The path coefficient analysis revealed that yield was more influenced by capsule bearing portion of main stem, TDMP, number of first capsule bearing node, number of nodes on main stem, capsule length, plant height, number of capsules per plant, number of capsules on branches, 1000 seed weight, number of capsules on main stem, harvest index, days to maturity and number of branches. However, significant genotypic correlation possessed by number of capsules on main stem, number of nodes on main stem, days to maturity, number of capsules per plant and number of branches have turned out to a negative direct effect.

On the other hand, number of capsules on branches, TDMP, plant height, capsule bearing portion of main stem, first capsule bearing node, harvest index, 1000 seed weight and capsule length which had significant positive genotypic correlation with seed yield continued to have positive direct effect and positive indirect effect via other characters, indicating thereby that these attributes can be relied upon for selection in a breeding programme for yield improvement.

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COMBINING ABILITY STUDIES IN GROUNDNUT

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ABSTRACT

Five rust resistant and four rust susceptible groundnut (*Arachis hypogaea* L.) genotypes were crossed in all possible combinations to study the nature of combining ability and gene action involved for 13 quantitative traits. Combining ability analysis showed the importance of GCA variance alone for number of primary branches and days to 50 per cent flowering while for the remaining characters, both the GCA and SCA variances were important with predominance of GCA indicating the scope for exploiting the available additive components. The rust resistant Virginia genotypes VG 78 and CS 31 were the best general combiners for yield and yield components while the two Spanish types CO 1 and VRI 1 for earliness, number of mature pods per plant and harvest index and VRI 1 for oil content also. Inter-subspecific hybridisation between the Spanish and Virginia genotypes followed by intermating is advocated to exploit both the additive and non-additive components.

KEY WORDS : Groundnut, Combining Ability

Rust caused by the *Puccinia arachidis* Speg. affects the yield and quality of ground nut *Arachis hypogaea*L. considerably. Therefore one of the objectives in groundnut breeding programmes is to develop disease resistant varieties. To breed resistant varieties, the most primary requisite is the identification of resistant sources. After identification of resistant genotypes, selection of donors possessing better combining ability for yield and yield attributes is necessary to produce superior ble 1. Estimates of variances for metric traits in groundnut

Due to	df	Length of main stem (cm)	Number of primary branches	Number of secondary branches	Length of primary branches (cm)	Length of secondary branches (cm)	Days to 50% flowering	Days to maturity	Number of mature pods per plant	Pod yield per plant	Total dry matter production per plant	Harvest Index (%)	Shelling per cent	Oil content (%)
eneral mbing ility	8	294.60**	3.44**	86.87**	623.65**	582.59**	23.60**	372.22**	40.44**	52.76**	57.70**	128.32**	37.82**	26.44**
pecific ombining ility	36	26.80**	0.51	7.59**	68.53**	62.19**	1.30	33.73**	1.50*	1.77**	7.92**	20.11**	17.10**	2.09**
eciprocal ffects	36	12.17**	0.21	1.05	18.35**	18.07**	0.84	7.06**	1.36	0.52	1.94**	6.17**	11.63**	1.91**
rror	240	12.34	0.36	0.56	1.53	1.30	1.17	3.22	0.33	0.56	2.04	4.09	1.51	0.12
CA : SCA		11.0:1	6.8:1	11.4:1	9.1:1	9.4:1	18.2:1	11.0:1	27.0:1	29.8:1	7.3:1	6.4:1	2.2:1	12.7:1

