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Comparative study of some selected introduced varieties of groundnut (*Arachis hypogea* L.) in Lafia

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Abstract

Groundnut (Arachis hypogeae.) serves as a very crucial means of getting of getting oil and for food also. Recent studies have shown that yearly, almost 35.6 million tones is produced on 26.4 million ha. Although groundnut is majorly cultivated to be eaten by man, it is also used as desert or produced as oil, butter or other produce from it. It is produced for the sole purpose of selling in many parts of Turkey because it has the tendency for more yield and the commercial value it carries. Groundnut is always grown for the purpose of large-scale production to sale, to be used as a major and suitable substitute for meat as protein or for other very important purposes for man. This study was carried out to compare the growth and yield parameters of some selected introduced varieties of groundnut in Lafia, Nasarawa State of Nigeria. The aim of this work was to examine the morphological parameters of some introduced varieties of groundnut and to investigate the best adapted variety of groundnut in Lafia, Nasarawa State. College of Agriculture, Science and Technology Lafia consultancy unit, Lafia, Nasarawa state was the site where the experiment was carried out during the major seasons of 2021. The varieties were ICG88104, ICG98294, ICG4412, ICG12189 and SAMNUT26. All improved varieties maturing in 93 to 104 days. Randomized complete Block Design (RCBD) was adopted as the experimental design while it was replicated five (5) times. Planting was done at a gap of 25cm between stands and between rows on a plot measured 1M×1M for each replicate. The results presented showed that the variety ICG88105 have the best adaptation in terms of germination percentage, quantity of leaves, quantity of flowers, quantity of pods, pod weight, dried haulm weight, fresh weight and the crop growth rate. Seedling establishment was favored in some varieties as other shows low seedling survival in this growing season. Results also showed that in seed selection of improve varieties, farmers should be considerate on the purpose of their farming either for pod or haulm this will enable them to make informed choices of which of which the improved variety should be selected.

Keywords: Groundnut, varieties, comparative, yield, growth.

Introduction

For income and food security, and the need to satisfy the nutritional requirements of people, groundnuts has been a very essential global food and oil crop. This very important agricultural crop makes it suitable for curbing food scarcity and brings about income. Groundnut is an important global food and oil crop that underpins agriculture-dependent livelihood strategies meeting food, nutrition, and income security. Aflatoxins, is a major issue when it comes to the consumption of groundnuts, this makes it very difficult in competing with other crops which in turn limits its market value among consumers.

Semi- arid is the most suitable place for growing groundnut as a result, when rainfall is low and insufficient at the middle and end of the planting season, drought plays a critical role thereby affecting the yield of pod and its quality[1-3]. Cultivars have hence got a very crucial breeding significance for the reasons of the development and improvement of Arachis campaign[4].

For human consumption, groundnut is very rich in vitamins, proteins, essential fatty acids, Minerals and calories[5]. Recent studies have shown that yearly, almost 35.6 million tones are produced on 26.4 million ha. Although groundnut is majorly cultivated to be eaten by man, it is also used as desert or produced as oil, butter or other produce from it[6]. Malnutrition in African has been curtailed to a large extend by the instrumentality of groundnut due to its abundant nutrients[7]. There are various breeding programs to achieve numerous objectives[8-10].

Groundnut has been widely utilized for morphological characterization for increased productivity, although, past studies only concentrated on small amount landraces or varieties where few characters were considered[11,12]. It is produced for the sole purpose of selling in many parts of Turkey because it has the tendency for more yield and the commercial value it carries[13]. Different parameters like pegs, number of flowers and pod are used to differentiate Groundnut types.

It has been reported that groundnut cultivars revealed great variation in its yield parameters as well as its reproductive aspects during its various stage of development[14]. The most crucial aspects that determine the yield of groundnuts include pegs, pods and flowers[15]. The Vision of Nigeria is to be the country that produce the highest quantity of groundnut in the continent of Africa. However, there are no sufficient information on the connectivity among character traits in Groundnuts and the information found is not applied correctly. The study was aimed at determining the morphological parameters of some introduced varieties of groundnut and to investigate the best adapted variety of groundnut in Lafia, Nasarawa State. These findings could assist in decision making in terms of which variety or genotype to select. This may in turn save the time and money needed in the trial of varieties for the best traits components. Finally, the factors responsible for the low yield of the crop as well as its survival can be achieved.

