Madras Agric. J.77, (9-12): 408-411 (1990)

https://doi.org/10.29321/MAJ.10.A01978

STUDIES ON COMBINING ABILITY IN SUNFLOWER (HELIANTHUS ANNUUS. L)

S. CHIDAMBARAM and N. SUNDARESAN
Regional Research Station,
Kovilkulam - 626 107.

ABSTRACT

Combining ability studies in sunflower revealed that additive gene action was predominant for all the characters except 100 seed weight and oil content. Among the female parents, EC 85820 and EC 69874 were the best general combiners for earliness, K 74 for seed yield and EC 93617 for oil content. The tester parents K 1 and Co 1 were the best general combiners for seed yield and oil content respectively. The best cross combinations for seed yield were EC 75272 x K 2 and Kanpur Selection x Co 1, while for oil content it was EC 93617 x Co 1. In general there was no correspondence between mean performance and sca effects of the crosses.

Key Words : Sunflower, Combining ability.

Various breeding methods like population improvement, heterosis breeding and development of synthetic varieties are being employed to improve the yield and its stability in sunflower. All these methods have one basic principle in common *viz.*, the choice of superior parents. The study of combining ability gives useful information in the selection of parents and hybrids. (Dhillon, 1975). So combining ability analysis is one of the best methods to screen all the exotic and indigenous materials so that the breeder can choose such of those parents and hybrids which have good combining ability.

MATERIALS AND METHODS

Twelve inbred lines of different geographical origin were crossed with three testers of well adapted improved varieties, namely K 1, K 2 and Co 1. The resultant 36 hybrids and 15 parents were evaluated under randomised block design, replicated three times with 15 plants per row and adopting a spacing of 60 cm x 30 cm. The crop was raised during November, 1985 at the Agricultural Research Station, Kovilpatti for studying the combining ability for yield and other economic characters. In each row, five plants were marked at random for recording observations on days to 50 per cent flowering, days to maturity, plant height, head diameter, number of leaves, 100 seed weight, seed yield per plant, harvest index and oil content. Analysis for combining ability was done by using the procedure developed by Kempthorne (1957).

RESULTS AND DISCUSSION

Analysis of variance for combining ability and estimates of variance due to GCA and SCA are presented in Table 1. The males were more variable than females and hybrids except for 100 seed weight in which females exhibited high values. High variances for males observed in the present investigation might be due to a wide diversity of the selected female inbred lines. The variances due to lines were significant for all characters except seed yield and oil content. The variances due to testers were significant for all the characters except 100 seed weight. The variances for the interaction of lines x testers were significant only for days to 50 percent flowering and maturity which indicated the inter allelic interaction for these two characters. However, the radio of GCA:SCA variances showed that GCA variances were greater than SCA variances in all the traits except 100 seed weight and oil content, indicating the predominance of additive gene effects

Table 1. Analysis of variance for combining ability in sunflower

Source	d.f.	Mean Sum of Squares								
		Days to 50% flowering	Days to Maturity	Plant height	Head Dia-meter	No.of leaves	100 Seed weight	Yield Per plant	Harvest Index	Oil Content
Blocks	2	12.1	3.1	2377.4	12.8	129.8	1.1	807.9	130.8	13.4
Hybrids	35	51.5**	39.1**	1165.9**	8.2**	18.5**	1.5**	91.7 NS	68.8**	19.8*
Female	11	63.7**	27.9**	1440.3**	7.6**	21.9**	3.2**	81.3NS	87.9**	19.6NS
Male	2	462.2**	438.00**	9074.7**	71.4**	167.5**	0.9NS	617.9**	357.2**	55.0**
Male X Female	22	8.0*	8.5**	309.9NS	2.8NS	3.3NS	0.7NS	49.0NS	33.0NS	16.7NS
Error	100	4.8	2.6	209.2	2.9	5.5	0.5	65.8	20.4	11.2
Gca		11,33	9.98	219.90	1.63	40.6	0.06	13.36	8.42	0.91
Sca		1.07	1.97	33.53	@	@	0.08	@	4.20	1.83
Gca / Sca		10.59	5.06	6.56	1.63	40.6	0.75	13.36	2.00	0.5

** Significant at P = 0.05 and 0.01 level respectively @ Negative value obtained was taken as zero.

for seed yield and most of the yield components and non-additive gene action for 100 seed weight and oil content. The results of this study in sunflower are comparable with those of earlier reports by Miller and Porcedu (1975), Manjunath (1978) and Sankara (1983).

