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Gene effects of pod yield and its components in two crosses of groundnut *(Arachis hypogaea* L.)

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Abstract
Groundnut, (*Arachis hypogaea* L.) is a major source of vegetable oil and protein and also a major source of fodder crop. Genetic systems that control the expression of quantitative traits facilitate the choice of the most efficient breeding and selection procedure. Generation mean analysis is commonly used in studies of inheritance of quantitative traits. Two groundnut genotypes which consist of late leaf spot and rust susceptible genotypes viz., SB-XI and TAG-24 and one resistance genotype Phule Unnati were used in the present study. The cross TAG-24 x Phule Unnati had additive gene action for most of the traits viz., dry pod yield per plant (g), shelling (%), harvest index (%) and haulm yield per plant (g). Hence, early generation selection could be practiced in TAG-24 x Phule Unnati. However due to the presence of epistasis, cross viz., SB-XI x Phule Unnati selection should be postponed to later generations.

Keywords: Groundnut, generation mean analysis, additive and dominance gene effects, epistasis

Introduction
Cultivated groundnut, (*Arachis hypogaea* L.) is an important oilseed crop. It is a major source of vegetable oil and protein, both for human beings and animals. In many drought prone areas of India, groundnut is the only source as a fodder crop, as no other fodder crop can match the drought tolerance as that of groundnut. Groundnut is an important multipurpose crop for resource less poor farmers in the semi arid tropics. Due to environmental stresses and disease pressure, average productivity is often below one tonne per hectare in groundnut.

Many traits of economic importance in groundnut are quantitatively inherited. The exploitation of genetic variability of these traits through hybridization and selection is the primary focus of most groundnut improvement programmes. A good knowledge of the genetic systems controlling expression of these characters facilitates the choice of the most efficient breeding and selection procedure. In addition to additive and dominance variation, it has been suggested that epistasis may also be involved in the inheritance of many quantitative characters in groundnut (Hammons, 1973; Wynne, 1976) [5, 2]. But the information available on nonallelic interactions for quantitative traits in groundnut is very limited. In spite of the limited scope of exploitation of nonallelic interactions in groundnut, the information on nonallelic interactions would be of value to groundnut breeders. While variation due to dominance effects and their interactions cannot be exploited effectively in groundnut, additive x additive epistatic variation is potentially useful, as it can be fixed in homozygous cultivars.

In the present study, the generation mean analysis was employed to partition the genetic variance into additive, dominance and epistasis, which helps in formulating an effective, and sound breeding programme. Hence, F1, F2 and F3 generations of two crosses viz., TAG-24 x Phule Unnati and SB-XI x Phule Unnati were raised along with the parents. Morphological traits were recorded from the parental and segregating generations and analysed to assess the gene action involved for various characters.

Material and Methods
The field experiment was carried out at at All India Co-ordinated Research Project on Groundnut MPKV, Rahuri, during the period from 2015-2017. Two groundnut genotypes consisting of late leaf spot and rust susceptible genotypes viz., TAG-24, SB-XI and one resistant genotype Phule Unnati, and their cross combinations viz., TAG-24 x Phule Unnati and SB-XI x Phule Unnati were used in the present study. Generations viz., P1, P2, F1, F2 and F3 populations were developed for the generation mean analysis during kharif 2017. All the plants were raised in 1.5 m length of 30 x 20 cm spacing. A total number of nine yield and yield component traits viz., plant height (cm), days to maturity**,** days to 50per cent flowering, number of branches / plant, number of pods / plant, pod yield/plant (g), kernel yield per plant (g), shelling percentage (%), hundred kernel weight (g), sound mature kernel (%), oil content

(%) and disease scoring for rust and late leaf spot was taken. Nine point disease scale (Subrahmanyam *et al*., 1995) was used to screen the lines for sources of resistance to rust and LLS.

