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GENETIC DIVERGENCE IN GERMPLASM OF GROUNDNUT (ARACHIS HYPOGEAE L.)

Dinesh Kumar Jain[1], S. K. Jain[2] & Raj Kumar Nagar[3]

[1,3]Plant Manager, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

[2]Associate professor, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

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ABSTRACT

Genetic divergence among 35 genotypes of Spanish bunch groundnut was estimated using Mahalanobis D^2 statics for 14 quantitative and qualitative characters. The analysis of variance revealed a significant difference among the genotypes for all characters. Based on Tocher's method 35 genotypes were grouped into eight clusters, where cluster I was largest containing 9 genotypes followed by cluster II and IV with 8 and 6 genotypes, respectively. The cluster VIII was having maximum inter–cluster distance with cluster I, cluster VI and Cluster VII followed by cluster V and VII, cluster II and VI and Cluster II and III. The intra-cluster distance was maximum in cluster VII followed by II and IV. Considering the cluster distance and cluster mean genotypes of cluster VIII, V, VI and III could be selected for hybridization programme.

KEYWORDS: *D^2, Genetic Divergence, Groundnut etc*

INTRODUCTION

Groundnut is one of the principle economic crops of the world. It is native to South America where the genus Arachis is distributed over a wide range of environment. The cultivated groundnut belongs to family Fabaceae subfamily Papilionaceae and comes under self pollinated group. It is an allotetraploid with 2n=40 chromosomes. Groundnut kernels are rich in oil and protein content. The oil and protein content range from 44.38 to 55.64 % and 20.52 to 32.08%, respectively, (Yang, 1993). Groundnut oils used either in liquid form or after hydrogenation is an important article of human diet. The biological value of groundnut protein is highest among the vegetable protein.

Groundnut shell finds the ready market as a fuel and sometimes applied to wetland rice soils as a mulch to improve the physical structure of the soil. The shell can also be used in the manufacture of particle boards.

To develop high yielding varieties a systematic breeding approach has to be adopted. Assessment of genetic diversity is an important step in any breeding program. Greater the diversity in the material better are the chances of improvement. Hence the present study was undertaken to estimate the genetic diversity among 35 genotypes of the groundnut for various characters.

MATERIALS AND METHODS

The experiment was conducted by using 35 genotypes of Spanish bunch groundnut, received from ICRISAT through AICRP on Groundnut, MPUAT Udaipur, in a randomized block design with 3 replications at the experimental farm of the department of plant breeding and genetics, Rajasthan College of Agriculture, Udaipur. Each entry was planted in four rows of 5-meter length, each placed 30 cm apart. Plant to plant distance of 10 cm was maintained. All the recommended agronomic practices were adopted to raise a good crop.

The observations were recorded for 14 quantitative and qualitative traits on 10 randomly selected plants for each entry under all the replications for all the characters except days to flowering and days to maturity where the entire population of the entry was considered. The genetic diversity between genotypes was worked out using Mahalanobis D^2 (1936) extended by Rao (1952). On the basis of D^2 values, the genotypes were grouped into clusters according to Tocher's method (Rao, 1952). The method of Singh and Choudhary (1985) were used to calculate the intra and inter-cluster distances. The contribution of individual character towards divergence was estimated using Singh (1981)

RESULTS AND DISCUSSIONS

In the present study, 35 genotypes of groundnut were grouped into eight clusters based on D^2 values (Table 1). Among the cluster, cluster Ist was the largest one containing 9 genotypes, cluster II having 8, cluster IV having 6 and cluster VI having 4 genotypes.

Table 2 revealed that mean values of inter-cluster distance were larger than the intra-cluster distance which indicated that greater diversity is present among the genotypes of different groups (Zaman et al., 2010). The inter-cluster analysis exhibited highest divergence between cluster I and cluster VIII (1268.73) followed by cluster VII and cluster VIII (1175.14), cluster VI and cluster VIII (1163.46), cluster V and Cluster VII (10410.48) and cluster II and Cluster VI (1036.36) as compare to others so the genotypes in these clusters can be utilized for selection of parents for hybridization. Cluster VIII contains only one genotype i.e. ICGV-93128 having maximum inter-cluster divergence from genotypes of cluster I, VII and VI which may be used as parents in hybridization programme. Bhakal and Lal (2015) also suggested that crossing between the genotypes allied to the cluster pairs cleaved apart by higher inter-cluster distances might develop anticipated transgressive segregates that eventually opens up the opportunity for identification of superior genotypes in the successive generation.

The highest intra-cluster distance was observed in cluster VII (653.11) followed by cluster II (525.37) and cluster IV (517.94) and lowest intra-cluster distance was observed in cluster VIII (0.00) and cluster V (216.82). The genotype ICGV-93134 and SB XI recorded the highest distance within the same cluster.

