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VARIABILITY STUDIES IN GROUNDNUT (*Arachis hypogaea* L.) UNDER ORGANIC MANAGEMENT

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ABSTRACT

The forty four genotypes of groundnut were used to study the genetic variability under organic management. Analysis of variance revealed highly significant differences among the genotypes for all the characters except shelling percentage. The estimates of PCV and GCV were high for the characters such as pod yield per plant, kernel yield per plant and number of pods per plant indicating the presence of genetic variability for these traits and less influence of environment under organic management. Moderate heritability coupled with high genetic advance as per cent of mean was recorded for the characters primary branches per plant, number of pods per plant, pod yield per plant, kernel yield per plant, mature pods per plant, harvest index and 100 seed weight. Improvement can be brought about in these traits through simple pedigree method of breeding and phenotypic selection would be effective.

Key words : *Genetic variability, groundnut, heritability, organic*

Groundnut (*Arachis hypogaea* L.) is important oilseed crop of the world. It is a segmental allotetraploid (2n=40), self-pollinating annual legume and it is grown throughout the tropical, sub-tropical and warm temperate regions of the world. Its seeds are valued both for its oil and protein contents. The production of oilseed crops was much higher after 1980's and it brought yellow revolution in oilseed crops in India. But our traditional agrosystem suffered a great setback, especially owing to the indiscriminate use of fertilizers that created the problem of serious environmental consequences. It is believed that organic farming can solve many of these problems as this system is believed to maintain soil productivity and pest control by enhancing natural processes and cycles in harmony with the environment. Organic agriculture is continuously growing worldwide on land and farms in more than 160 countries. There is a growing demand for the varieties suitable to organic and / or low input farming.

The major constraint in organic farming is the lack of suitable varieties specifically bred for optimal production in organically managed systems (1). In the words of (2) with crop cultivars bred in and adapted to the unique conditions inherent in organic systems, organic agriculture will be better able to realize its full potential as a high-yielding alternative to conventional agriculture.

In several circumstances varieties that perform well in organic systems have different yield rankings under conventional management. Hence it would be a challenge for the breeders to develop cultivar for that condition. In organic agriculture, the immediate need is to make available greater quantity of organically produced seed. Hence there is essential need to encourage breeding programmes, designed in concert with organic farming.

Variation is the basis of plant breeding, as success of any crop improvement programme largely depends on the magnitude and range of variability in the available genetic stock. The magnitude of heritable variation in the traits studied has immense value in understanding the potential of the genotype for future breeding programme.

MATERIALS AND METHODS

The material for the present investigation comprised of 44 genotypes of groundnut evaluated in organic management using a Randomized Block Design with three replications, during *kharif*, 2014 at dryland Farm of S.V. Agricultural College, Tirupati. Each genotype was sown in single row of 3 m length adopting recommended spacing of 30×10 cm. In organic management trial, FYM at the rate of 20 t ha^{-1} at the time of field preparation and at fifteen days interval Jeevamrutha was applied. The seed of groundnut was treated with bijamrutha. No inorganic chemicals were used. In order to encounter biotic stresses biopesticides (neemasthram, bramhastram, Gobanam) were used. The biometrical observations were recorded for twelve traits *viz.,* days to 50 % flowering, plant height, primary branches per plant, number of pods per plant, pod yield per plant, mature pods per plant, kernel yield per plant, shelling percentage, harvest index, 100 seed weight, oil content and protein content for five randomly selected plants per genotype per replication. The analysis of variance technique on the basis of model proposed by (3). The coefficient of variation was calculated as per (4). Heritability in broad sense and genetic advance were calculated as per (5).

