Evaluation of Groundnut Advanced Lines on the Basis of Morphometric Characters

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A R T I C L E I N F O

A B S T R A C T

An experiment titled "Evaluation of groundnut advanced lines on the basis of morphometric characters" was conducted at National Agricultural Research Center (NARC), Islamabad to evaluate the different traits of groundnut genotypes during the kharif season of 2021. Twelve different genotypes of groundnut were assessed in this trial. The experiment was conducted according to Randomized Complete Block Design (RCBD) with three replications. All plot contained of three rows each having a length of four meters and row to row distance of 45 cm. Similarly, within each row, a plant to plant distance of 15 cm was maintained. Altogether the agronomic applies were kept constant throughout the experiment. Data were recorded on ten different parameters that included plant height (cm), stem diameter (mm), leaf length (cm) and leaf width (cm). The experimental results revealed that the maximum plant height was 53.267 cm recorded in genotype PG-1302 while the lowest plant height was 32.033 cm that was observed for genotype PG-1294. The maximum stem diameter was 4.7333 cm that was observed for PG-1302, while the minimum was 3.6333 cm in case of genotype PG-1294. Maximum leaf length was recorded for PG-1302 which was 6.2333 cm while the lowest one was 4.8000 cm found in BARI-2011 genotype. The maximum leaf width was 2.4667 cm exhibited by PG-1302, while the minimum value was 2.0000 cm in genotype PG-1296. Among all the lines of groundnut PG-1302 is best in term of biomass and in term of yield PG-1267 is performed best. So the recommendation is for high yield production is the variety PG-1267 is best

INTRODUCTION

Groundnut (Arachis Hypogaea L) is a self-Pollinate legume summer crop belong to family Fabaceae having tap root system. Its major division is Spermatophyte & sub- division is Angiosperm producing dicotyledon seed & intermediate crop pattern. Groundnut, 'the erratic legume' is also known as earthnut, peanut, monkey nut and manilla nut. It is the 13th most important food crop and 4th utmost significant oilseed crop of the world. The botanical name Arachis hypogaea L. has been derived from the Greek words, Arachis meaning a legume and hypogaea meaning below ground denoting to geocarpic nature of pod creation. The groundnut contain about 40-50% edible oil , 20-30% protein ,10-20% charbohydrate and also rich in some nutritional component like calcium , thiamine, zinc, magnesium, iron, potassium and vitamin-E. Its oil is too used for the grounding of soaps, makeups, cold cream and for many manufacturing uses. Groundnut is a native New World crop. Now a days its spell and found that it is cultivated in Mesoamerica as well as south America.it is also a remnant pericarp tissue coverd from archaeological positions in peru times its determined agriculture use their use about 3900-3750 year ago .Groundnut main acquired place in the valley of Parana and Paraguay river system in gran Chaco area of south America. Natural existence of the genus Arachis is partial to five countries, i.e., Argentina, Bolivia, Brazil, Paraguay, and Uruguay. The headwaters of the Paraguay River in the region of Mato Gross are careful to be the center of its source. Taxonomy of the genus is not well defined and the assemblage of species into 7 segments is only hesitant; there may be as several as 70 species in the genus Arachis. The cultivated groundnut, Arachis hypogaea L., initiated in the zone of southern Bolivia and northwestern Argentina on the eastern hills of the Andes. Groundnut, also recognized as peanut, is an significant oil, food, and feed legume crop grownup in over 100 countries. It enclosed 24 million ha area worldwide with a total manufacture of 38 million tons in 2010. In the last era (2000–2010), the universal groundnut assembly improved slightly. The overall yearly growth in manufacture was 0.4% which was due to both, an yearly rise in yield by 0.1% and in area by 0.3%. The predictable request of groundnut in Asia only by 2020 is estimated to be 1.6 times extra than the equal of manufacture in 2000 (Birthal et al., 2010). If the predictable strains have to be encountered, the efficiency and production of the crop has to increase at a abundant advanced progress rate than the current one. Asia and Africa account for 95% of global groundnut area where it is cultured under rainfed situations with low efforts by source deprived growers. Groundnut is a money crop provided that profits and source of revenue to the farmer. It also donates to nourishment of farmhouse families through consumption of energy- and protein-rich groundnut kernels and provides nutritious fodder (haulms) to livestock. Thus groundnut cultivation contributes to the sustainability to mixed crop-livestock production systems, the most prime system of the semi-arid areas.