Materials and methods

Five (5) groundnut cultivars (*Arachis hypogaea* L.) obtained from the Institute of Agricultural Research Samaru, Zaria through the Nasarawa Agricultural Development Program (NADP), Nasarawa State were planted at the Consultancy Unit of the College of Agriculture, Science and Technology Lafia, Nasarawa state. The varieties were SAMNUT 26, ICG88105, ICG12189, ICG98294 and ICG4412. Land preparation was done manually. Management practices such as Weeding was carried out manually once at three weeks intervals after planting using a small hoe[16].

Randomized complete Block Design (RCBD) was adopted as the experimental design while it was replicated five (5) times. Land used for the experiment was 891.75 m2 and two (2) seeds per hole at 3cm depth planted on 25cm apart, 41 long ridges having an inter ridge distance of 0.75 m[12;16].

Data Collection: Seed Germination Percentage at 5 days after planting (DAP): At 5 DAP After five days of sowing, number of seedlings germinated was counted and the percentage calculated.

Plant Height: This was measured by the aid of a meter rule from tip to the main stem in centimetres (cm).

Number of branches: Each date collection measured the number of branches that grew directly from the main stem.

Number of Leaf per plot: Three 3 plants were selected randomly per plot for each of the planting spacing and the total number of leaves was counted. The Mean leaf count was recorded.

Leaflet Area: The leaflet area was calculated using the data obtained from the physical parameters as follows; Leaflet Area (LA) = L×W×2.325[17].

Number of flowers per plant: Mean number of flowers was counted and recorded.

Number of pods per plot: Number of pods for each stand and plot was counted at the time of harvest and the mean number of pods was recorded.

Weight of fresh and dry pods per plot and stand: All the pods harvested from the plot were weighed. The mean weight of pod per stand and plot was recorded.

Weight of fresh haulm per plot and per stand: All the haulm harvested from the plot was weighed. The mean weight of fresh haulm per plot and stand was recorded.

Weight of dry Haulm per plot and stand: All the Dried haulm harvested from the plot was weighed. The mean weight of dried haulm per plot and stand was recorded.

Accessions were evaluated qualitatively and quantitatively to characterise them[18]. There was a total of 17 characters examined. Computation was done in Excel workbook. Analysis of Variance (ANOVA) at 5% level of probability using the GENSTAT statistical package 4.3 was used to analyse the data.

Results and Discussion

There was no discernible difference in plant height recorded among ICG 4412, ICG98294 and ICG12189 which ranged from 13.16cm-16.64cm) at 12WAS. However, higher plant height was recorded among ICG88105 and Samnut 26 (22.89 and 24.44) respectively (Table-1). Groundnut (*Arachis hypogaea* L.) has traditionally been among the most crucial plants of the smallholder-farming sector in Nigeria. It is an important part of the rural people's diet as a protein source. Despite the multiple benefits and roles groundnut plays in Nigeria, farmers' field pod yields have remained poor, averaging 1082kg ha-1 compared to 3000 kg ha-1 and 3500 kg ha-1 potential yields in industrialised countries[19].

The large gap has been attributed to several factors such as poor soil fertility, continuous use of poor yielding indigenous varieties, inappropriate crop management practices, pests and diseases. *Arachis hypogaea* is described in this report as a crop having a variety of morphological characteristics. SAMNUT 26 variety was found to have the highest plant height (24.44 cm) at 12th week after sowing. While ICG4412 variety had the lowest plant height (13.16 cm) at the same duration. This in agreement with a similar work on groundnuts where poor growth in different varieties of which could be due to the experimental site's low soil nitrogen content (0.18 percent T.N.) was a predictor of the groundnut's growth history and height of the groundnut[20]. Different heights of four varieties of groundnut at seven weeks after sowing was reported which collaborates with this finding[21].

Soft white winter wheat plant grown from different varieties were both tall and short, some are heavier and had more tillers than others were also reported[22]. Cotyledon (seed leaf) reserve in some varieties of legumes influence in the initial growth of crops but has little importance in subsequent growth once leaves emerge, is like the recent observation. Some varieties emerged rapidly but did not have the highest height.

Significant difference was not recorded for number of leaves with ICG88105 variety showing the highest number of leaves (108.68) while ICG98294 variety had the least number of leaves (73.26 cm). There was no observable difference in the leaf area among the varieties considered. ICG88105 variety recorded the highest Leaf area (28.76) while ICG98294 had the lowest leaf area (15.78cm). This finding might be due to the differential response of genotypes to environmental changes affects its height. Similarly, ICG88105 possessed the greatest number of leaves, branches, and leaf area, and germination percentage compared to other varieties observed. Findings also revealed varying morphological differences among groundnuts grown in Mubi[21]. This therefore suggests that the leaves of ICG88105 is likely the most suitable cultivar for use as fodder[14] (Table-1).

