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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(9): 525-528

www.thepharmajournal.com
Received: 05-06-2022
Accepted: 30-08-2022

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Studies on genetic variability for pod yield related traits in two F_2 populations of groundnut (*Arachis hypogaea* L.)

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Abstract
Crosses were made to develop a drought tolerant groundnut lines with bold kernel features traits using TG-76 and two drought tolerant parents (Dh-257 and Dh-256). Two F_2 cross derivatives with their parents were used to study their mean performance, genetic variability, heritability and genetic advance as percentage of mean for yield and contributing characters. Among the two crosses, the cross Dh-257 × TG-76 had higher mean performance for test weight and shelling per cent and can be used as best cross combination for improving bold kernel types. The variability parameters revealed that the phenotypic coefficient of variation was higher than genotypic coefficient of variation for all the characters studied indicating the role of environmental variance in the total variance. Phenotypic coefficients of variance (PCV) and genotypic coefficients of variance (GCV) for important yield contributing characters such as primary branches per plant, pod yield per plant, number of pods per plant, kernel yield per plant, test weight and shelling per cent in F_2 generations were higher in magnitude and displayed high heritability along with high GAM in both crosses. It suggests that all the six characters are conferred by additive gene action and these characters could be improved through simple selection in earlier generations.

Keywords: Groundnut, PCV, GCV, heritability, genetic advance

1. Introduction

In India, groundnut ranks first among the edible oilseed groups. Its seeds are rich source of edible oil (43-55%) and protein (25 to 28%). Its cake is used as feed or for making other food products and haulms provide quality fodder. Globally, it is cultivated in more than 100 countries, with the annual production of 45.95 million metric tonnes in an area of 28.5 m ha (FAOSTAT, 2018) [3]. The success of any crop improvement programs largely depends on the genetic variability present in the population. Heritability estimates are used to determine the amount of variation present in the population. Heritability combined with genetic advance will bring out the genetic gain expected from selection. In the present study crosses were made to develop drought tolerant groundnut lines and combination of drought tolerant and bold seeded groundnut genotypes with acceptable pod and kernel traits using TG-76 a bold seeded variety and drought tolerant parents (Dh-257 and Dh-256). These crosses were studied for mean and variability parameters for various pod and kernel yield as well as other component characters.

2. Material and Methods

The material for the present investigation consisted of two F_2 populations *viz*., Dh-256 × Dh-257 and Dh-257 × TG-76, wherein Dh-256 and Dh-257 are drought tolerant groundnut varieties while, TG-76 is a bold seeded variety. These crosses along with their parents were evaluated for productivity parameters during *kharif* 2018 at All India Coordinated Research Project (AICRP) on Groundnut, Main Agricultural Research Station (MARS), University of Agricultural Sciences, Dharwad.

Recommended cultural practices were followed throughout the crop period. The spacing adopted was 30 x 10 cm. All the parents and F_2 crosses were evaluated in non-replicated trial. Observations were recorded on plant height (cm), primary branches per plant, pod yield per plant (g), number of pods per plant, kernel yield per plant (g), test weight (g) and shelling per cent (%). In groundnut compared to other crops expected population size is low amongst other crops based on selection criteria and we took two crosses. A total of 20 in parents and 210-250 plants per crosses were observed. Phenotypic and genotypic coefficients of variation for all the characters were estimated using the formulae suggested by Burton and De Vane (1953) [2].

Broad sense heritability was estimated as the ratio of genotypic variance to the total variance and the extent of genetic advance expected through selection for all the characters also estimated as suggested by Johnson *et al.* (1955) [7].

3. Results and Discussion

Two F_2 populations derived from the crosses Dh-256 × Dh-257 and Dh-257 × TG-76 were evaluated to know the amount of variability, heritability and GAM for pod yield related traits in groundnut and it is furnished in Table 1 and mean performance of parents in Table 2. The variance indicated highly significant differences among three crosses for all the characters investigated.

3.1 Genetic variability parameters

Among the two crosses, the cross Dh-256 × Dh-257 had higher mean performance for primary branches per plant number of pods per plant, pod yield per plant and kernel yield per plant selection can be practiced for yield related traits and the cross Dh-257 × TG-76 had higher mean performance for plant height, test weight and shelling per cent selection can be practiced for improving bold kernel types.

High GCV and PCV was noticed in cross Dh-257 × TG-76 for plant height, whereas in the other cross Dh-256 × Dh-257 documented low to moderate GCV and PCV. Injeti *et al.* (2008) [5] and Savaliya *et al.* (2009) [14] registered moderate GCV and PCV in groundnut for plant height, thus it supports the outcome of the present study. Both crosses Dh256 × Dh257 and Dh-257 × TG-76 exhibited high variability at both genotypic and phenotypic level for branches per plant. A similar finding was registered in groundnut by Nandini *et al.* (2011) [10], Vishnuvardhan *et al.* (2012) [21] and Yadlapalli (2014) [22] registered moderate to high GCV and PCV for primary branches per plant.