Groundnut is an important cash crop in barani areas of upper Punjab and parts of NWFP. In Sindh, it is grown under irrigated conditions. About 84 % of the total groundnut area lies in Punjab, 13% in NWFP and 3 % in Sindh. During 1998-99, the total area under groundnut was 97,500 hectares with the production

of 104,000 tons and average yield of 1067kg/ha. Groundnut performs well in sandy loam soil because sandy soil have well drained soil. The PH of the soil should be between 5.5 to 7 in range. Presently groundnut used as roasted from their shell. As groundnut produced on small scale because its market value is low as compared to other staple crops, though it is an oil seed crop. Groundnut also used as few traditional dishes. The overall market value of groundnut is limited. Groundnut is a main cash crop of the rainfed zone and is a good basis of eatable oil as it comprises around 50% oil of good excellence. Groundnuts are refined in the hot and subtropical areas of the world on sandy soils. Incomes of groundnut differ from about 400 kg to more than a few tons per hectare, liable on the making system, but on the usual, the worldwide yield is 2500–2700 kg each hectare.

LITERATURE REVIEW

Conducted by Ahmad and Rahim in 2007, a study at the Agricultural Research Institute (North), Mingora, Swat, throughout 2002-03 aimed to identify high-yielding groundnut varieties for optimal farming in Malakand Division. The research, utilizing a randomized complete block design, identified varieties PG-479 and PI-338337 as superior, producing 4024.1 and 3703.7 kg per hectare, respectively. These varieties are recommended for commercial agriculture in Malakand Division.

Evaluated by Atoyebi et al. in 2017, the study assessed 300 accessions of Bambara groundnut from the global repository at the International Institute of Tropical Agriculture. Thirty-seven agro-morphological traits were recorded for each plant. Results highlighted lines such as TVSu-293 and TVSu-395 with high yield potential. The study provides valuable information for future nutrition and breeding programs for Bambara groundnut.

Reported by Botha and Kock in 2020, groundnut production in South Africa showed a significant decline over the past two decades, with hectares planted and yield decreasing despite an increase in average yield per hectare. The decline raises concerns about the sustainability of groundnut cultivation in the region.

In 2018, Fatimah et al. compared different techniques for controlling hereditary multiplicity in bambara groundnut genotypes. Morphological traits and RAPD analyses were used to assess genomic associations. Two groups with a relationship grade of 52% for morphological traits and 51% for RAPD symbols were identified, emphasizing the importance of considering both types of data for genotype improvement in plant propagation and management platforms.
Stated by Hari et al. in 2003, peanuts (Arachis hypogaea L.) are a vital oilseed crop cultivated in 96 countries globally. The study describes the development of a basic collection from 14310 peanut strains available from the ICRISAT Gene Bank. This core collection, representing diverse genetic resources, can be a valuable tool for the efficient management and enhancement of groundnut genotype properties.

Reported by Hogas et al. in 2014, the study in Ethiopia evaluated the heritable increase in grain yield and related characteristics of 14 peanut germplasms. Progressive genomic improvements were observed in yield-related traits, while undesirable genomic changes occurred in bio-phenological traits. The findings demonstrate the effectiveness of breeding approaches in developing cultivars with improved yields and faster ripeness, contributing to increased productivity in peanut farming.