Action of the genes controlling quantitative characters can be described by the use of gene models. The four types of gene action viz., additive (d), dominance (h), additive x additive (i) and dominance x dominance (l) were estimated using five-parameter model. The variances and corresponding standard error of the means were computed from the deviations of the individual values from the pooled mean for each of the generation in each cross. The adequacy of the simple additive-dominance model in a generation was detected utilizing C and D scaling tests according to the method proposed by Mather and Jinks (1971). By using the variances of various generations for the respective mean, tests of significances were made. The t value observed for ratio C/ SE of C and D/ SE of D is compared either to the 't' table at 5 and 1 per cent level of significance. The calculated 't' value is referred to the 't' table to test the significance. In each test, the degrees of freedom are sum of the degrees of freedom of various generations involved. The additive-dominance model was considered inadequate when any one of the two scales was found to deviate significantly from zero. Mean of five generations viz., P1, P2, F1, F2 and F3 could be used to estimate five parameters following a perfect fit solution given by Cavalli (1952) [3].

Results and Discussion

The generation mean analysis is commonly employed in studies of inheritance of quantitative traits. Analysis of this technique is based on different generations of a cross viz., parents, their F1, F2, F3 and different back crosses.

Mean performance of parents and generations for late leaf spot and rust resistance for different character show in table1.

Cross-I SB-XI x Phule Unnati

The mean performance of parents and different generations of cross-I SB-XI x Phule Unnati for different characters are presented as below

1. Days to 50 per cent flowering

Days to 50 per cent flowering in the parental lines ranged from 31.20 (SB-XI) to 35.13 days (Phule Unnati). Among the different generations, F_1 (30.33) was earliest followed by F_3 (30.64) and F_2 (34.01).

2. Days to maturity

The parents, P_1 (SB-XI) took 98.40 days for maturity and it was earliest as compared to P_2 (Phule Unnati) 107.4 days. Among the different generations, F_1 (95.80) was earliest to mature followed by F_3 (101.6) and F_2 (102.4).

3. Plant height (cm)

Parent SB-XI (33.42 cm) was taller as compared to Phule Unnati (24.07). From the different generations, F_1 (38.22 cm) was tallest followed by F_3 (31.11 cm) and F_2 (30.01 cm).

4. Number of branches per plant

The parents, SB-XI and Phule Unnati recorded 4.66 and 8.20 number of primary branches per plant, respectively. Among the different generations F_1 was 6.53, F_2 was 4.89, and F_3 4.93 were recorded number of branches per plant, respecti

5. Number of mature pods per plant

The range of variation for number of mature pod per plant of the two parents was 8.06 (SB-XI) to 16.06 (Phule Unnati). Among the different generations, F_1 (21.00) had more number of mature pod plant followed by F_2 (18.05) and F_3 (16.10).

6. Number of immature pods per plant

The range of variation for number of mature pod per plant of the two parents was 2.73 (SB-XI) to 2.33 (Phule Unnati). Among the different generations, F_1 was (2.20), F_2 was (2.50), F_3 was (2.55) were having number of immature pods per plant.

7. Dry pod yield per plant (g)

Parent Phule Unnati recorded highest dry pod yield (13.06 g) as compared to parent SB-XI (6.06 g). From other generations F_1 (18.00 g) recorded highest dry pod yield followed by F_2 (15.25 g) and F_3 (13.13 g).

8. Haulm yield per plant (g)

The haulm yield per plant in SB-XI and Phule Unnati were 16.06 g and 23.06 g, respectively, while F_1 and F_2 recorded 28.00 and 25.25 g followed by F_3 23.13 g.

9. Hundred kernel weight (g)

Out of the two parents, Phule Unnati (35.33 g) had highest hundred kernel weight than SB-XI (31.19 g). Among the different generations, F_1 (35.79 g) recorded highest seed weight followed by F_2 (32.69 g) and F_3 (31.14 g).

10. Shelling (%)

Out of the two parents, SB-XI (69.47) had highest shelling (%) than Phule Unnati (68.52). Among the different generations, F_1 (70.53) recorded highest shelling (%) followed by F_2 (68.68) and F_3 (68.19).

11. Harvest Index

The harvest Index in SB-XI and Phule Unnati were 27.32 and 36.12 per cent, respectively, while F_1 and F_2 recorded 39.09 and 36.56 followed by F_3 36.11 %.

13. Oil content (%)

The oil content of SB-XI and Phule Unnati was 46.81 and 50.34 per cent, respectively, while F_1 and F_2 recorded 51.23 and 48.73 followed by F_3 (48.43 %) generation.

