Evaluation and Characterization of Groundnut (*Arachis hypogaea* L.) germplasm lines as per DUS Guidelines

ABSTRACT

Evaluation and characterization of groundnut germplasm lines is important due to increasing needs of varietal development. TIn the present investigation, 76 germplasm lines of RARS, Palem were evaluated in a randomized block design (RBD) with two replications at Regional Agricultural Research Station, Palem, Telangana during *Rabi,* 2022 and 2023.Observations were recorded on 16 morphological characters *viz*., Plant growth habit, leaflet size, leaflet colour, stem pubescence, flower presence on main axis, flower arrangement on side branches, time of maturity, pod constriction, pod reticulation, pod-number of kernels, pod-presence of beak, shelling percentage, testa colour, kernel clour, kernel shape and weight of 100 kernels. The genotypes were grouped based on the data and further, the lines will be used in the breeding programmes.

Key words : *Groundnut, DUS, Morphological characterization.,Genotypes*

1.INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a leguminous plant that is widely cultivated in the tropics and subtropics between 40°N and 40°S latitudes. It is a major oilseed crop of India and also an important agricultural export commodity, there is a need to obtain high yielding varieties to ensure food security needs of the world's rapidly rising population. It is a valuable source of nutrients and a rich source of protein. India is the world's second largest producer, processor, and exporter of groundnuts, accounting for nearly 25-30% of global production after China. In India, it is cultivated in an area of 47.07 lakh ha with 101.8 lakh tonnes production and productivity of 2163 kg/ha in 2023-24(Source: Ministry of Agriculture & Farmers Welfare, Govt. of India.).

Genetic resources provide basic material for selection and improvement through breeding. Conservation and utilization of plant genetic resources are important components of any breeding programmes (Upadhyaya*et al.,*2008).Use of only few elite germplasm lines and/or cultivars in breeding programs reduces the genetic variation, leading to a narrow genetic base in the groundnut gene pool (Gupta et al. 2015). Improving the genetic potential of groundnut for qualitative and quantitative traits is one of the major objectives in most groundnut breeding programs (Upadhyaya et al. 2005). The differences in morphology act as a initial basics to differentiate one variety from other variety. The Government of India has enacted Plant Varieties and Farmers' Rights Act, 2001 for providing protection to plant varieties based on distinctiveness, uniformity and stability test (DUS test). The characters used for DUS test are primarily morphological characters being scored in the field and laboratory or with specific markers in the field during various growth stages of the crop varietal characterization *viz.,* seed, seedling, vegetative stage, reproductive stage and maturation stage. The morphological descriptors in sequential manner is useful and convenient to distinguish the different varieties (Karthikeyan et al.,2023). Keeping this in view, the present study was carried out to differentiate 76 groundnut germplasm lines based on morphological markers as per DUS characterization.

2.MATERIAL AND METHODS

The experiment was conducted during *Rabi,* 2022 and 2023 at Regional Agricultural Research Station, Palem, Telangana. A total of 76 germplasm lines of RARS, Palem (table 1) were evaluated in a randomized block design (RBD) with two replications and a plot size of 2 rows and 5meter length by adopting a spacing of 30 cm x 10 cm and grouped with the help of a descriptors provided by National Test Guidelines and UPOV for the conduct of DUS test. The recommended agronomic practices were

followed for raising the crop. Data pertaining to 16 characters were recorded *viz*., Plant growth habit, leaflet size, leaflet colour, stem pubescence, flower presence on main axis, flower arrangement on side branches, time of maturity, pod constriction, pod reticulation, pod-number of kernels, pod-presence of beak, shelling percentage, kernel clour and weight of 100 kernels.