METHODOLOGY

A field experiment titled "Evaluation of groundnut advanced lines on the basis of morphometric character" was performed at National Agricultural Research Center "NARC" Islamabad. During the 2021 Kharif season, 12 peanut genotypes were evaluated using 3 replication randomized complete block designs (RCBD). Each plot contained three rows that were 4 meters long and had a spacing of 45 cm.15 cm plant spacing was maintained in all plots. All genotypes were sown at the National Agricultural Research Center (NARC) Islamabad on March 31, 2021 at recommended seed rates. The data are plant height (cm), stem diameter (mm), leaf length (cm) and leaf width (cm)

Plant Height (Cm)

Data of plant height was measured by using scale meter from the bottom of main stem to the top of the stem from three plants in each plot which were selected randomly and the mean value was calculated.

Stem Diameter (Mm)

Stem diameter data was together using calipers, and data collected from three plants in every plot were randomly carefully chosen and averaged.

Leaf length (cm)

Data on leaf length was collected by using scale from the bottom of leaf to the tip of the leaf of three plants in each plot which were selected randomly and the mean value was calculated.

Leaf Width (Cm)

Leaf width was measured of three plants in each plot which were selected randomly by using ruler from longest extension of any two points on the blade edges perpendicular to the leaf length axis and the mean value was collected.

Statistical Analysis:

Each and every traits of this experiment was statistically analyzed by the analysis of variance (ANOVA) using statistical software Statistic 8.1. Mean values were compared at a significant level using Least Significant Difference Test.

Plant Height (Cm):

For measuring the plant height we measured average plant height of three plants in each plot the highest plant height is clear in genotype named PG-1302 having 53.267 plant height followed by PG-1292with 50.667 plant height whereas the lowermost plant height is perceived in line PG-1294 having 32.000 cm plant height followed by PG-1296 having 32.033 plant height. This is also find by Shukla et al., (2014) observation were recorded by five randomly selected plant per replication for field mergence, plant height, primary branches/plants, pod yield per plant, sound mature kernel, hundred kernel weight, shelling, kernel yields, kernel homogeneity & remark on days to 50% blossoming & days to development were verified on plot base and 4 qualitative character oil yield, oleic acid, protein content and oil content. The data were exposed the data were to burton measurements to quantity the phenotypic constant of variation and germplasm constant of dissimilarity. Genomic was functioned out by using method recommended by Lush (1949) and Burton & Devane (1953). The genomic advanced i.e. the predictable genetic advantage was worked out by using the formula suggested by (Johnson et al .1955).

Stem Diameter (Mm):

For determining and studying stem diameter were measured three plants in each plot the maximum stem diameter is observed in genotype PG-1302 having 4.7333cm stem diameter followed by PG-1291 with 4.5667mm stem diameter on other hand the lowest stem diameter is cleared in genotype PG-3.6333mm followed by PG-1276 having 3.8333mm stem diameter. Umoh et al., (2021) the result of the effect of tillage methods on plant height and stem diameter is shown in. It shows that ridge tilled soil had the tallest plant height while the zero tillage plots had the shortest height. The trend was in these order Ridge> Bed> minimum till> Zero till. The tillage method had a significant effect on the height and stem diameter of groundnut which is an expression of vegetative growth. Ridge tillage produced the biggest stem diameter but was not significantly different from other treatments. The tilling effect could be efficient in releasing of nutrient in the soil for plant uptake. Similar results were obtained by Aikins & Afuakwa (2010) for cowpea while Aikins et al., (2012) had similar result for maize growth on tilled plots in comparison with that in zero tilled plots.

