



Performance Evaluation of Early Maturing Ground Nut Varieties in West Guji lowland, Southern Ethiopia

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Article History

Received: April 12, 2020

Revised: May 5, 2020

Accepted: May 13, 2020

Published: May 15, 2020

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Abstract

Groundnut is an important oil seed crop, grown throughout the tropics and sub tropics worldwide. It is one of the three economically important oilseed crops grown in Ethiopia. Groundnut is commonly produced by small scale farmers as food and cash crops in the study area. The area has potential to the production of Ground nut for food and nutrition security as well as export commodity. However, scarcity of varieties that fit to the environment is one of the major constraints of production. Therefore, this experiment was conducted to evaluate five Ground nut varieties and select early maturing varieties with considerable yield and agronomic traits. The field experiment was conducted in 2017 and 2018 at Abaya and varieties were planted in Randomized complete block design (RCBD). Data were collected on yield and important agronomic traits. The computed analysis of variance revealed significant variations among varieties for days to maturity, number of primary branches, number of pegs per plants, Grain yield and shelling percentage. The pooled over year mean of varieties indicated, Tole- 1 variety (Check) is high yielding with mean grain yield of 4174.7kg followed by variety Sedi (3552.5kg/ha) and Babile local (3550.4kg/ha). Variety Sedi has special merit in terms of earliness and therefore recommended for moisture stress areas of Abaya and location with similar agro ecologies while Tole -1 (Standard check) is high yielding varieties and should be used in production until new varieties will be developed through selection/breeding program.

Keywords: Ground nut; Early maturity; Yield and yield related.

1. Introduction

The word *A. hypogaea* has been derived from two Greek words *Arachis* meaning a legume and *hypogaea* meaning below ground (referring to the formation of pods in the soil). It is an annual legume which is also known as peanuts, earthnut, monkey-nut and goobers. It is the 13th most important food crop and 4th most important oil seed crop of the world. Groundnut seeds (kernels) contain 48-50% oil, 26-28 % protein and are a rich source of dietary fibre, minerals and vitamins. Groundnut kernels are consumed directly as raw, roasted or boiled kernels while the oil extracted from the kernel is used as culinary oil. It is also used as animal feed and industrial raw material [1].

Groundnut or peanut is an important oil seed crop, grown throughout the tropics between 40° South and 40° North of the equator where the annual rainfall ranges between 500 to 1200 mm and with average daily temperature higher than 20°C. The crop is grown in tropical and subtropical regions of the world. It is grown in six continents, but mainly in Asia, Africa and America in over 100 countries with a world production of 37.10 million metric tons from an area of 23.11 million hectares. Groundnut is one of the three economically important oilseed crops including noug, and sesame in Ethiopia and is largely produced in the eastern part of the country [2].

The annual world groundnut production was around 38.2 million tons from 26.4 million ha of production area. Developing countries constitute 97% of the global area and 94% of the global production of this crop. The average national yield of groundnut is about 1.1 ton ha⁻¹ [3] which is significantly lower than the World's average of about 1.49 t ha⁻¹ [4]. The major groundnut producer region in Ethiopia is Oromia region (41,089 ha), followed by Benshangul- Gumuz (14,759 ha) and Amhara (3,161 ha) regional states [5]. Groundnut is planted both during the "Belg" season (March) and also during the main season (June), in some parts of western Ethiopia.

With regard to final utilization, groundnut varieties are categorized into two major groups: oil types and confectionery ones. Confectionery groundnut varieties are those with large seeds and are mostly used for various food types (roasted seeds, peanut butter, candies, cookies and other snacks). A great amount of the groundnut produce in Ethiopia is consumed locally for confectionery purposes [6].

Therefore, this study was undertaken with the objective of selecting early mature and high yielder Ground nut Variety for the study area.

2. Material and Methods

2.1. Site Description

The experiment was conducted at Abaya during 2017 and 2018 cropping season. The experimental areas are located in the Southern part of the country in the Oromia Regional State. Abaya is sub-site of Yabello Pastoral and Dryland Agriculture Research Center and located at 365 km far from Addis Ababa cit. The detail description of the study areas are listed in the Table blow.

Table-1. Description of the study area

Variables	
Soil type	Sandy clay loam
Altitude (m.a.s.l.)	1442
Latitude	06°43'520"N
Longitude	038°25'425"E
Annual Temperature °C	
Minimum	12.6
Maximum	29.9
Annual rainfall (mm)	
Minimum	500
Maximum	1100

2.2. Experimental Materials

For this study, 4 released Ground nut varieties were obtained from Haramaya University and evaluated with one standard check for performance evaluation of Yield and yield related traits.

2.3. Experimental Design and Managements

The experiment was laid out in Randomized Complete Block Design. Each entry was planted in a plot having 6 rows of 3 meter length. Four rows were harvested and two border rows were left to exclude border effect. The row and plant spacing was kept at 40 cm and 10 cm, respectively. Individual plot size was 2.4 m x 3m=7.2 m² and 1.5m between each block. All other agronomic managements were applied uniformly in all experimental plots as per national recommendation for the crop.