RESULTS AND DISCUSSION

The analysis of variance carried out in respect of twelve quantitative characters revealed highly significant differences among the genotypes for eleven characters

Table-1 : Mean, range, coefficient of variation, heritability (broad sense) and genetic advance as per cent of mean for twelve characters in fourty four groundnut genotypes under organic management

Sl. No.	Character	Mean	Range		Variance		Coefficient of Variation		Heritability (Broad sense) (%)	Genetic advance (GA)	Genetic advance as percent of mean (%)
			Min.	Max.	Genotypic	Phenotypic	Genotypic	Phenotypic			
1.	Days to 50% flowering	32.94	26.00	38.00	7.43	12.40	8.27	10.69	59.93	4.34	13.20
2.	Plant height (cm)	48.43	34.40	68.33	66.46	89.56	16.83	19.54	74.21	14.46	29.87
3.	No. of primary branches per plant	4.74	3.33	7.67	0.68	1.66	17.43	27.24	40.93	1.08	22.97
4.	No. of pods per plant	17.53	9.67	29.33	12.37	27.97	20.07	30.17	44.25	4.82	27.50
5.	No. of mature pods per plant	14.64	7.67	23.67	8.31	18.75	19.68	29.57	44.32	3.95	27.00
6.	Kernel yield per plant (g)	7.52	3.32	12.05	3.09	6.41	23.39	33.67	48.29	2.51	33.49
7.	Shelling percentage (%)	57.31	42.83	67.93	7.69	55.07	4.83	12.94	13.97	2.13	3.72
8.	Harvest index (%)	38.13	17.66	49.81	56.72	103.45	19.75	26.67	54.83	11.48	30.12
9.	100 seed weight	29.84	17.89	47.95	24.59	54.49	16.62	24.74	45.13	6.86	22.99
10.	Oil content (%)	47.25	45.30	48.80	0.81	0.81	1.9045	1.9120	99.19	1.84	3.90
11.	Protein content (%)	24.90	22.80	26.40	0.006	0.006	1.6035	1.6118	98.97	0.16	3.28
12.	Pod yield per plant (g)	13.11	7.07	19.73	8.84	16.74	22.68	31.21	52.82	4.45	33.96

viz., days to 50% flowering, plant height, primary branches per plant, number of pods per plant, mature pods per plant, kernel yield per plant, harvest index, 100 seed weight, oil content and protein content where as shelling percentage exhibited no significant difference. These results indicate the presence of considerable amount of genetic variation for all the traits except shelling percentage under organic fertilizer management. Shelling percentage may be an intrinsic trait of each genotype with least or no G×E. The range of variation observed for the characters revealed that highest range of variation was noticed for plant height, followed by harvest index, 100 seed weight, shelling percentage and number of pods per plant, where as range was found to be least for oil content, protein content and primary branches per plant.

Phenotypic co-efficient of variation was of high magnitude than the genotypic co-efficient of variation for all the characters (Table-1) indicating the influence of environment in the expression of these traits. Similar kind of observations were also reported by (6). The characters such as kernel yield per plant (GCV : 23.39 %; PCV : 33.67 %), pod yield per plant (GCV : 22.68 %; PCV : 31.21 %) and number of pods per plant (GCV : 20.07 %; PCV : 30.17 %) showed higher estimates of variability indicating the ample variation among the genotypes for these traits. Therefore, simple selection could be effective for further improvement of these characters.

The characters, number of mature pods per plant (GCV : 19.68%; PCV : 29.57%), number of primary branches per plant (GCV : 17.43%; PCV : 27.24%), harvest index (GCV : 19.75%; PCV : 26.67%), 100 seed weight (GCV : 16.62%; PCV : 24.74%) showed moderate estimates of GCV and high PCV. Moderate estimates of GCV and PCV were also observed for the trait plant height (GCV : 16.83%; PCV : 19.54%). Low estimates of GCV and moderate estimates of PCV were observed for the traits days to 50% flowering and shelling percentage.

However, low estimates of coefficient of variation was observed for characters like oil content (GCV : 1.90%; PCV : 1.91%), and protein content (GCV : 1.60%; PCV : 1.61%). The low range of variation found in these characters in the present genotypes under organic management indicate that there is a little scope for further improvement of these characters through simple selection.

Reports of high GCV and PCV for kernel yield per plant were similar to the reports of (6). The high variability estimates for pod yield per plant were reported by (7). The high variability estimates recorded for number of pods per plant was in conformity with (8).