The primary criterion for the choice of desirable parents was on the basis of performance of inbreds for their high expression of mean and general combining ability for various traits (Kadambavana sundaram, 1982). General combining ability effects for females and males are presented in Table 2. Among the females, EC 85820 and EC 69874 were the best combiners for earliness. EC 102249 was the good combiner for improving 100 seed weight and harvest index.

K 74 was the best general combiner for improving seed yield, plant height, head diameter and number of leaves, while it was the poor combiner for oil content. EC 93617 was the poor combiner for improving oil content, but it was the poorest combiner for seed yield and yield components.

Of the 36 F1s, the superior crosses have been selected on the basis of *per se* performance and *sca* effects (Table 3). In general, these was no correspondence between these two parameters but the selected cross combinations exhibited high values for both *per se* performance and effects. The superior crosses for earliness were EC 85820 x Co 1 and EC 69874 x Co 1. The best cross combination or head diameter was K 74 x K 1 while EC 22237 x K 1 exhibited high values for plant height and number of leaves. The superior cross combinations for seed yield were EC 75272 x K 2 and Kanpur selection x Co 1, while for oil content was EC 93617 x Co 1.

It is clear from the study that improvement of seed yield and oil content would be possible by the simultaneous exploitation of both additive and non-additive genetic components in sunflower. Most of the yield components *viz* plant height, head diameter and number of leaves were governed by additive gene action. 100 seed weight alone which has a major contribution for yield in sunflower (Pathak, 1978) was governed by non-additive gene action. Putt (1966), Kovacik and Skaloud (1972) and Sudhakar (1979) also reported the predominance of non-additive gene action for 100 seed weight. The oil content was also governed by non-additive gene action which is in

Table 2. Effect of General combining ability in sunflower

Source	Mean Sum of Squares								
	Days to 50% flowering	Days to Maturity	Plant height	Head Dia-meter	No.of leaves	100 Seed weight	Harvest Index	Yield Per plant	Oil Content
Male									
K 1	3.57**	3.7*	15.11**	1.3**	2.2**	-0.1	-3.5**	3.2	1.36
K 2	0.02	-0.5	1.5	0.2	-0.1	-0.1	0.9	1.5	1.06
Co 1	-3.59**	-3.2**	-16.6**	-1.5**	-2.1**	0.2	2.6*	-4.7	0.32
SE ±	0.52	0.38	3.41	0.4	0.39	0.15	1.06	1.91	0.79
Females									
E.C 85820	-3.37**	-2.5**	-7.6	-1.2	-1.6	-0.1	1.5	-3.5	2.64
E.C 75272	-0.15	0.2	7.0	-0.2	0.3	-0.4	2.5	2.2	1.71
E.C 102249	-3.37**	-1.5	-16.5*	-0.7	-0.7	1.3**	5.5*	1.5	-0.91
E.C 68415	-0.04	0.9	1.8	-0.1	0.2	0.1	-0.8	0.6	1.79
E.C 100101	-0.48	0.4	-2.0	0.4	-0.2	-0.2	2.0	1.7	-0.28
K 74	2.19*	1.1	21.3**	1.8*	2.6*	0.7*	-5.3*	4.5	0.43
E.C 69874	-3.48**	-2.7**	-23.0**	-1.4	-3.1**	-0.4	3.4	-6.5	1.16
E.C 93617	-1.15	-1.5	-0.7	0.6	-0.5	0.5	0.2	1.1	2.39
Sunrise	1.85	0.9	-0.3	-0.2	0.4	-0.5	-2.4	-1.0	1.09
Morden	-0.15	-0.1	-6.5	-0.1	-0.7	-0.3	-0.6	-2.7	0.11
Kanpur Selection	4.30**	3.0**	13.6*	0.7	2.1	-0.1	-1.9	1.8	-0.18
E.C 22237	3.85**	1.8*	12.9	0.4	1.2	-0.6	-4.1	0.3	-1.25
SE : ±	1.03	0.76	6.82	0.8	0.78	0.32	2.13	3.82	1.58

* Significant at P = 0.05 ** Significant at P = 0.01

accordance with the earlier results reported by Tuberosa *et al.*, (1982) and Mohammed Sheriff (1985).