2. Cross-II TAG-24 x Phule Unnati

The mean performance of parents and different generations of cross-II TAG-24 x Phule Unnati for different characters are presented as below.

1. Days to 50 per cent flowering

Days to 50 per cent flowering in the parental lines ranged from 32.06 (TAG-24) to 35.20 days (Phule Unnati). Among the different generations, F_1 (31.66 days) was earliest followed by F_3 (31.14 days) and F_2 (35.32 days) generation.

2. Days to maturity

The parents, P_1 (TAG-24) took 96.33 days for maturity and it was earliest as compared to P_2 (Phule Unnati) 110 days. Among the different generations, F_1(93.66 days) was earliest to mature followed by F_3 (101.15days) and F_2 (108.1days) generation.

3. Plant height (cm)
Parent Phule Unnati (35.13 cm) was taller as compared to TAG-24 (24.12 cm) From the different generations, F_1 (36.22 cm) was tallest followed by F_2 (36.01 cm) and F_3 (31.10 cm) generation.

4. Number of branches per plant
The parents, TAG-24 and Phule Unnati recorded 7.53 and 8.13 number of primary branches per plant, respectively. Among the different generations F_1 was exhibited to (8.66) followed by F_2 (7.90) and F_3 with 8.79 number of branches per plant.

5. Number of mature pods per plant
The range of variation for number of mature pod per plant of the two parents was 13.33 (TAG-24) to 15.33 (Phule Unnati). Among the different generations, F_1 (21.66) had more number of mature pod plant followed by F_2 (18.21) and F_3 (11.45) generation.

6. Number of immature pods per plant
The range of variation for number of mature pod per plant of the two parents was 4.86 (TAG-24) to 3.20 (Phule Unnati). Among the different generations, F_2 observed 3.49, F_3 (7.00) and F_1(5.33) pod per plant.

7. Dry pod yield per plant (g)
Parent Phule Unnati recorded highest dry pod yield (12.53 g) as compare to parent TAG-24 (11.00 g). From other generations F_1 (23.40 g) recorded highest pod yield followed by F_3 (16.46 g) and F_2 (16.04 g) generation.

8. Haulm yield per plant
The haulm yield per plant in TAG-24 and Phule Unnati were 18.86 and 23.12 g, respectively, while F_1 and F_2 recorded 25.20 and 16.51 g followed by F_3 (24.45 g) generation.

9. Hundred kernel weight (g)
Out of the two parents, Phule Unnati (34.99 g) had highest hundred kernel weight than TAG-24 (32.10g). Among the different generations, F_1 (34.99 g) recorded highest seed weight followed by F_2 (31.95g) and F_3 (31.64 g) generation.

10. Shelling (%)
Out of the two parents, SB-XI (69.90) had highest shelling (%) than Phule Unnati (68.70). Among the different generations, F_1 (69.57) recorded highest shelling (%) followed by F_2 (67.60) and F_3 (69.43) generation.

11. Harvest Index
The harvest Index in TAG-24 and Phule Unnati was 36.37 and 40.97 per cent respectively, while F_1 and F_2 recorded 48.78 and 50.61 followed by F_3 (39.98 %) generation.

12. Sound mature kernel (%)
The Sound mature kernel in TAG-24 and Phule Unnati was 95.61 and 94.65per cent respectively, while F_1 and F_2 recorded 94.56 and 94.01 followed by F_3 (94.27 %) generation.

13. Oil content (%)
Oil content in TAG-24 and Phule Unnati was 48.18 and 51.34 per cent respectively, while F_1 and F_2 recorded 51.34 and 48.38 respectively, followed by F_3 (49.72 %) generation.

However, the mean performance for different characters varied over five generations in both studied two crosses (Table 4.3 to 4.4). The F_1's means in most of the crosses approached to words mid parental values or exceeded over better parent, indicating their dominance (partial/over) in respective cross for different traits. Among the parents, SB-XI was earliest in day to 50per cent flowering and TAG-24 was earliest in day to 50per cent flowering and days to maturity, parent Phule Unnati was better for plant height, whereas F_1 of cross-II (TAG-24× Phule Unnati) recorded highest number of primary branches per plant and number of mature pods per plant, dry pod yield per plant, haulm yield per plant, shelling percentage, harvest index and sound mature kernel. It was also observed that the F_1 of cross-I (SB-XI x Phule Unnati) was highest for hundred kernel weight and oil percentage. This implies that due consideration should be given to the *per se* performances of the generations along with the gene actions inferred therein, while selecting for improvement in the respective cross(s).