2.4. Data Collection

The following data were collected during the experiment time both from the net plot and sampled plants by random selection method from the middle of four rows of each plot.

2.4.1. Data Recorded on Plant Basis

Plant height at harvest (cm): Height of five randomly taken plants during harvest period from each experimental plot was measured in centimeter from the ground level to top of the plants and the average height was recorded.

Number of primary branches: Number of productive branches extending from the main stem was recorded from five randomly selected plants and average branch number was taken.

Number of pods per plant: this was recorded as average total number of pods of five randomly selected plants from each experimental plot at harvest.

Number of seeds per pod: This was recorded as average total number of seeds of five randomly selected plants from each experimental plot divided by total number of pod of the same plants at harvest.

Seeds per plant: Average number of seeds counted from five randomly selected plants.

2.4.2. Data Recorded on Plot Basis

Days to Flowering: The numbers of days from the date of emergence to the date on which about 50% of the plants in each plot produce flowers.

Days to maturity: The number of days from planting to maturity period

Stand count at harvest: This was recorded by counting the total number of plants from the four middle rows of each plot at harvest.

Grain yield (g/plot): Grain yield in grams obtained from the central four harvestable rows of each plot was harvested, threshed and weighted using sensitive balance

Grain yield (kg/ha): Grain yield obtained from each plot was used to estimate grain yield (kg) per hectare.

2.5. Data Analysis

2.5.1. Analysis of Variance

Analysis of variance (ANOVA) was computed for grain yield and other traits as per the methods described by Gomez and Gomez [7] using SAS computer software (Version 9) for Randomized complete block design.

Comparison of treatment means was made using Least significant difference (LSD) at 5% level of significance test. ANOVA were computed using the following mathematical model:

$$Y_{ijk} = \mu + G_i + y_j + B_k + G_{ij} + \epsilon_{ijk}$$

Where: Y_{ijk} = is the observed mean of the i^{th} variety (G_i) in the j^{th} year (y_j), in the k^{th} block (B_k)

μ = General mean of trait Y

G_i = Effect of the i^{th} variety

y_j = Effect of the j^{th} year

B_k = Block effect of the i^{th} variety in the j^{th} year

G_{ij} = The interaction effects of the i^{th} variety and the j^{th} year

ϵ_{ijk} = The error term

3. Results and Discussions

3.1. Analysis of Variance

Analysis of variance computed for each location revealed that variation among varieties were highly significant ($P < 0.01$) for all traits except number of primary branches are significant ($P < 0.05$) and pods per plants are not significant (Table 2). The presence of variations among varieties under experiment for traits studied indicated the presence of sufficient variability among Ground nut varieties that would be exploited. Similar results were reported by Chavadhari, *et al.* [8]; Izge, *et al.* [9] in ground nuts. The year effect was highly significant ($P < 0.01$) for maturity dates, pods per plants and grain yield indicated that the performance of varieties are different in different year for these traits.

In Ethiopia, Biru and Daraje [10] reported the presence of highly significant variation among 12 ground nut varieties conducted in two environments. He also reported the existence of significant variation for days to flowering, days to maturity, plant height, hundred seed weight and grain yield. Chavadhari, *et al.* [8] and Izge, *et al.* [9] also reported highly significant variation for plant height, pods per plant, seeds per plant, hundred seed weight and grain yield in Ground nut which is in line with this finding.

Table-2. Mean squares from combined analyses of variance over two years for 8 traits of Ground nut varieties grown at Abaya in 2017 and 2018 E.C

Sources of variation	DF	FD	MD	PH (cm)	NPB	PPP	GY (kg /ha) (with shell)	GY(kg/ ha) (shelled)	SP (%)
Year	1	4.03	448.53**	2.7	25.03	1068.03**	6373048.66*	3400797.949*	59.36
variety	4	24.12**	144.78**	23.95**	28.62*	17.30	448765.16	1959362.38*	594.269*
Rep within year	2	21.23	6.43	3.43	16.78	98.23	1713251.1	31295.10	293.33
Rep*variety	8	1.225	35.43	1.23	3.24	23.53	593381.88	313206.98	146.22
Year*variety	4	0.95	102.78*	1.12	13.99	163.53	1515385.29	1365636.03	254.47
Error	10	17.27	33.43	0.76	9.9	46.13	919478.68	526073.55	169.971
CV (%)		8.65	3.74	1.78	28.31	25.69	17.75	21.42	20.69
LSD		5.05	7.438	0.318	4.05	8.737	1233.5	933.05	16.76

ns, *, **&***, non-significant, significant, highly significant and very highly significant at $P < 0.05$, $P < 0.01$ and $P < 0.001$, respectively. DF= degrees of freedom, FD= Flowering date, MD= days to maturity, PH=Plant Height, NPB= number of primary branch, PPP= pods per plant, SP (%) =Shelling Percentage, GY (Kg/ha) = Grain yield in Kilogram per hectare.