3. RESULTS AND DISCUSSION

In the present study, 76 groundnut germplasm lines were evaluated and characterized to establish distinctiveness among the germplasm lines and these were presented below (table 2) as per the national test guide lines for the conduct of DUS test in groundnut (Anonymous, 2009). The genotypes under study showed wide range of variability for all the traits studied. Frequency distribution for all the characters under study was also computed. For the plant growth habit, among the 76 germplasm lines studied, 33 were observed as erect, 40 were of semi spreading type and 3 genotypes (PGP 41, PGP 55 and PGP 73) were spreading growth habit. While studying leaflet size, observed Small (<4.0 cm) size in 65 genotypes, medium (<4. 0-6.0cm) size in 7 genotypes and none of the genotypes were observed in large leaf let size (>6 cm). The leaf let color of 23 genotypes were light green color, 19 were green color and 34 genotypes were observed as dark green leaflet color. Similar research findings were reported in crops like pearl millet (Arunkumar *et al.*, 2004), Jute (Kumar *et al*., 2006), Lucerne (Dumbre *et al*., 2007) and maize (Yadav and Singh, 2010) for varietal identification. Based on the study on stem pubescence the genotypes were grouped as absent (18 no.), Sparse (47 no.) and medium (11 no.).

Two flower characters i.e Flower: Presence on main axis and Flower: Arrangement on side branches were studied in 76 germplasm lines and observed that 71 genotypes were having flower present on main axis and 5 genotypes were observed as flower absent on main axis. Same as like in flower arrangement on side branches were categorized into sequential, alternate and irregular. Out of 76 genotypes 71 showed sequential, 3(PGP 25, PGP 26 and PGP 38) were alternate and 2 genotypes (PGP 96 and PGP 123) showed irregular arrangement of flower. (Gupta *et al*. (2010) Distinctness in Indian soybean (*Glycine max*).

Based on days to maturity, genotypes were grouped as Early (90-10 days) (2 no.), Medium (101-110 days) (71 no.) and Late (111-120 days) (3 no.) duration.

Pod characters i.e pod constriction, pod reticulation, pod-number of kernels, pod-presence of beak and pod shelling percentage were studied. Among the 76 genotypes, pod constriction was observed as absent in 32 genotypes, shallow in 20 and medium in 24 genotypes. The pod reticulation was observed as prominent in 19 genotypes, medium in 24 genotypes and absent in 33 genotypes. Pod-number of kernels >60 % 2 seeded observed in 76 genotypes. The pod beak was present in 20 genotypes and was absent in rest of the varieties. The Shelling percentage >75 was observed in 5 genotypes, medium (66-75) in 62 and Low (<66) in 9 genotypes.

The seed morphological characters *viz*., testa color, kernal color, kernal shape and 100 kernel weight were easy to measure and classified the groundnut varieties into few broad categories. Testa color was observed as uniform in all the genotypes studied. Based on kernel colour the genotypes were grouped as, off white (1 (PGP 20), tan (22), rose (52) genotypes and dark red 1 genotype (PGP 47). Based on the seed shape, the studied 76 genotypes were grouped as spheroid in 18 genotypes, cylindrical in 23 and 35 genotypes as fusiform. Maximum weight (>65 g) per 100 seeds were recorded in (PGP 151), low seed weight (>36g) were observed in 61 varieties, medium 100 seed weight (36-50g) were observed in 36 genotypes and high seed weight (51-65 g) observed in 17 genotypes. These results were in conformity with the findings of Karthikeyan et al., 2023 and Rajgopal et al., 2004 in groundnut and Patra et al., (2010) in rice revealed the use of seed characters for the identification of varieties.

Table 1 List of genotypes used for the study of Distinctiveness, Uniformity and Stability Test

S.No.	Genotype	S.No.	Genotype	S.No.	Genotype
1	PGP -6	27	PGP-42	53	PGP -87
2	PGP- 9	28	PGP -43	54	PGP -91
3	PGP -11	29	PGP -44	55	PGP -94
4	PGP -13	3	PGP -45	56	PGP -96
5	PGP -15	31	PGP -47	57	PGP -97
6	PGP -16	32	PGP -49	58	PGP -99
7	PGP -17	33	PGP -51	59	PGP -102
8	PGP -19	34	PGP -52	60	PGP -108
9	PGP -20	35	PGP-53	61	PGP -109
10	PGP -22	36	PGP -54	62	PGP -110
11	PGP -23	37	PGP -55	63	PGP -114
12	PGP -25	38	PGP -56	64	PGP -115
13	PGP -26	39	PGP -59	65	PGP -120
14	PGP -27	40	PGP -60	66	PGP -121
15	PGP -29	41	PGP -61	67	PGP -122
16	PGP -31	42	PGP -62	68	PGP -123
17	PGP- 32	43	PGP-64	69	PGP -128
18	PGP-33	44	PGP -75	70	PGP -129
19	PGP-34	45	PGP -67	71	PGP -130
20	PGP-35	46	PGP -68	72	PGP -134
21	PGP-36	47	PGP -70	73	PGP -136
22	PGP-37	48	PGP -71	74	PGP -151
23	PGP-38	49	PGP -73	75	PGP -154
24	PGP-39	50	PGP -76	76	PGP -155
25	PGP-40	51	PGP -85		
26	PGP-41	52	PGP -86		