ICG88105 variety showed the highest number of branches (5.54) at 12 WAS which is not significantly different from the other varieties except ICG98294 (4.00) which had the least (Table-1). It was also found that, there were varying number of branches among Mung bean in different levels of potassium[23] which could be the reason for the difference in the number of branches was due to varietal differences.

The ICG88105 recorded 100.00% germination percentage though it is not significantly different from the other varieties except ICG98294 (70.80) with the lowest germination percentage (Table-1, Figure-1, Figure-2). This finding agrees with a researcher who revealed differences in the germination percentage in Mung Bean accessions when treated in potassium[23].

Yield parameters indicated that at 15WAP, ICG88105 had the highest pod weight per plot, highest pod weight per stand, highest number of pods per plant and highest haulm per plot with ICG12198 having the least among all the parameters measured (Table-2,3). Over the years, parameters that are relayed to yield have been the interest of most improved program on groundnut for a long[8,24]. As a result, groundnut breeders would be interested in any activity that helps yield forecast or crop improvement. Normal physiological mechanisms like water absorption ability and photosynthesis[24] could explain the observed moderate connection between plant biomass and seed weight. Groundnut seed formation also necessitates adequate water intake[25]. The current study completely accords with prior research that have found substantial correlations in reproductive characteristics[12]. The size and seed's number present should be determined by the size pod's number present. The seed's number should also be proportional to their weight. Breeders trying to increase seed yield can then concentrate solely on increasing pod yield and size, regardless of the pod's constriction pattern. Previously, same results were reported on crop 11. The plant biomass factor is a weight-related factor that is inextricably linked to the plant's moisture content. This means that the crop requires a lot of water to produce the most pods and seeds. Groundnut pods are buried underground and linked to the plant root system, which is where water is absorbed.

Table-1: Plant Height, Number of Leaves, Number of Branches, Leaf Area and Germination Percentage.

Varieties	Plant Height 12WAS	Number of Leaves 12WAS	Numbers of Branch 12WAS	Leaf Area 12WAS	Germination Percentage 1WAS
ICG4412	13.16±1.03^{a}	79.20±5.47^{ab}	5.20±.17^{ab}	18.18±1.40^{a}	82.80±5.72^{ab}
ICG98294	13.46±3.47^{a}	73.26±18.91^{a}	4.00. ±1.00^{a}	15.78±4.07^{a}	70.80±18.30^{a}
ICG12189	16.64±0.87^{a}	85.00±7.46^{ab}	4.57±.17^{ab}	23.60±1.70^{b}	97.60±1.47^{b}
ICG88105	22.89±1.21^{b}	108.68±3.35^{b}	5.54±26^{b}	28.78±1.3^{b}	100.00±.00^{b}
Samnut26	24.44±2.42^{b}	93.72±11.87^{ab}	4.74±.38^{ab}	22.14±1.17^{ab}	94.20±1.47^{b}
LSD	6.07	32.18	1.49	6.83	25.83

Value represents mean ± standard error. The mean values with the same superscripts are not statistically different (P>0.05), they have less than the LSD.

Figure-1: SAMNUT26 at 3WAS (Source: Researcher on November 18, 2021; GPS Coordinates 8.55924, 8.53923).

Figure-2: Research layout at 10WAS (Source: Researcher on November 18, 2021; GPS Coordinates 8.55924, 8.53923).

Figure-3: ICG12189 at 12WAS (Source: Researcher on November 18, 2021; GPS Coordinates 8.55924, 8.53923).

Figure-4: 1CG88105 at 14WAS (Source: Researcher on November 18, 2021; GPS Coordinates 8.55924, 8.53923).

Figure-5: ICG98294 Dried haulm (Source: Researcher on November 18, 2021; GPS Coordinates 8.55924, 8.53923).

Different varieties of groundnut can be produced in greater numbers from a given quantity of maternal resources available for investment in the offspring[26]. The yield differences in pods could be due to genetic or environmental factors. Some improved plant varieties exercised superiority over others on pod yield in the pot experiment. This could mean that when given the same leverage of resources each variety has the capacity to convert energy and photosynthates into reproductive parts. The relatively high establishment rate in favor of this variety agrees with work done where it was reported that improve varieties may utilized cotyledonary reserve (UCR) at higher rate of stem elongation and root and shoot dry weight build-up than others[27].

Different numbers of pods among different varieties of groundnut[21]. Further reports revealed that, some improve varieties have greater nutrient reserve and usually produce strong seedlings with satisfactory development of root and stems[28].