RESULTS AND DISCUSSION

Table 1. LSD All-Pairwise Comparison Test for Plant Height and Stem Diameter

Genotype	Mean	Genotype	Mean
PG-1302	53.267a	PG-1302	4.7333a
PG-1292	50.667ab	PG-1291	4.5667ab
PG-1291	49.700abc	PG-1293	4.5667ab
PG-1276	46.733abc	BARI-2011	4.4667ab
PG-1285	42.500abcd	PG-1299	4.4333ab
PG-1305	41.233bcd	PG-1296	4.4000ab
PG-1304	40.033bcd	PG-1285	4.3333ab
PG-1299	39.267bcd	PG-1305	4.3333ab
BARI-2011	39.033cd	PG-1292	4.2800ab
PG-1293	38.833cd	PG-1304	4.0667ab
PG-1296	32.033d	PG-1276	3.8333ab
PG-1294	32.000d	PG-1294	3.6333b

Leaf Length (Cm):

It is generally believed that measuring leaf area in peanut is much difficult than other agronomic crops. The reason behind this is that it has a tetra-foliated compound leaf which makes it hard to determine leaf area or even compute it that involves a lot of labor and cost if measured through latest equipment (Ma et al., 1992). Our results revealed significant differences among the tested genotypes. The maximum leaf length is found in genotype PG-1302 having 6.2333 leaf length followed by PG-1292 with 5.9000 leaf length while the lowest leaf length is observed in genotype BARI-2011 with 4.8000 leaf length followed by PG-1294 which is also the same leaf length. Measured the average leaf length of 3 plants in each plot. According to Kathirvelan et al., (2007) who detailed that leaf length and width of groundnut seeds of genotype CO2 were seeded on sandy loam soil kharif season of 2003 at coconut research station, Aliyarangar, Tamil Nadu Agriculture University, Coimbotare. 127 leaves were randomly certain at blossoming phase of the crop. The leaves were separated plunged in water for one hour and ventilation using filter paper. The exciting linear quantities viz extreme length & width were documented. The true leaf area was also determined with the help of auto metric leaf area meter (Model Li-Co 3100) and denoted by TLA. The getting worse constant was calculated from multiple regression coefficients to fit in allometric model.

Leaf Width (Cm):

For recording the leaf width we measured the average leaf width of 3 plants in each plot but the variation in leaf width is occure among the different entries of groundnut same study was reported by the technique has revealed important variances in characters that are considered to be the best important in explaining the variations among the accession. Dissimilarities in the results of

multivariate methods for properties that best summarize variance within the population have been previously reported by Ariyo (1993) and Nair et al. (1998).

Table 2. LSD ALL-Pairwise Comparisons Test of Leaf Length and Leaf Width for ENTRY

Genotype	Mean	Genotype	Mean
PG-1302	6.2333a	PG-1302	2.4667a
PG-1292	5.9000ab	PG-1292	2.4333a
PG-1305	5.4667abc	PG-1276	2.4000a
PG-1293	5.3667bc	PG-1285	2.2667ab
PG-1276	5.2667bc	PG-1291	2.3000ab
PG-1291	5.2333bc	PG1299	2.2667ab
PG-1285	5.0000c	PG-1305	2.2667ab
PG-1299	4.9667c	BARI-2011	2.2667ab
PG-1304	4.9667c	PG-1304	2.2000ab
PG1296-	4.8667c	PG-1293	2.1333ab
PG-1294	4.8000c	PG-1294	2.1333ab
BARI-2011	4.8000c	PG-1296	2.0000b

CONCLUSIONS AND RECOMMENDATIONS

The only conclusion facing in groundnut that it is cultivated only on sandy or sandy loam soil and mostly former grow other cereal crops another problem is that the market value is not good but for oil purpose if a farmer grow it will retain good profit. Among all the lines of groundnut PG-1302 is best in term of biomass and in term of yield PG-1267 is performed best. So the recommendation is for high yield production is the variety PG-1267 is best.

FURTHER STUDY

Advanced research could focus on enhancing market value for groundnut, exploring strategies to improve its economic viability beyond oil production. Investigate agronomic practices for groundnut cultivation in non-sandy soils to broaden its geographic suitability. Additionally, delve into genetic improvement to develop varieties with optimal biomass and yield, addressing both economic and agronomic aspects for sustainable cultivation.