Scaling test was performed using the mean measurements of various generations for the observed traits. As only five generations were involved, the scales C and D were calculated. The genetic parameters viz., (m), (d), (h), (i) and (l) provides information about the gene action involved for a particular trait under investigation. The parameters viz., mid parental effect (m), additive (d), dominance (h), additive x additive (i) and dominance x dominance (l) of the two crosses presented in Table2.

For plant height, both major gene effects additive (d) and dominance (h) effects were highly significant in both the crosses. Among the epistasis components, both the non allelic gene interactions, i.e. additive x additive (i) and dominance x dominance (l) were found highly significant in both the crosses except cross-II (TAG-24 x Phule Unnati) with dominance x dominance (l) interaction found non-significant. In both the crosses all genetic component were highly significant except dominance x dominance (l) component was non-significant in cross cross-II (TAG-24 x Phule Unnati). In the previous studies, importance of additive (d) gene actions were reported by Reddy *et al.* (1986) [8] revealed that additive gene action was significant for height of main axis.

For number of branches per plant, cross-I (SB-XI x Phule Unnati) both major gene effects additive (d) and dominance (h) effects as well as non allelic gene interactions, i.e. additive x additive (i) and dominance x dominance (l) were found highly significant with predominace of additive (d) gene effects. In the cross-II (TAG-24 x Phule Unnati), among the major gene effect only dominant (h) gene effect was highly significant whereas, among non-allelic interaction both additive x additive (i) and dominance x dominance (l) gene action were highly significant with predominace of additive gene action. Duplicate and complimentary type of epistasis were observed in cross-I (SB-XI x Phule Unnati) and cross-II (TAG-24 x Phule Unnati) respectively. For the character number of branches per plant, all genetic components were highly significant in both the crosses except additive (d) gene effect was non-significant in cross II (TAG-24 x Phule Unnati). Duplicate type of epistasis was observed in cross-I (SB-XI x Phule Unnati) revealed their potential in controlling this character in the respective cross, which supports the earlier findings of Kalaimani and Thangavelu, 1996.

For Number of mature pods per plant, in cross-I (SB-XI x Phule Unnati) both additive (d) and dominance (h) major gene effects were highly significant with predomince of dominace (h) gene effect. Among epistasis component, only dominance

x dominance (l) gene interaction was highly significant. Duplicate type of epistasis observed due to opposite sign of dominance (h) and dominance x dominance (l) gene interaction. In the cross-II (TAG-24 x Phule Unnati) only dominace (h) gene action was highly significant with positive magnitude. Among epistasis gene interaction both additive (d) dominance x dominance (l) were highly significant with additive (d) gene action. Complimentary type of gene interaction was found due to same sign of dominance (h) and dominance x dominance (l) gene interaction. For number of mature pod per plant dominance (h) effects were predominant in cross-I (SB-XI x Phule Unnati) and cross-II (TAG-24 x Phule Unnati), in addition to this, preponderance of dominance x dominance (l) type of interaction was observed in cross-I, additive x additive (i), and dominance x dominance (l) type of interactions were observed in cross-II (TAG-24× Phule Unnati) with duplicate type of epistasis in cross-I (SB-XI x Phule Unnati) revealed their potential in controlling this character in the respective cross which supports the earlier findings of Senthil and Varman (1998).