* Significant at 1% level ; * Significant at 5% level

able 2. General combining ability effects in 9 x 9 diallel

Due to	Length of main stem (cm)	Number of primary branches	Number of secondary branches	Length of primary branches (cm)	Length of secondary branches (cm)	Days to 50% flowering	Days to maturity	Number of mature pods per plant	Pod yield per plant	Total dry matter production per plant	Harvest Index (%)	Shelling per cent	Oil content (%)
Co 1	-5.61**	-0.49**	-1.64**	-5.74**	-6.06**	-1.65**	-3.90**	1.79**	0.74*	-0.34	3.23**	2.07**	-0.45**
TMV 7	-4.54**	-0.28*	-1.53**	-7.82**	-6.19**	-1.25**	-6.27**	0.47	-0.78*	-0.07	2.55**	1.16**	-0.11
VRI 17	-5.43**	-0.19	-2.25**	-6.73**	-6.66**	-0.76**	-4.61**	1.88**	2.51**	0.72*	4.46**	1.04**	0.37**
NcAc 605	3.58**	-0.44**	-1.78**	-0.34	-1.09**	-0.36	- 1.02*	-4.74**	-3.83**	2.64**	-1.88**	-2.52**	-2.31**
NcAc 17090	1.95*	-0.11	-1.05**	0.84**	-0.27	-0.12	0.28	-2.19**	-1.86**	-1.76**	-0.34	-1.11**	-1.23**
NcAc 17135	2.51**	-0.04	-0.24	-0.14	0.12	-0.13	-0.59	-2.28**	-3.73**	-1.43**	-1.68**	-0.74**	-0.04
VG 78	2.30**	0.19	2.82**	5.27**	6.19**	1.17**	4.38**	3.74**	2.23**	1.97**	-2.25**	0.55**	1.00**
CS 31	0.69	0.72**	2.72**	6.52**	5.80**	1.61**	5.75**	1.27**	1.84**	2.93**	-1.66**	0.66**	1.53**
CS 820	4.55**	0.64**	2.97**	8.25**	8.15**	1.23**	5.99**	0.06	2.87**	0.63*	-2.43**	-1.11**	1.14**
SE	0.78	0.13	0.17	0.28	0.25	0.24	0.40	0.37	0.34	0.32	0.4627	0.08	

** Significant at 1% level ; * Significant at 5% level

Table 3. Best crosses showing significant specific combining ability effects

Length of main stem	Number of secondary branches	Length of primary branches	Length of secondary branches	Number of mature pods per plant	Pod yield per plant	Total dry matter production per plant	Shelling per plant	Oil content
VG 78 x CS 820 (4.55*)	NcAc17135 x CS 820 (1.35**)	NcAc17090 x CS 31 (2.85**)	NcAc17090 x CS 820 (1.95**)	CO 1 x VRI-1 (2.56*)	CO 1 x VG 78 (2.41*)	VG 78 x CS 31 (2.23*)	CO 1 x TMV 7 (2.85**)	TMV 7 x VG 78 (0.55*)
			NcAc17135 x VG 78 (5.39**)	Co 1 x VG 78 (2.58*)	Co 1 x CS 820 (4.67**)		Co 1 x VRI 1 (2.73**)	VRI 1 x VG 78 (1.11**)
			NcAc17135 x CS 31 (6.53**)	Co 1 x CS 31 (3.92**)			VRI 1 x VG 78 (2.11**)	VRI 1 x CS 31 (1.47**)
				VRI x VG 7 (2.10*)				
			CS 31 x CS 820 (2.25**)	TMV 7 xVRI 1 (4.88*)				
				TMV 7 x VG 78 (2.65*)				
				CS 31 X CS 820 (2.27*)				

igures in parentheses are the specific combining ability effect of the combinations
* Significant at 1% level ; * Significant at 5% level

off springs possessing resistance for the disease by studying the combining ability. These studies will also elucidate information on the nature and magnitude of gene action involved in the expression of the quantitative traits. The main objective of the study is to find out the combining ability of the rust resistant genotypes for yield and yield attributes.

MATERIALS AND METHODS

Five rust resistant and four rust susceptible genotypes were chosen for the study. The resistant genotype include NcAc 17090 and NcAc 17135 (classified under var. *fastigiata* of the subspecies *fastigiata*, the valencia group) and recorded rust grades of 2.2 and 4.1 respectively (Subrahmanyam and McDonold, 1987). The other three resistant parents namely VG 78, CS 31 and CS 820 are the interspecific derivatives of the cross *A.hypogaea x A. cardenasii* krap. et Greg. nom. nud. These derivatives possess high degree of resistance to rust by recording grades of 1.9, 1.9 and 1.8 respectively and are classified under the var. *hypogoea* of the sub species *hypogaea*, the Virginia group. The susceptible group include four genotypes namely NcAc 605, Co 1, TMV 7 and VRI 1 in which the latter three belong to var. *vulgaris* of the subspecies *fastigiata*, the Spanish group, while NcAc 605 belongs to the valencia group. All the nine parents were crossed in all possible combinations to make a 9 x 9 full diallel. The resulting 81 Fis along with the parents were raised in randomised block design with four replication during *kharif* 1989-90. Observations were recorded on ten randomly chosen plants in each replication for 13 quantitative characters and the mean values used for statisticaly analysis. The combining ability analysis was carried out as per Griffing (1956) method I and model 2.