3.2. Mean Performance of Varieties

3.2.1. Crop Phenology

Flowering duration of five varieties of ground nut ranges from 45.17-50.5 while the maturity duration of varieties ranges from 145.33-157.67. The mean performances of these traits are presented in Tables 3. The earliest flowering and maturing varieties was Sedi (145.33 days) while the late maturing variety was Baha gidu (157.67 days) followed by Babile local (156.33 days) (Tables 3). Similar result was reported by Biru and Daraje 2014.

3.2.2. Growth Traits Yield and Yield Components

Mean performances of varieties for plant height ranged from 39.33 cm to 45.13cm. Baha guddo is significantly shorter than the other varieties while Sedi was significantly taller. Varieties showed considerable variations for number of primary branches that ranged from 8.33 for Sedi to 13.87 for Tole 1 (Tables 3). Variation for plant height and branches in Ground nut is also reported by other author [8-10]. Shelling percentage was calculated by dividing shelled yield weight to total pods weight (unshelled pod) and multiplying by hundred [11]. In this experiment, the mean of shelling percentage ranged from 54.015% to 78.077%. The Highest shelling present was recorded by variety Tole- 1 (78.077%) followed by Sedi (67.105%). According to Jeyaramraja and Fantahun 2014, higher shelling percent indicates less seed case (pod) weight and more seed weight and so, it is preferable in ground nut. Other authors also reported similar results in shelling percentage of ground nuts [8, 12, 13].

The variation of varieties for pods number per plant ranged from 24.83 (Baha giddu) to 29.0(Tole-1). The mean shelled grain yield of varieties ranged from 2878.0 kg to 4174.7kg; (Tables 3). Significantly highest mean grain yield was recorded from Tole-1 (4174.7kg/ha) followed by Sedi (3552.5kg/ha) and Bablile local (3550.4kg/ha). The high yielding capacity of these three varieties may be due to high pods per plant, number of primary branches in Variety Tole-1 while short maturity periods and relatively higher shelling percentage in Sedi varieties. A wide range of variation in ground nuts varieties for grain yield was also reported by Jeyaramraja and Fantahun [12]; Wedajo and Wondewosen [14] which is in line with this finding.

Table-3. Pooled Mean value of yield and yield related traits of 5 Varieties of Ground nut tested at Abaya for two consecutive years (2017 and 2018)

Varieties	FD	MD	PH (cm)	NPB	PPP	GY(kg/ha) (with shell)	SP (%)	GY(kg/ha) (shelled)
Tole 1	50.5a	155.67a	42.93c	13.87a	29.a	5398.1a	78.077a	4174.7a
Baha gidu	49.0b	157.67a	43.07b	11.63ab	24.83a	5108.4a	54.788b	2776.6b
Sedi	45.17d	145.33b	45.13a	8.33b	26.33a	5307.9a	67.105ab	3552.5ab
Baha guddo	48.0bc	155.67a	39.33e	12.17ab	27.0a	5339.7a	54.015b	2878.0b
Babile local	47.17c	156.33a	40.27d	9.57ab	25.00a	5849.5a	61.035ab	3550.4ab
CV (%)	8.65	3.74	0.59	28.31	25.7	17.75	20.68	21.42
LSD	5.05	7.438	0.20	2.55	ns	ns	16.764	933.05

CV = Coefficient of variations, FD= Flowering date, MD= days to maturity, PH=Plant Height, NPB= number of primary branch, PPP= pod per plant, SP (%) =Shelling Percentage, ShGY (Kg/ha) = Grain yield in Kilogram per hectare, LSD= Least significant difference

4. Conclusion and Recommendations

The results of experiment conducted at Abaya exhibited significant variation among varieties for all traits except pods per plants and unshelled grain yields. Significant variation among varieties for phenological traits also point out that the possibility of selecting early maturing varieties for the study areas. Regardless of this, Sedi variety was significantly early maturing variety in the study area. The mean of shelling percentage in this experiment ranged from 54.015% to 78.077%. The highest shelling percentage was recorded by variety Tole- 1 (78.077%) followed by Sedi (67.105%). The highest mean grain yield was exhibited by Tole-1 (4174.7kg ha⁻¹) followed by Sedi (3552.5kg ha⁻¹) and Babile local (3550.4 ha⁻¹). The high yielding capacity of these three varieties may be due to presence of high pods per plant, number of primary branches in Tole-1 Variety while short maturity periods and relatively higher shelling percentage in Sedi varieties. In this experiment, Tole-1 variety is identified as high yielding variety while Sedi variety is recommended as early maturing varieties. Therefore, farmers and ground nut producers around the study area and similar agro ecologies can use those varieties.

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