For dry pod yield per plant (g), in cross-I (SB-XI x Phule Unnati) both additive (d) and dominance (h) major gene actions were highly significant with predominance of dominance (h) gene action. Among epistatic gene interaction only dominance x dominance (l) component was found significant. Complimentory type of gene interaction was found due to same sign of dominance (h) and dominance x dominance (l) gene interaction. In the cross-II (TAG-24 x Phule Unnati) both Additive (d) and dominance (h) major gene actions were found non- significant. Among epistasis gene interaction both additive x additive (i) and dominance x dominance (l) gene interaction were higly significant with predominance of additive x additive (i) gene interaction. The gene effect governing dry pod yield per plant, showed the both additive (d) and dominance (h) genetic effects were highly significant in cross-I (SB-XI x Phule Unnati), which is important in expression of this trait. Among epistatis interaction both additive x additive (i) and dominance x dominance (l) were highly significant in cross-II (TAG-24 x Phule Unnati), whereas, dominance x dominance (l) gene interaction was significant in cross-I (SB-XI x Phule Unnati). However, the dominance (h) and dominance x dominance (l) interaction *i.e.* non-additive genetic effects was appeared to be predominant in the expression of this characters has been reported by earlier workers, (Suneetha *et al*., 2006 and Parameshwarappa and Kumar, 2007) [10, 7].

Additive (d) and dominace (h) gene effects were highly significant in both the crosses, among non-allelic interaction both additive x additive (i) and dominance x dominance (l) genetic component were non-significant in hundred kernel weight. Importance of non additive gene action for this trait was reported by Upadhyaya *et al*. 1992 and Senthil and Varman, 1998) [11, 9].

For shelling percentage**,** in cross-I (SB-XI x Phule Unnati) both major gene effects additive (d) and dominance (h) effects were found highly significant and the non allelic gene interactions, i.e. additive x additive (i) and dominance x dominance (l) were found non-significant. However in cross-II (TAG-24 x Phule Unnati) all the gene effects i.e. additive (d) and dominance (h) as well as non-allelic gene interactions, i.e. additive x additive (i) and dominance x dominance (l) were found highly significant with higher magnitude of additive (d) gene action. Complementary epistasis interaction prevailed in the only cross-II (TAG-24 x Phule Unnati) this was confirmed with earlier finding Dobaria *et al.* (2003) [4] observed both additive and dominant genetic effects in case of shelling out-turn. Parameshwarappa and Kumar (2007) [7] reported major role of non additive gene action as well as dominance x dominance genetic interaction for shelling per cent (Adamu *et al*., 2008) [1].

The presence of duplicate epistasis would be detrimental for rapid progress, making it difficult to fix genotypes with increased level of character manifestation because the positive effect of one parameter would be cancelled out by the negative effect of another. Hence, early generation intermating besides accumulating the favourable genes and maintaining heterozygosity in the population are likely to throw out desirable recombinants. The characters plant height and 100 kernel weight were under the control of additive or additive type of epistasis. All other characters had epistatic gene action which includeed additive as well as dominance type gene interaction. The cross TAG-24 x Phule Unnati had additive gene action for most of the traits viz., dry pod yield per plant (g), shelling (%), harvest index (%) and haulm yield per plant (g). Hence, early generation selection could be practiced in TAG-24 x Phule Unnati. However due to the presence of epistasis, cross viz., SB-XI x Phule Unnati selection should be postponed to later generations.

Table 1: Mean performance of parents, F_1's, F_2's and F_3's generations of cross-I (SB-XI x Phule Unnati) for dry pod yield and its components

Sr. No.	Characters	Mean ± SE	P_1	P_2	F_1	F_2	F_3
1.	Days to 50per cent flowering	Mean	31.20	35.13	30.33	34.01	30.64
		±SE	±0.07	±0.19	±0.18	±0.34	±0.32
2.	Days to maturity	Mean	98.40	107.4	95.80	102.4	101.6
		±SE	±0.23	±0.13	±0.20	±0.36	±0.33
3.	Plant height (cm)	Mean	33.42	24.07	38.22	30.01	31.11
		±SE	±0.43	±0.47	±0.40	±0.73	±0.69
4.	No. of branches per plant	Mean	4.66	8.20	6.53	4.89	4.93
		±SE	±0.18	±0.18	±0.16	±0.61	±0.55
5.	No. of mature pods per plant	Mean	8.06	16.06	21.00	18.05	16.10
		±SE	±0.18	±0.24	±0.21	±0.52	±0.45
6.	No. of immature pods per plant	Mean	2.73	2.33	2.20	2.50	2.55
		±SE	±0.18	±0.18	±0.17	±0.26	±0.23
7.	Dry pod yield per plant (g)	Mean	6.06	13.06	18.00	15.25	13.13
		±SE	±0.18	±0.24	±0.21	±0.50	±0.42
8.	Haulm yield per plant (g)	Mean	16.06	23.06	28.00	25.25	23.13
		±SE	±0.18	±0.24	±0.20	±0.50	±0.45
9.	Hundred kernel weight (g)	Mean	31.19	35.33	35.79	32.69	31.14
		±SE	±0.15	±0.16	±0.13	±0.37	±0.31