ICG12198 recorded the highest number of days to flowering (25.40) compared ICG98294 (19.80) (Table-4) at 15 WAS. ICG98294 is clearly seen as the variety with the shortest the time it takes for flowers to bloom and for the plant to reach physiological maturity. This is in concert with[21] working with Groundnut opined Kampala and Gargajiya varieties recorded the highest number of flower (42.5 and 40.0 respectively) while Amarya recorded an average of 30 numbers of flowers per plant. Generally, varietal differences are seen as the main reason for the delay and or early flowering in the groundnut varieties considered.

Table-2: Pod Weight per Plot, Pod Weight per Stand, Haulm Weight per Plot, Haulm Weight per Stand, Haulm Weight per Stand.

Varieties	Pod Weight Per Plot 15WAS	Pod Weight Per Stand 15WAS	Haulm Weight Per Plot 15WAS	Haulm Weight Per Stand 15WAS	Number of Pods 15WAS
ICG4412	240.00±53.39^{ab}	49.96±7.45^{a}	490.00±81.24^{ab}	79.89±20.00^{a}	12.04±1.77^{a}
ICG98294	190.00±50.99^{a}	39.96±12.46^{a}	560.00±163.1^{ab}	110.00±31.45^{a}	14.20±4.78^{a}
ICG12189	190.00±24.49^{a}	33.30±00^{a}	440.00±60.00^{a}	93.34±12.46^{a}	15.40±2.04^{a}
ICG88105	320.00±37.42^{b}	59.94±6.66^{a}	760.00±40.00^{b}	103.32±15.27^{a}	26.08±2.43^{b}
Samnut26	300.00±31.62^{ab}	49.96±7.45^{a}	680.00±63.33^{a}	106.68±19.43^{a}	19.14±2.28^{ab}
LSD	121.28	29.99	272.94	61.24	8.48

Value represents mean ± standard error. The mean values with the same superscripts are not statistically different (P>0.05), they have less than the LSD.

Table-3: Number of Flowers, Dried Haulm Weight per Stand, Dried Haulm Weight per Plot, Dried Pod Weight per Stand, Dried Pod Weight per Plot.

Varieties	Number of Flowers At 3WAS	Dried Haulm Weight per Stand At 15WAS	Dried Haulm Weight per Plot At 15WAS	Dried Pod Weight per Stand At 15WAS	Dried Pod Weight Per Plot At15WAS
ICG4412	7.34±1.17^{a}	48.72±16.13^{a}	385.84±59.76^{a}	20.14±1.48^{a}	170.86±37.18^{ab}
ICG98294	10.54±3.10^{ac}	84.06±24.17^{a}	430.38±130.74^{a}	23.42±7.21^{a}	142.13±14.45^{a}
ICG12189	1.02±1.17^{a}	62.22±12.13^{a}	394.88±50.67^{a}	22.68±.755^{a}	137.72±24.12^{a}
ICG88105	17.14±1.85^{b}	73.86±15.90^{a}	600.68±43.02^{a}	34.08±2.98^{b}	242.42±5.14^{b}
Samnut26	14.08±1.85^{bc}	74.98±17.98^{a}	550.68±48.02^{a}	21.88±2.32^{a}	260.04±21.17^{b}
LSD	5.51	52.3	228.6	10.9	90.5

Value represents mean ± standard error. The mean values with the same superscripts are not statistically different (P>0.05), they have less than the LSD.

Table-4: Number of Days to Flowering, Number of Days to Physiological Maturity.

Varieties	Number of Days to Flowering At 3WAS	Number of Days to Physiological Maturity At 15WAS
ICG4412	24.80±.583[a]	104.80±1.49[a]
ICG98294	19.8±4.95[a]	80.80±20.26[a]
ICG12189	25.40±.583[a]	100.60±2.34[a]
ICG88105	21.00±.000[a]	93.80±1.07[a]
Samnut26	24.80±316[a]	96.40±979[a]
LSD	6.6	27.0

Value represents mean ± standard error. The mean values with the same superscripts are not statistically different (P>0.05), they have less than the LSD.

Conclusion

The results presented showed that variety ICG88105 had the best adaptation in terms of germination percentage, number of leaves, number of flowers, number of pods, pod weight, dried haulm weight, fresh weight and the crop growth rate. Seedling establishment was favored in some varieties as other showed low seedling survival in this growing season. Results also showed that in seed selection of improve varieties, farmers should be considerate on the purpose of their farming either for pod or haulm this will enable them to make informed choices of which the improved variety should be selected.

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