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INTER-RELATIONS OF YIELD AND ITS COMPONENTS IN SESAME

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Abstract: One hundred sesame types were evaluated in replicated trials in rice fallows. There was positive and significant genotypic correlation of yield of seeds with number of capsules on branches, number of capsules per plant, number of branches, number of fruiting axils per unit length and weight of 1000 seeds. Number of days to flowering, maturing, height of the plant, height up to first capsule, length and circumferance of capsule and number of seeds per capsule exerted negative and significant genotypic correlation with yield of seeds. The quality characters such as seed oil content and seed protein content did not have significant genotypic correlation with yield of seeds.

The maximum positive direct effects on yield of seeds was exerted through number of capsules per plant followed by number of branches. The indirect effects of other characters via. these characters on yield of seeds were considerable. Hence it can be inferred that number of capsules per plant and number of branches are to be given importance in selection programme. The proposed plant architecture for higher productivity during summer can be dwarf in stature, profuse branching, early flowering and maturing, bearing large number of capsules with large sized seeds.

INTRODUCTION

An estimate of interrelationships between yield of seeds and yield contributing characters is vital. This would facilitate effective selection for simultaneous improvement of one or more yield contributing components. The intensity and direction of association between characters may be measured by genotypic and phenotypic correlation coefficients. The study of path analysis throws light on the cause and effect relation in crops so that complex quantitative characters like yield could be understood in a simpler and better way.

MATERIALS AND METHODS

An experiment with 100 selected sasame genotypes was laid out in simple lattice design during slimmer (January to April) 1982 at the Rice Research Station, Kayamkulam. Observations on days to flowering and maturity, height of the plant, number of branches, number of capsules on main stem and branches, number of capsules per plant, number of fruiting axils per unit length, length and circumferance of capsule, number of seeds per capsule, weight of 1000 seeds, seed oil and protein content and yield of seeds per plant were taken.

The genotypic and phenotypic covariances were estimated from the analysis of covariance of the data generated from the simple lattice design with $q^2 = 100$ types, blocks of $q = 10$ plots each and $p = 2$ replication.

The path coefficient analysis for seed yield at the genotypic level was carried out using the characters which had significant correlation with seed yield. The direct and indirect effects of each path of causation were derived from the path coefficient analysis as suggested by Wright (1923).

RESULTS AND DISCUSSION

Correlation

The genotypic correlation coefficients were found slightly higher than the phenotypic correlation coefficiencts (Table 1). This indicates the masking effect of the environment to the total expression of the genotype. These results are in accordance with the report of Thangavelu and Rajasekharan (1983).

The genotypic correlation coefficient for yield of seeds with number of branches, number of capsules per plant, number of fruiting axils per unit length and weight of 1000 seeds were positive and highly significant. This indicates that any improvement in any one of these characters will lead to an increase in yield of seeds.

A positive and significant correlation of yield of seeds with number of capsules per plant was reported by Zhan (1983), with number of branches was reported by Thangavelu and Rajasekharan (1983) and with weight of 1000 seeds by Zhan (1983). The high significant and positive correlation of number of branches, number of capsules on branches and number of capsules per plant with yield of seeds at both genotypic and phenotypic level indicated that these three characters could be reliable yield indicators during summer.

The yield of seeds was negatively and significantly correlated with number of days to flowering, height of the plant, height up to first capsule, length and circumferance of capsule, number of seeds per capsule and number of days to maturity. This gave a clear indication that selection for improvement of any one of the above characters will result in a decline of yield of seeds. Newell and Eberhart (1961) were of the view that it would be difficult to exercise simultaneous selection for the characters which show negative association among themselves. Hence these characters act as determinants for the formulation of a comprehensive selection schedule.

Quality characters such as seed oil content and seed protein content, exerted non-significant genotypic correlation with yield of seeds during summer. This shows that they are under different genetic control. This is in accordance with the report of Trehan *et al*. (1975). Hence simultaneous improvement of both quality characters (seed oil content and seed protein content) and yield of seeds is rather difficult and so independent breeding programme has to be formulated for attaining the objectives of simultaneous cop improvement for these characters.

During summer, seed oil content was affected positively by number of days to flowering, weight of 1000 seeds, number of seeds per capsule, circumferance of capsule and number of fruiting axils per unit length. Hence, late flowerng plants with large sized seed enhance oil content during summer. Seed protein content is positively and significantly correlated with number of days to maturity during summer. This suggests that late maturing varieties contain more seed protein.