Moderate estimates of GCV and high PCV recorded for number of mature pods per plant were in consonance with reports of (9). Moderate estimates of GCV and high PCV recorded for number of primary branches per plant was in accordance with the results of (10). The reports of (9) were similar to the present report of moderate GCV and high PCV estimates for 100 seed weight.

The moderate estimates of GCV and PCV for plant height reported in present investigation were in conformity with reports of (10). While, low GCV and moderate estimates of PCV for days to 50% flowering and shelling percentage were in accordance with the reports of (9). (11) also reported low GCV and moderate PCV for shelling percentage as observed in the present study. The low estimates of variability for oil content was in agreement with the reports of (10). Low PCV and GCV estimates for protein content were similar to the reports of (12).

Under organic management, high heritability estimates were recorded for oil content (99.19 %) followed by protein content (98.97 %) and plant height (74.21%) in decreasing order of their magnitude indicating the least influence of environment on these characters. While the characters viz., days to 50 % flowering, primary branches per plant, number of pods per plant, mature pods per plant, kernel yield per plant, harvest index, hundred seed weight and pod yield per plant registered moderate heritability where as shelling percentage showed low heritability estimates. Heritability in broad sense includes both additive and epistatic gene effects, it will be reliable only if accompanied by high genetic advance.

High heritability coupled with high genetic advance as percent of mean was recorded for plant height (h^2_b = 74.21%, GAM = 29.87%) indicating preponderance of additive gene action and hence phenotypic selection would be more effective for these character. High heritability coupled with high genetic advance as percent of mean for plant height was earlier reported by (10). On contrary, low heritability coupled with low genetic advance as per cent of mean for plant height was recorded by (13).

Moderate heritability coupled with high genetic advance as percent of mean was recorded for number of primary branches per plant (h^2_b = 40.93%, GAM = 22.97%), number of pods per plant (h^2_b = 44.25 %, GAM = 27.50%), number of mature pods per plant (h^2_b = 44.32%, GAM = 27%), kernel yield per plant (h^2_b = 48.29 %, GAM = 33.49%), harvest index (h^2_b = 54.83%, GAM = 30.12%), 100 seed weight (h^2_b = 45.13%, GAM = 22.99%) and pod yield per plant (h^2_b = 52.82%, GAM = 33.96%). Improvement can be brought about in these traits through simple pedigree method of breeding and phenotypic selection would be effective. Moderate heritability coupled with high genetic advance as percent of mean for pod yield per plant was in accordance with the results of (9). On contrary low heritability coupled with low genetic advance as per cent of mean for pod yield per plant was reported by (14). High heritability coupled with high genetic advance as per cent of mean for pod yield was reported by (15).

High heritability coupled with low genetic advance as percent of mean recorded for oil content (h^2_b = 99.19%, GAM = 3.90%) and protein content (h^2_b = 98.97%, GAM = 3.28%) indicates the presence of non-additive gene action. The high heritability is being exhibited due to favourable influence of environment rather than the genotype and selection for such traits may not be rewarding. This finding obviates simple selection and necessitates recombination breeding with postponement of selection at later generations for the improvement of oil content and protein content.

High heritability coupled with low genetic advance as percent of mean for oil content was also recorded by (16). Where as (16) reported high heritability coupled with low genetic advance as percent of mean for protein content. On contrary, low heritability coupled with low genetic advance as per cent of mean for oil content was reported by (17). Moderate heritability coupled with moderate genetic advance as per cent of mean for protein content was reported by (12).

Moderate heritability coupled with moderate genetic advance as percent of mean was recorded for days to 50 % flowering (h^2_b = 59.93 %, GAM = 13.20 %) indicating that both additive and non-additive gene actions have a role in their inheritance and phenotypic selection would be effective to some extent. Where as moderate heritability coupled with low genetic advance as per cent of mean for days to 50 % flowering was reported by (6).

Low heritability coupled with low genetic advance as percent of mean was recorded by shelling percentage (h^2_b = 13.97%, GAM = 3.72%) which indicates that the character is highly influenced by environmental effects and selection would be ineffective. Similar results were also found by (9).

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