The cluster mean value (Table 3) for days to flowering was highest in cluster III (41.67 days), for days to maturity in cluster VIII (116.33 days), for dry pod yield per plant and kernel yield per plant in cluster V (8.65 g and 5.78 g) followed by cluster VIII (8.11 g and 5.70 g), respectively. Cluster VIII was having higher mean value for oil content (53.6%) followed by cluster VI (49.17%). The highest mean value for protein content was observed in cluster I (23.98%) and cluster VIII (23.21%).

A contribution of characters towards divergence (Table 4) was observed maximum through protein content (26.72%) followed by dry pod yield per plant (14.62%), oil content (13.44%) and shelling per cent (10.25%). Yaikhom et al (2015) also observed dry pod yield per plant as the major contributor towards total genetic divergence in groundnut. It has been suggested that divergence should be given importance for undergoing hybridization programme. Considering the cluster distance and cluster mean in present investigation emphasis should be given to genotypes belonging cluster VIII, I V, VI and VII for selection of parents for hybridization programme.

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APPENDICES

Table 1: Distribution of 35 Groundnut Genotypes in Different Clusters

Cluster No.	No. of Genotypes	Name of Genotypes
I	9	ICGV- 91155, ICGV-92195, ICGV-92206, ICGV-92217, ICGE-92218, ICGV-92222, ICGV-92229, ICGV-93388, ICGV-93420
II	8	ICGV-92267, ICGV-93370, ICGV-93382, ICGV-93392, ICGV-93461, CHICO, GG-2, J-24
III	3	ICGV-92001, ICGV-92004, ICGV-92015
IV	6	ICGV-92022, ICGV-92023, ICV-92027, ICGV-92028, RG-141, TAG-24
V	2	ICGV-92035, ICGV-93135
VI	4	ICGV-92033, ICGV-92040, ICGV-93133, ICGV-93136
VII	2	ICGV-93134, SB-XI
VIII	1	ICGV-93128

Table 2: Average Intra- Cluster (Bold) and Inter-Cluster Distance D^2 Values

Cluster	I	II	III	IV	V	VI	VII	VIII
I	**394.22**	765.30	812.42	1004.90	918.18	528.433	582.63	1268.73
II		**525.37**	1025.49	782.50	1001.93	1036. 36	793.28	801.26
III			**332.30**	795.915	284.79	603.68	847.54	555.40
IV				**517.94**	594.79	952.63	897.24	492.02
V					**216.82**	801.60	1041.48	416.12
VI						**324.60**	439.21	1163.46
VII							**653.11**	1175.14
VIII								**0.00**

Table 3: Cluster means of Different Characters in Groundnut Genotypes

Character / Cluster	Days to Flowering	Days to Maturity	Ht. of Main Axis (cm)	No. of Primary Branches	No. of pods per plant	Haulm Yield Per Lant (g)	Dry pod Yield Per Plant (g)	Kernel Yield Per Plant (g)	Shelling per cent	100- Kernel wt (g)	Sound Mature Kernel (%)	Harvest Index (%)	Oil Content (%)	Protein Content (%)
I	32.85	101.56	21.78	4.02	18.15	13.00	5.34	3.74	70.04	28.29	83.14	43.75	46.84	23.98
II	31.04	99.63	15.88	3.71	16.92	8.12	5.29	3.96	73.62	32.15	81.21	68.44	46.58	21.34
III	41.67	115.78	16.59	5.04	17.91	17.67	7.29	4.88	67.11	28.14	76.33	42.96	47.46	20.67
IV	37.72	111.44	18.19	4.33	20.49	14.22	7.42	5.19	71.44	41.89	81.94	55.13	45.58	22.34
V	40.00	114.50	19.67	4.18	20.70	19.67	8.65	5.78	68.67	31.74	77.18	44.75	44.25	20.68
VI	39.92	113.92	18.77	4.18	14.08	15.33	5.59	4.02	72.25	34.41	80.25	36.83	49.17	23.78
VII	34.83	107.68	14.68	4.73	14.02	11.33	4.59	3.42	73.67	35.54	77.17	41.65	45.16	20.13
VIII	41.33	116.33	15.68	4.60	17.33	12.33	8.11	5.70	69.33	36.64	81.33	65.89	53.16	23.21

Table 4: Relative Contribution of Each Character towards Divergence

Character	% contribution
Days to flowering	3.025
Days to maturity	0.000
Ht. of main axis (cm)	2.521
No. of primary branches	0.000
No. of pods per plant	1.848
Haulm yield per lant (g)	9.580
Dry pod yield per plant (g)	14.622
Kernel yield per plant (g)	0.168
Shelling per cent	10.252
100- Kernel wt (g	6.723
Sound mature kernel (%)	1.176
Harvest index (%)	9.916
Oil content (%)	13.445
Protein content (%)	26.723