The yield components exhibited varying trends of association among themselves. Number of branches, number of capsules on branches and 1000 seed weight exhibited maximum positive correlation with minimum association with other component characters.

Path analysis

The direct and indirect effects of nine charaters which were selected on significant rg/SE(rg) are presented in Table 2. The maximum direct effect on yield of seeds was exerted through number of capsules per plant and it exerted only a negligible indirect effect via. other characters. The highest direct effect of number of capsules per plant on yield of seeds in sesame has also been reported by Shukla (1983). The indirect effects of the other characters via. number of capsules on yield of seeds were considerable indicating the importance of this character in selection programme. This is in agreement with the results of Thangavelu and Rajasekharan (1983). The physiological analysis

Table 1. Genotypic and phenotypic correlation between yield of seeds and 15 characters and among themselves

Characters		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1)	G	0.67	0.57	0.85	0.37	-0.52	-0.02	-0.36	0.05	-0.32	0.15	0.05	0.04	0.61	0.06	-0.81
	P	0.58	0.30	0.64	0.32	-0.34	0.06	-0.13	0.03	-0.13	0.05	0.03	0.03	0.05	0.05	-0.09
(2)	G		0.54	0.65	0.19	-0.39	-0.04	-0.31	0.02	-0.16	-0.02	-0.09	0.52	-0.12	0.36	-0.18
	P		0.34	0.48	0.18	-0.19	0.13	-0.01	0.03	-0.08	-0.07	-0.06	0.26	-0.06	0.18	0.03
(3)	G			0.79	0.50	-0.15	0.17	0.06	-0.14	-0.26	-0.33	-0.19	0.09	0.09	0.03	-0.29
	P			0.55	0.39	0.37	0.52	0.53	0.10	0.02	0.12	-0.06	0.07	0.06	0.02	0.42
(4)	G				0.51	-0.65	0.16	-0.29	0.11	-0.29	-0.05	-0.07	0.22	0.03	0.03	0.36
	P				0.40	-0.31	0.16	-0.03	0.08	0.11	-0.03	-0.08	0.19	0.02	0.03	-0.28
(5)	G					-0.36	0.83	0.46	-0.35	-0.25	-0.32	-0.21	0.16	0.00	-0.01	0.60
	P					-0.05	0.64	0.45	-0.10	-0.14	0.17	-0.15	0.03	0.00	-0.01	0.32
(6)	G						-0.01	0.57	-0.52	-0.21	-0.34	-0.25	-0.25	-0.10	0.00	0.17
	P						0.32	0.69	-0.94	0.01	-0.15	-0.13	-0.12	-0.06	0.00	0.41
(7)	G							0.82	-0.03	-0.17	-0.56	-0.41	0.17	-0.01	0.18	0.68
	P							0.89	0.07	0.02	-0.21	-0.18	0.03	-0.01	0.10	0.64
(8)	G								0.03	-0.21	-0.67	-0.48	0.00	-0.06	0.13	0.69
	P								0.19	0.06	-0.22	-0.18	-0.03	-0.03	0.07	0.66
(9)	G									0.33	0.16	0.20	0.11	0.17	0.30	0.27
	P									0.35	0.13	0.14	0.12	0.11	0.20	0.11
(10)	G										0.25	0.37	-0.02	0.14	0.13	-0.39
	I .										0.18	0.28	0.04	0.12	0.11	0.08
(11)	G											0.92	0.22	0.33	0.09	-0.96
	P											0.79	0.17	0.28	0.07	-0.19
(12)	G												0.09	0.34	0.13	-0.71
	P												0.06	0.30	0.11	-0.10
(13)	G													0.25	0.27	0.26
	P													0.19	0.12	0.01
(14)	G														0.03	-0.10
	P														0.03	-0.02
(15)	G															0.13
	P															0.03

G - Genetypic correlation coefficient, P - Phenotypic correlation coefficient

The characters are::

(1) Number of days to flowering (2) Number of days to maturity (3) Height of the plant (4) Height up to first capsule (5) Number of branches (6) Number of capsules on main stem (7) Number of capsules on branches (8) Number of capsules per plant (9) Number of fruiting axils per unit length (10) Length of the capsule (11) Circumferance of the capsule (12) Number of seeds per capsule (13) Weight of 1000 seeds (14) Seed oil content (15) Seed protein content (16) Yield of seeds per plant