10.	Shelling (%)	Mean	69.47	68.52	70.53	68.68	68.19
		±SE	±0.17	±0.29	±0.21	±0.51	±0.44
11	Harvest index	Mean	27.32	36.12	39.09	36.56	36.11
		±SE	±0.37	±0.18	±0.16	±0.38	±0.10
12.	Sound mature kernel (%)	Mean	94.93	93.65	96.69	93.79	93.66
		±SE	±0.18	±0.26	±0.21	±0.49	±0.42
13.	Oil (%)	Mean	46.81	50.34	51.23	48.73	48.43
		±SE	±0.18	±0.20	±0.18	±0.25	±0.21

Table 2: Mean performance of parents, F_1's, F_2's and F_3's generations of cross-II (TAG-24 x Phule Unnati) for dry pod yield and its components

Sr. No.	Characters	Mean ± SE	P_1	P_2	F_1	F_2	F_3
1.	Days to 50per cent flowering	Mean	35.06	35.20	31.66	35.32	31.14
		±SE	±0.21	±0.22	±0.11	±0.30	±0.26
2.	Days to maturity	Mean	96.33	110.0	93.66	108.1	101.15
		±SE	±0.25	±0.19	±0.23	±0.47	±0.42
3.	Plant height (cm)	Mean	24	35.13	36.22	36.01	31.10
		±SE	±0.91	±0.94	±0.89	±1.66	±1.05
4.	No. of branches per plant	Mean	7.53	8.13	8.66	7.90	8.79
		±SE	±0.29	±0.35	±0.33	±0.58	±0.50
5.	No. of mature pods per plant	Mean	13.33	15.33	21.66	18.21	11.45
		±SE	±0.68	±0.71	±0.66	±0.84	±0.75
6.	No. of immature pods per plant	Mean	4.86	3.20	5.33	3.49	7.00
		±SE	±0.22	±0.29	±0.30	±0.48	±0.40
7.	Dry pod yield per plant (g)	Mean	11.00	12.53	23.40	16.04	16.46
		±SE	±0.77	±0.54	±0.65	±2.18	±1.95
8.	Haulm yield per plant (g)	Mean	18.86	23.12	25.20	16.51	24.45
		±SE	±0.80	±0.98	±0.85	±2.18	±2.05
9.	Hundred kernel weight (g)	Mean	32.10	34.99	34.99	31.95	31.64
		±SE	±0.35	±0.34	±0.40	±0.55	±0.47
10.	Shelling (%)	Mean	69.90	68.70	69.57	67.60	69.43
		±SE	±0.20	±0.16	±0.15	±0.35	±0.27
11	Harvest index	Mean	36.37	40.97	48.78	50.61	39.98
		±SE	±0.69	±0.77	±0.66	±0.85	±0.12
12.	Sound mature kernel (%)	Mean	95.61	94.65	94.56	94.01	94.27
		±SE	±0.20	±0.40	±0.40	±0.51	±0.45
13.	Oil (%)	Mean	48.18	51.04	51.34	48.38	49.72
		±SE	±0.16	±0.21	±0.20	±0.29	±0.25

Table 3: Estimates of gene effects for dry pod yield and its components of cross-I (SB-XI x Phule Unnati) and cross-II (TAG-24 x Phule Unnati) in groundnut *(Arachis hypogaea* L.)