Table 1: Genetic variability parameters for yield related traits in F_2 generation of two crosses in groundnut

Character	Cross	Mean	h^2 (%)	GCV (%)	PCV (%)	GAM (%)
Plant height (cm)	Dh256 × Dh257	15.75	26.38	8.9	17.33	9.42
	Dh-257 × TG-76	18.02	93.18	29.63	30.69	58.92
Primary Branches per plant	Dh256 × Dh257	3.25	72.36	22.36	26.74	46.37
	Dh-257 × TG-76	2.83	81.01	28.27	31.41	52.41
Pod yield per plant (g)	Dh256 × Dh257	26.26	88.61	51.62	54.83	100.09
	Dh-257 × TG-76	13.13	74.66	61.2	70.83	108.94
Number of Pods per plant	Dh256 × Dh257	31.32	92.99	50	51.85	99.32
	Dh-257 × TG-76	16.32	84.04	52.79	57.59	99.69
Kernel yield per plant (g)	Dh256 × Dh257	15.04	86.59	58.76	63.14	112.63
	Dh-257 × TG-76	8.1	72.41	65.19	76.61	114.28
Test weight (g)	Dh256 × Dh257	22.11	50.75	26.77	37.59	39.29
	Dh-257 × TG-76	35.55	82.53	75.17	82.74	140.67
Shelling per cent (%)	Dh256 × Dh257	53.9	72.92	22.88	26.8	40.25
	Dh-257 × TG-76	74.2	99.47	140.75	141.12	289.16

The present investigation noticed high GCV and PCV for pod yield per plant, number of pods per plant, kernel yield per plant, test weight and shelling per cent in both the crosses of groundnut. This finding is in conformity with earlier reports of Parameshwarappa *et al.* (2005) [11] for kernel yield; John *et al.* (2006) [6] and Blummel *et al.* (2012) [1] for pod yield; Shoba *et al.* (2010) [15] for number of pods per plant, pod yield per plant and kernel yield per plant; Nandini *et al.* (2011) [10], Yadlapalli (2014) [22] and Shukla and Rai (2014) [16] for kernel yield and pod yield per plant and Thirumala Rao *et al.* (2014) [18] for number of pods per plant, pod yield and kernel yield per plant. Higher genetic variability for these characters in these crosses indicates scope for selection.

Table 2: Mean performance of parents

Parents	Plant height (cm)	Primary Branches per plant	Pod yield per plant (g)	Number of Pods per plant	Kernel yield per plant (g)	Test weight (g)	Shelling per cent (%)
Dh-257	25.20	4.00	17.00	20.40	10.39	25.03	60.72
Dh-256	19.60	5.00	19.90	24.00	13.26	28.12	66.69
TG-76	22.00	2.40	9.57	7.20	5.14	71.63	53.13

3.2 Selection parameters

Heritability estimates facilitate in deciding the relative measure of heritable portion from the total variation. Heritability value itself does not reveal the number of best individual while exploring the genetic variability because the constraints of estimating the broad sense heritability as it comprise both additive and non-additive gene effects. Heritability estimates appear to be more significant when accompanied by estimates of genetic advance as percent of the mean (GAM).

3.2.1 Heritability and genetic advance as per cent of mean

High heritability with high GAM was exerted in cross Dh-257 × TG-76 for plant height, For plant height, Hamasselbe *et al.* (2011) [4], Shukla and Rai (2014) [16] and Yadlapalli (2014) [22]; High heritability concurred with high expected GAM registered indicating the lesser influence of environment on the expression of these characters. These characters are directed by additive gene effect, hence, ample scope for exercising selection to improve these productive related traits. Moderate heritability with low GAM was noticed in the cross Dh256 × Dh257 for plant height. Indicates influence of environment on the expression of character because of non-additive gene action, selection could be done in later generations to improve these characters in cross Dh256 × Dh257.

Primary branches per plant, pod yield per plant, number of pods per plant, kernel yield per plant, test weight and shelling per cent exerted high broad-sense heritability with high GAM in both the crosses Dh256 × Dh257 and Dh-257 × TG-76. For primary branches per plant, Nandini *et al*. (2011) [10], Shukla and Rai (2014) [16], Vange and Maga (2014) [19] and Yadlapalli (2014) [22]; for pod yield Hamasselbe *et al*. (2011) [4], Patidar *et al*. (2014) [12]; for number of pods per plant, Savaliya *et al*. (2009) [14], Nandini *et al*. (2011) [10]; for kernel yield, Sumathi *et al*. (2009) [17], Patidar *et al*. (2014) [12]; for test weight Kadam *et al*. (2016) [8]; Vinithashri *et al*., 2019 [20] and for shelling percentage, Lal *et al*. (2007) [9], Injeti *et al*. (2008) [5] and Savaliya *et al*. (2009) [14], Sumathi *et al*. (2009) [17], Shoba *et al*. (2010) [15], Patil *et al*. (2014) [13] and Shukla and Rai (2014) [16]; reported high heritability with high GAM in groundnut. High heritability concurred with high expected GAM registered for these characters indicate the lesser influence of environment on the expression of these characters. These characters are directed by additive gene effect, hence, ample scope for exercising selection to improve these productive related traits.

4. Conclusion

Among the two crosses, the cross Dh256 × Dh257 had higher mean performance for primary branches per plant number of pods per plant, pod yield per plant and kernel yield per plant selection can be practiced for yield related traits and the cross Dh-257 × TG-76 had higher mean performance for plant height, test weight and shelling per cent selection can be practiced for improving bold kernel types. Phenotypic coefficients of variance (PCV) and genotypic coefficients of variance (GCV) for important yield contributing characters such as primary branches per plant, pod yield per plant, number of pods per plant, kernel yield per plant, test weight and shelling per cent in both the F_2 generation crosses were higher in magnitude. Except for plant height in Dh256 × Dh257 documented low to moderate GCV and PCV. This denotes that presence of variation for majority of the characters studied in both the F_2 populations. High heritability and GAM for primary branches per plant, pod yield per plant, number of pods per plant, kernel yield per plant, test weight and shelling per cent were noticed in both the F_2 populations. It indicates additive gene action conferring all the six characters, hence less influenced by environment and these characters were improved through simple selection in early generations.

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