Thus the results of the present study with the selected parents revealed that yield and yield components in sunflower were controlled by both additive and non-additive gene action and the predominance of additive gene effects for all traits except 100 seed weight. Also, it was inferred that larger part of total genetic variation was found to be associated with

Table 3. Best parents and hybrids selected on the basis of per se performance, gca and sca effects

Character	Best parents based on Per se and gca effects	Best Hybrids based on Per se and sca effects
Days to 50 percent flowering	EC 85820, EC 102249, EC 69874 and CO 1	EC 85820 x CO 1, EC 102249 X CO 1 and EC 69874 x CO 1
Days to maturity	EC 85820, EC 69874 and CO 1	EC 85820 x CO 1 and EC 69874 x CO 1
Plant height	K 74 and K 1	EC 22237 x K 1
Head diameter	K 74 and K 1	K 74 x K 1
Number of leaves	K 74 and K 1	EC 22237 x K 1
100 seed weight	EC 102249 and K 74	EC 102249 x K 1 and K 74 x CO 1
Seed yield per plant	EC 75272, K 74, Kanpur Selection and K 1	EC 75272 x K 2 and Kanpur Selection x CO 1
Harvest index	EC 102249 and CO 1	EC 102249 x CO 1 and EC 69874 x K2
Oil content	EC 93617	EC 93617 x CO 1

gca effects of the parents. The performance of the crosses does not correspond with *per se* performance of the parents but well related with *gca* effects of the parents. These findings are in agreement with the earlier results of Sankara (1983) in sunflower. As such, improvement of seed yield could be possible only by the improvement of component characters like plant height, head diameter, number of leaves and 100 seed weight. The parents which have good general combining ability for these yield components could be utilised in hybridization programme for improving the yield of sunflower. Breeding methods like genotypic recurrent selection for exploiting the characters governed by additive gene effects and reciprocal recurrent selection for those characters governed by non-additive gene action could be further employed to improve the seed yield and oil content in sunflower.

REFERENCES

ALBA, E. and PORCEDU, E. 1975. Combining ability estimates in inbred sunflower lines. **Annali della Fa Coltadi Agiaria University di Bari; 27:** 869-877.

DHILLON, B.S. 1975. The application of partial diallel crosses in plant breeding - a review. **Crop Improv., 2:** 1-7.

KADAMBAVANASUNDARAM, M. 1982. Concept of combining ability and its impact on breeding procedures. Proceedings of the Summer institute on theoretical and applied aspects of exploiting heterosis in crop plants. TNAU, Coimbatore pp 1-9.

KEMPTHORNE, O. 1957. **An introduction to Genetic Statistics.** John Wiley and Soms, Inc; NewYork. pp. 458-471.

KOVACIK, A. and SKALOUD, V. 1972. A study of the combining abilities of sunflower lines and of heterosis on crossing them. **P. Breed. Abstr.,** (1978), **48:** 1040.

MANJUNATH, A. 1978. Genetics of seed yield, oil content and other quantitative characters in sunflower. **Mysore J. Agric. Sci., 12** (4): 667-668.

MOHAMMED SHERIFF, N. APPADURAI, R. and RANGASWAMY, M. 1985. Combining ability in sunflower. **Indian J. agric. Sci., 55(5):** 315-8.

PATHAK, R.S. 1978. Yield components in sunflower. 271-28 (En, 16 ref) University Nairobi Dept. Applied Pl. Sci. Nairobi; Kenya, **Pl. Breed. abstr., 48** (5): 4570.

PUTT, E.D. 1966. Heterosis and combining abilities and predicted synthetics from a diallel cross in sunflower. **Canad. J. Pl. Sci., 46:** 59-67.

SANKARA, A.C. 1983. Evaluation of sunflower inbreds for their combining ability. **Pl. Breed. Abstr., 54(8):** 6111.

SUDHAKAR, D. 1979. Heterosis and combining ability studies in sunflower. **Mysore. J. Agric, Sci., 13:** 476.

TUBEROSA, R. ALBA, E. and GRECO, I. 1982. Eval uation of combining ability in pure lines of sunflower. **Pl. Breed abstr., 53(4):** 3308.

Madras Agric. J.77, (9-12): 411-413 (1990)

GENETIC PARAMETERS AND INTER-RELATIONSHIP ANALYSIS IN LUCERNE (MEDICAGO SATIVA L.)

SUKANYA SUBRAMANIAN[1]

School of genetics, Tamil Nadu Agricultural University,

Coimbatore - 641 003.

ABSTRACT

The genetic variability and correlations were worked out in forty two F_1 progenies of the diallel crosses of seven parental varieites of lucerne for four characters. Analysis of variance revealed highly significant differences for all the characters. Seed yield expressed a maximum genotypic coefficient of variability and genetic advance as per cent of means with low heritability values, whereas plant height recorded the maximum heritability value. Green fodder yield was significantly and positively correlated with seed yield, branch number and plant height.

Key Words : Lucerne, Variability, Correlation.

1. Professor, Forest College & Research Institute, Mettupalayam