Table 2 Frequency distribution of Groundnut germplasm lines for DUS characters

S.No.	Characteristics	State	Note	No. of genotypes	Frequency distribution %
1	Plant: Growth habit	Erect	1	33	43.42
		Semi spreading	2	40	52.63
		Spreading	3	3	3.95
2	Leaflet: Size (fully developed basal leaflet)	Small (<4.0 cm)	3	69	90.78
		Medium (<4. 0 – 6.0cm)	5	7	9.21
		Large(>6.0cm)	7	0	5.26
3	Leaflet:Colour	Light green	1	23	30.26
		Green	2	19	25.00
		Dark green	3	34	44.74
4	Stem:Pubesence	Absent	1	18	23.68
		Sparse	3	47	61.84
		Medium	5	11	14.47
5	Flower:Presence on main axis	Absent	1	5	6.58
		Present	9	71	93.42
6	Flower: Arrangement on side branches	Sequential	1	71	93.42
		Alternate	2	3	3.95
		Irregular	3	2	2.63
7	Time of maturity (For curing)	Very early (<90 days)	1	0	0.00
		Early (90-10 days)	3	2	2.63

		Medium (101-110 days)	5	71	93.42
		Late (111-120 days)	7	3	3.95
		Very late(>120 days)	9	0	0.00
8	Pod: Constriction	Absent	1	32	42.11
		Shallow	3	20	26.32
		Medium	5	24	31.58
		Deep	7	0	0.00
9	Pod: Reticulation	Absent	1	33	43.42
		Medium	3	24	31.58
		Prominent	5	19	25.00
10	Pod: Number of kernels (on100 pod basis)	>60 % 2 seeded	1	76	100.00
		>60 % 3 seeded	3	0	0.00
		>60 % 4 seeded	5	0	0.00
11	Pod: Presence of beak	Absent	1	56	73.68
		Present	9	20	26.32
12	Pod: Shelling percentage	Low (<66)	3	9	11.84
		Medium(66-75)	5	62	81.58
		High (>75)	7	5	6.58
13	Testa colour	Uniform	1	76	100.00
		Variegated	9	0	0.00
14	Kernel: Colour of testa (varieties wit monochrome testa only)	White (1 A 1)	1	0	0.00
		Off white (1 A 2)	2	1	1.32
		Tan (12 E 4)	3	22	28.95
		Rose (Grayish red 8 B3)	4	52	68.42
		Purple (14 F 4)	5	0	0.00
		Dark purple(14 F 7)	6	0	0.00
		Salmon (6 A 4)	7	0	0.00
		Red (10 B 7)	8	0	0.00
		Dark red (11 C 8)	9	1	1.32
15	Kernel: Shape	Spheroid	1	18	23.68
		Cylindrical	2	23	30.26
		Fusiform	3	35	46.05
16	Kernel: Weight of 100 kernels (about 9 % moisture)	Low (<36 g)	3	22	28.95
		Medium (36-50 g)	5	36	47.37
		High (51-65 g)	7	17	22.37
		Very high (>65 g)	9	1	1.32

4. CONCLUSION

The study on 76 genotypes for various 16 morphological characters based on National Test Guidelines and UPOV for the conduct of DUS test, the genotypes were found to be distinctive. Based on these

results, this study will be useful for the breeder for selection of genotypes and will be used in breeding programmes.

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