RESULTS AND DISCUSSION

The results of analysis of variance for combining ability are furnished in Table 1. The mean sum of square for general combining ability was significant for all the characters studied. Similarly, the mean sum of squares due to specific combining ability were also significant for all the characters except for number of primary branches results indicated the presence of additive and non-additive genetic components in controlling the traits except for number of primary branches and days to 50 per cent flowering which are governed only by additive genetic components. The involvement of both additive and non-additive genetic components in governing the number of mature pods per plant, pod yield per plant and shelling per cent was earlier reported. Further, for all the characters studied, the GCA variance was in greater proportion indicating the predominant role of additive genetic components in controlling the traits. Predominance of additive genetic components for number of primary branches, number of mature pods per plant, and pod yield per plant were also reported.

The general combining ability of the parents is furnished in Table 2. The rust resistant Virginia parent VG 78 was found to be the best general combiner for all the characters except for number of primary branches, days to 50 per cent flowering, days to maturity and harvest index. Similarly, the other rust resistant virginia parent CS 31 was the best general combiner for all the traits except for length of main stem, days to 50 per cent flowering, days to maturity and harvest index. The rust susceptible spanish bunch parents CO 1 and VRI 1 were the best general combiners for early 50 per cent flowering, days to early maturity, number of mature pods per plant, harvest index and shelling. VRI 1 in addition to the above traits was the good general combiner for oil content also.

The specific combining ability effects of best combinations which involved atleast one good general combiner or both the parents possessing significant general combining ability effects are furnished in Table 3. These combinations are specifically important as they have significant general combining ability effects of the parents involved in the crosses. These crosses are likely to throw transgressive segregants in the advanced generations which are of specific significance in practical plant breeding for improvement of yield and yield attributes. Since both additive and non-additive components are involved, reciprocal recurrent selection is to be followed to exploit both the components. However, groundnut being a highly self-pollinated crop, this selection procedure is not practicable. Therefore, the possible choice is the inter- subspecific hybridization between the spanish and virginia types followed by intermating among F_2 progenies to exploit both the additive and non-additive genetic components.

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AZOSPIRILLUM INOCULATION ON SUGARCANE

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ABSTRACT

Field experiments were conducted at the Sugarcane Research Station, Cuddalore with the objective of finding out the use of *Azospirillum* sp. as a supplemental source of N in sugarcane crop cv Co. 6304. Application of 7 kg of *Azospirillum* sp. along with 225 kg of N ha^{-1} recorded same cane yield to that of 300 kg N ha^{-1}, resulting in a saving of 75 kg N ha^{-1}. The influence of *Azospirillum* was more evident at optimum N levels rather than at higher levels.

KEY WORDS : Sugarcane, *Azospirillum*, Inoculation, Yield

Sugarcane crop requires higher dose of nitrogen upto 300 kg ha^{-1}, as compared to many other crops. Consequent on the release of high yielding varieties of sugarcane, the demand for N may go up further. In the late 1960s and early 1970s, synthetic N fertilizer was being used increasingly to meet the extra N required for high crop yields. With the present energy crisis and the concomitant escalating cost of synthetic N fertilizer, the scientists are exploring the alternative sources of N for crop production. In this context, an attempt was made to study the use of *Azospirillum* sp in sugarcane as a supplemental source of N According to Subba Rao (1986), *Azospirillum brasilense* has been established as the best Indian isolate for sugarcane and soil + powdered FYM in the ratio of 1:1 acts as an ideal carrier. Experiments conducted by Michael Raj *et al.* (1984) in four types of soils over two seasons indicated that *Azospirillum* was observed to be more effective in enhancing the cane yield. In a field experiment conducted by Rajaram and Srinivasan (1986) under loamy soil condition proved that *Azospirillum* application to sugarcane either as sett treatment or soil application along with 200 kg N ha^{-1} as urea showed the same available N status as that of 280 kg N ha^{-1} as urea alone. Based on the results available and also to explore further the utilisation of *Azospirillum* sp. in sugarcane in east coast zone of Tamil Nadu as supplemental source of N, the present research study was undertaken at the Sugarcane Research Station, Cuddalore, Tamil Nadu.

MATERIALS AND METHODS

Field experiments were carried out consecutively for two years (1989-90 and 1990-91) under sandyloam soil condition at the Sugarcane Research Station, Cuddalore with the variety Co. 6304, in plant crop. The design was randomised block with three replications. The experiment comprised of ten treatments (Table 1). Of *Azospirillum* (35 pockets, each 200 g) was applied with 5 pockets as sett treatment, 20 pockets as basal dressing, and the remaining as top dressing on 30th day of [illegible]