Character		Genetic Components				
		M	d	H	I	l
Dry pod yield per plant (g)	C-I	15.25** (±0.50)	-3.50** (±0.15)	7.50** (±1.10)	-4.02 (±1.31)	7.93** (±4.21)
	C-II	16.04** (±0.65)	-0.76 (±0.47)	3.77 (±0.52)	21.89** (±1.20)	-9.39** (±2.45)
Haulm yield per plant (g)	C-I	25.25** (±0.5)	-3.50** (±0.15)	7.49** (±1.10)	-4.02 (±1.31)	7.90** (±4.21)
	C-II	16.51** (±0.85)	0.3 (±0.63)	-15.39** (±1.20)	65.51** (±1.50)	-21.42** (±3.30)
Hundred-seed weight (g)	C-I	32.69** (±0.37)	-2.06** (±0.27)	6.19** (±1.12)	0.04 (±1.17)	-0.47 (±3.43)
	C-II	31.95** (±0.55)	-0.99** (±0.24)	2.85* (±1.71)	6.44 (±1.46)	-1.02 (±4.57)
Shelling (%)	C-I	68.68** (±0.51)	0.47** (±0.17)	2.53* (±1.11)	2.34 (±1.32)	1.95 (±1.55)
	C-II	67.60** (±0.17)	0.60** (±0.20)	-3.57** (±0.48)	15.02** (±0.58)	-2.64** (±1.67)
Harvest Index (%)	C-I	36.56** (±0.38)	-4.40** (±0.21)	2.89** (±0.83)	4.33 (±1.06)	-13.28** (±3.17)
	C-II	50.61** (±0.77)	-2.30** (±0.71)	27.10** (±0.88)	-61.51** (±1.82)	12.39** (±2.38)
Sound mature kernel (%)	C-I	93.79** (±0.18)	0.64* (±0.31)	2.27** (±0.64)	7.04** (±0.84)	1.15 (±1.91)
	C-II	94.02** (±0.20)	0.48 (±0.32)	0.32 (±0.52)	2.82 (±0.86)	1.21 (±2.02)
Oil (%)	C-I	48.73** (±0.18)	-1.76** (±0.17)	2.45** (±0.52)	5.12** (±0.60)	-3.73** (±1.74)

	C-II	48.38** (±0.16)	-1.43** (±0.18)	-1.59** (±0.43)	15.04** (±0.58)	-6.19** (±1.51)

Character		Genetic Components				
		M	D	H	I	L
Days to 50per cent flowering	C-I	34.01** (±0.08)	-1.96** (±0.21)	6.45** (±0.06)	27.64** (±0.50)	5.35** (±0.87)
	C-II	35.32** (±0.11)	-0.06 (±0.18)	8.71** (±0.28)	-32.06** (±0.48)	12.05** (±1.08)
Days to maturity	C-I	102.46** (±0.36)	-4.50** (±0.13)	-2.13* (±0.85)	-22.40** (±0.98)	-4.03** (±3.05)
	C-II	108.1** (±0.40)	-6.83** (±0.18)	8.92 (±0.75)	-75.64 (±1.05)	4.75 (±2.90)
Plant height	C-I	30.67** (±0.43)	4.68** (±0.43)	3.97* (±1.70)	22.95** (±1.81)	3.67** (±5.15)
	C-II	36.01** (±0.94)	-5.56** (±0.46)	13.24** (±0.18)	-25.68** (±1.23)	4.54 (±0.18)
Number of branches per plant	C-I	4.89** (±0.18)	-1.76** (±0.32)	0.98* (±0.47)	4.60* (±0.65)	-2.65** (±1.79)
	C-II	7.90** (±0.22)	-0.3 (±0.25)	-1.85** (±0.55)	6.73** (±0.75)	-3.28** (±2.13)
Number of mature pods per plant	C-I	18.05** (±0.52)	-4.00** (±0.15)	7.16** (±1.13)	-2.55 (±1.35)	-9.77** (±4.35)
	C-II	18.21** (±0.68)	-1.00 (±0.55)	20.34** (±1.70)	-26.88* (±1.80)	11.01** (±4.15)
Number of immature pods per plant	C-I	2.5** (±0.18)	0.2 (±0.16)	-0.35 (±0.51)	-0.48 (±0.61)	0.37 (±1.72)
	C-II	3.49** (±0.22)	1.23** (±0.16)	0.36 (±0.51)	-5.08* (±0.68)	4.46** (±1.99)

Table 4: Scaling test for pod yield and its components of cross-I (SB-XI xPhule Unnati) and cross-II (TAG-24 x Phule Unnati) in groundnut *(Arachis hypogaea* L.)