REFERENCES

Ahmad, N. and Rahim, M., 2007. Performance of promising groundnut, Arachis hypogaea L. varieties for yield and other characters. Journal of Agricultural Research Pakistan.

Atoyebi, J.O., Oyatomi, O., Osilesi, O., Adebawo, O. and Abberton, M., 2017. Morphological characterisation of selected African accessions of bambara groundnut (Vigna subterranea L.) verdc.). International journal of plant research, 7(2), pp.29-35.

Botha, A. and De Kock, L., 2020. Groundnut production: cultivar evaluation and development are vital. Oilseeds Focus, 6(4), pp.17-17.

Fatimah, S. and Ardiarini, N.R., 2018. Genetic diversity of Madurese bambara groundnut (Vigna subterranea L. Verdc.) lines based on morphological and RAPD markers. SABRAO Journal of Breeding & Genetics, 50(2).

Gonné, S., Félix-Alain, W. and Benoît, K.B., 2013. Assessment of twenty bambara groundnut (Vigna subterranea (L.) Verdcourt) landraces using quantitative morphological traits. International Journal of Plant Research, 3(3), pp.39-45.

Hagos, F., Zeleke, H. and Woyossa, B., 2012. Genetic gain in yield and yield related traits of groundnut [Arachis hypogea (L.)] in central rift valley of Ethiopia. East African Journal of Sciences, 6(2), pp.125-136.

Jahanzaib , Nazakat Nawaz, Haris khurshid, Sohail ahmad Jan, Muhammad arshid & Ishtiaq hussain, estimating genotype x environment interaction for groundnut seed yield across different ecological zone, International Journal of Groundnut & Biology 2019,vol,22,No.1.

Mohammed, M.S., Shimelis, H.A. and Laing, M.D., 2016. Phenotypic characterization of diverse Bambara groundnut (Vigna subterranea [L.] Verdc.) germplasm collections through seed morphology. Genetic Resources and Crop Evolution, 63(5), pp.889-899.

Ntundu, W.H., Shillah, S.A., Marandu, W.Y.F. and Christiansen, J.L., 2006. Morphological diversity of bambara groundnut [Vigna subterranea (L.) Verdc.] landraces in Tanzania. Genetic Resources and Crop Evolution, 53(2), pp.367-378

Ouedraogo, M., Ouedraogo, J.T., Tignere, J.B., Bilma, D., Dabire, C.B. and Konate, G., 2008. Characterization and evaluation of accessions of Bambara groundnut (Vigna subterranea (L.) Verdcourt) from Burkina Faso. Sciences & Nature, 5(2), pp.191-197.

Unigwe, A.E., Gerrano, A.S., Adebola, P., Pillay, M. and Monrovia, L., 2016. Morphological variation in selected accessions of Bambara groundnut (Vigna subterranea L. Verdc) in South Africa. Journal of Agricultural Science, 8(11), pp.69-80.

Upadhyaya, H.D., Ortiz, R., Bramel, P.J. and Singh, S., 2003. Development of a groundnut core collection using taxonomical, geographical and morphological descriptors. Genetic Resources and Crop Evolution, 50(2), pp.139-148.

Valombola, J.S., Akundabweni, L.M., Awala, S.K. and Hove, K., 2019. Agronomic and morphological diversity of Bambara groundnut (Vigna subterranea (L.) Verdc.) accessions in North-Central Namibia. Welwitschia International Journal of Agricultural Sciences, 1, pp.88-99.

Zenabou, N., Martin, B.J., Ernest, F.P., Bassiaka, O., Claude, S. and Didier, D., 2014. Agro- morphological variability in twelve Bambara groundnut (Vigna subterranea (L.) Verdc.) accessions in Cameroon. Sciences, Technologies et Developpement, 16(5), pp.38-45.