS = Not significant

Table 4. Grain and oil yield per hectare and per day in five genotypes of sunflower

Varieties	Duration (days)	Grain yield (kg)		Oil yield (kg)	
		per hectare	per day	per hectare	per day
V_1 (EC. 68414)	85	1241	14.6	435	5.1
V_2 (EC 68415)	90	1271	14.1	460	5.1
V_3 (SUF. 1)	75	1126	15.0	372	5.0
V_4 (SUF. 2)	65	1024	15.8	346	5.3
V_5 (K2)	80	1117	14.0	379	4.7

When high yield alone was considered EC 68415 was found to be better followed by EC 68414. However SUF 2 had high per day production values for grain (15.8 kg) and oil (5.3) per hectare (Table 4) with high stability performance over different environments (Table 3).

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