Source of variation / Cross	C		D		X^2	
	C-I	C-II	C-I	C-II	C-I	C-II
Days to 50per cent flowering	9.06**	7.70**	-11.66**	-16.35**	1236**	1502**
Days to maturity	12.46**	38.8	- 4.33**	- 17.93**	68.5**	6.76**
Plant height	-11.59**	12.49*	5.62*	-6.76**	20.28**	9.58**
Number of branches per plant	-6.36**	-1.36	-2.91**	3.68**	39.07**	25.17**
Number of mature pods per plant	6.10**	0.86	4.18**	-19.30**	77.85**	108.0**
Number of immature pods per plat	0.53	1.1	0.16	-2.71**	3.26	22.20**
Dry pod yield plant per plant (g)	5.90**	-6.16	2.88*	10.25**	53.46**	23.94**
Haulm yield per plant (g)	5.90**	-21.46**	2.88*	27.66**	53.46**	120.33**
Hundred kernel wt (g)	-7.36**	-8.35**	-7.32**	-3.52**	63.86**	66.55**
Shelling (%)	-4.33*	-7.34**	-2.57*	3.92**	35.24**	80.73**
Harvest index (%)	4.62**	27.52**	7.87**	-18.60**	168.72**	91.91**
Sound mature kernel (%)	-6.79**	-3.33*	-1.5	-1.2	42.03**	9.62*
Oil (%)	-4.71**	-8.37**	-0.86	2.90**	33.51**	105.3**

References

1. Adamu AK, Olorunju PE, Ado SG, Alabi SO. General and specific combining ability estimates for rosette resistance, early maturity and other agronomic traits in groundnut (*Arachis hypogaea* L.). International Journal of Pure and Applied Sciences. 2008; 2:33 41.
2. Ali N, Wynne J, Murphy JP. Combining ability estimates for early maturity and agronomic traits in peanut (*Arachis hypogaea* L.). Pakistan J of Botany. 1995; 27(1):111-119.
3. Cavalli LL. An analysis of linkage in quantitative inheritance. In: Quantitative Inheritance (Reeve, R.C.R. and C.H. Waddington, Eds.), HMSD, and London. 1952, 135-144.
4. Daboria JR, Ratnakuma AL, Bhorodia PS. Genetic analysis of yield and confectionary traits in crosses involving large dry poded genotypes of groundnut. Journal of Oil dry pods Research. 2003; 21(1):11-16.
5. Hammons RO. Genetics of *Arachis hypogaea* L. In: Peanuts-culture and uses, American Peanut Research and Education Association, Stillwater, Oklahoma. 1973, 135-173.
6. Subrahmanyam P, McDonald D, Waliyar F, Reddy LJ, Nigam SN, Gibbons RW *et al*. Combining ability studies in groundnut. Madras Agricultural Journal. 1996; 83:691-693.
7. Parameshwarappa KG, Kumar B. Genetic analysis of pod yield and other confectionery traits in large dry poded groundnut. Journal of Oil dry pods Research. 2007; 24(2):237-240.
8. Reddy TVB, Reddi NS, Subramanyam D, Reddi MV. Combining ability studies in groundnut (*Arachis hypogaea* L.) by line x tester analysis. Andhra Agriculture Journal. 1986; 33:254-262.
9. Senthil N, Vindhiya Varman P. Combining ability studies in groundnut. Annals of Agricultural Research. 1998; 19:231-232.
10. Suneetha K, Dasaraha Rami Reddy C, Ramana JV. Line x Tester analysis for combining ability in groundnut

(*Arachis hypogaea* L.) Andhra Agricultural Journal. 2006; 53(1, 2):49-52.
11. Upadhyaya HD, Gopal K, Nadaf HL, Vijaya Kumar S. Combining ability studies for yield and its components in groundnut. Indian Journal of Genetics. 1992; 52:1-6.
12. Rao VR, Singh AK, Pande S, Reddy PM, Subba PV, Rao. Screening methods and sources of resistance to rust and late leaf spot of groundnut. Information Bulletin No. 47. ICRISAT, Patancheru PO 502324, AP, India, 1995, 24.