Table 2. Direct and indirect effects of 9 component characters on yield of seeds

Characters	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	1.00	0.38	0.36	-0.03	-0.15	0.12	-0.10	0.04	0.04
	(-0.13)	(0.04)	(0.04)	(0.00)	(-0.07)	(0.01)	(0.00)	(0.00)	(0.00)
(2)	0.38	1.00	0.43	0.29	0.46	0.13	-0.03	-0.16	0.07
	(-0.05)	(0.10)	(0.05)	(0.01)	(0.21)	(0.01)	(0.00)	(0.02)	(0.01)
(3)	0.36	0.43	1.00	0.55	0.41	-0.17	-0.15	-0.17	0.09
	(-0.05)	(0.04)	(0.12)	(0.02)	(0.19)	(0.01)	(-0.01)	(0.02)	(0.01)
(4)	-0.03	0.29	0.55	1.00	0.75	0.07	0.04	0.16	0.03
	(0.00)	(0.03)	(0.07)	(0.04)	(0.34)	(0.01)	(0.00)	(0.02)	(0.00)
(5)	-0.15	0.46	0.41	0.75	1.00	0.11	-0.08	-0.28	-0.04
	(0.02)	(0.04)	(0.05)	(0.03)	(0.46)	(0.01)	(0.00)	(0.03)	(0.00)
(6)	0.12	0.13	-0.17	0.07	0.11	1.00	0.19	0.11	0.02
	(0.02)	(0.01)	(-0.02)	(0.00)	(0.05)	(0.07)	(0.01)	(-0.01)	(0.00)
(7)	-0.10	-0.03	-0.15	0.042	-0.08	0.19	1.00	0.14	-0.04
	(0.01)	(0.00)	(-0.02)	(0.00)	(-0.04)	(0.01)	(0.03)	(-0.02)	(0.00)
(8)	0.04	-0.16	-0.17	-0.16	-0.28	0.11	0.14	1.00	0.13
	(-0.01)	(-0.02)	(-0.02)	(-0.01)	(-0.13)	(-0.01)	(0.01)	(-0.11)	(0.01)
(9)	0.36	0.07	0.09	0.03	-0.34	0.02	-0.04	0.13	1.00
	(-0.01)	(0.01)	(0.01)	(0.00)	(-0.02)	(0.00)	(0.00)	(-0.01)	(0.07)

Values in lines represent interrelationships, in diagonal brakets represent direct effect and in offdiagonal brackets represent indirect effect

The characters are:
(1) Number of days to flowering (2) Height of the plant (3) Number of branches (4) Number of capsules on branches (5) Number of capsules per plant (6) Number of fruiting axils per unit length (7) Length of the capsule (8) Number of seeds per capsule (9) Weight of 1000 seeds

of yield of seeds in sesame had also indicated that production of a larger number of capsules per plant leads to high yield of seeds (Saha and Bhargava, 1980).

During summer, next to the number of capsules per plant, number of branches exhibited high positive direct effect on yield of seeds which also had high indirect effect via. length of the capsule. Height of the plant and number of capsules on branches also contributed their major effect indirect via. number of capsules per plant. A high direct effect of number of branches to yield of seeds in sesame has been reported by Yadava *et al*. (1980). During summer, number of days to flowering had negative direct effect on yield of seeds. Similar reports of negative direct effect of this character on yield of seeds have been made by Shukla (1983). Hence emphasis should be given to selection of early flowerng plants with profuse branching during summer. Thus it can be inferred that number of capsules per plant and number of branches are to be given importance in selection programme durng summer.

Ideal plant type

There can be several approaches to the problem of identification of ideal plant type. Construction of ideotype after identification of morphological frame work through correlation analysis (Donald, 1968), regression technique and path coefficient analysis (Deway and Lu, 1959) is the way by which one can identify the model plant. Chaudhary *et al*. (1980) suggested the use of several plant models and their subsequent testing so that the most suitable models may be picked up for each growing condition.

Based on present study, the plant architecture can be proposed on the basis of the association analysis of yield components. Hence, in sesame improvement programmes in summer rice fallows, the plant type may be of dwarf stature with profuse branching, early flowering and maturing with large number of capasules containing large sized seeds.

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