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Research Article

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Performance Evaluation of Groundnut (*Arachis hypogaea* L.) Varieties for Growth, Yield and Yield Components under Irrigation at Lowland Area of South Omo Zone, Southern Ethiopia

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Abstract

Groundnut is an important oil crop in the world. However, the yield of this crop is limited mainly due to uncover suitable area for groundnut production and shortage of improved varieties suited to specific area. This field experiment was conducted during 2019/2020 cropping season to evaluate groundnut varieties for yield production at Weyito in South Omo Zone, Southern Ethiopia. The experiment contains five varieties namely Fetene, Werer-961, Baha jidu, Roba and Local. The experiment was conducted using randomized complete block design with three replications. Data were collected on plant height, primary branch, pods per plant, seeds per pod, grain yield and hundred seeds weight and subjected to analysis of variance using SAS software program. The result of this study revealed that, there was significant different among varieties on all traits expect seeds per pod. The highest (1924kg ha^{-1}) and (1905 kg ha^{-1}) grain yield were recorded from Fetene and Werer-961 varieties, respectively among tested treatments. Fetene and were -961 varieties well performed at study area. However, the experiment has to be repeated by including more released varieties and across over location as well as seasons with consideration of farmer's preference of the ground nut varieties to reach at conclusive recommendation.

Keywords: *Groundnut varieties; Performance evaluation; Grain yield*

Introduction

Groundnuts (*Arachis hypogaea* L,) also called pea nuts, monkey-nuts belongs to Leguminoseae family and is a tropical annual legume (Ntare et al., 2008). Groundnuts have a well-developed tap-root, with many laterals as well as adventitious roots emanating from the Hypocotyls and aerial branches. The flowers are small, yellow and grow singly or in clusters of from two to four, Close to the ground and after fertilization, pegs move towards the soil, and seed-containing pods are formed and developed underneath the soil. Groundnuts have very high caloric value and are easily digestible. For people in many developing countries, groundnuts are the principal source of digestible protein (25 to 34%), cooking oil (44 to 56%), and vitamins like thiamine, riboflavin, and niacin. The oil extracted from them is used in the preparation of hydrogenated cooking-fats and fraying oils; a fraction that settles out during the manufacturing process is used for soap making. The oil cake and hay are widely used in concentration rations of livestock feed. Groundnuts are used in various forms, which include groundnut oil, roasted, and salted groundnut, boiled or raw groundnut or as paste popularly known as groundnut (or peanut) butter (Prasad et al., 2009) Groundnuts require abundant sunshine and warmth for

their normal development. They don't appear to be especially sensitive to day-length and are typical summer crops that grow well from the tropics to the middle temperate zone (Harris and Bledsoa, 1961). Groundnuts grow best in light textured sandy loam soils with neutral pH. Optimum temperature for their growth and development ranges from 28 to 30ºC; the crop requires about 500 - 600 mm of well distributed rainfall (Prasad et al., 2009).

The lowland areas of Ethiopia have considerable potential for increased oil crop production including groundnut. Groundnut is used for oil extraction, generates considerable cash income for several small, scale producers and foreign exchange earnings through export for the country (Gezahagn, 2013). Groundnut was grown on about 74,861.4 ha in Ethiopia from which about 129,636.42 tons are produced in the year 2017, with the average regional yield of 1.73 t ha^{-1}. In the same year 182.01 ha was covered with common bean in SNNP Region from which about 239.28 tones were produced, with the average zonal yields was 1.32 t ha^{-1} (CSA, 2017). However, this grain yield is far less than the attainable yield (2.4 to 3.0 t ha^{-1}) under good management conditions (MOANR, 2016).

Weyito is one of the lowland parts of South Omo Zone which are agro ecologically feasible for groundnut production. However, the production and productivities of groundnut was limited in the study area. Hence, the objective of this experiment was to select best performing groundnut variety on yield and yield related traits under irrigation condition for increased production and productivities in the study area.

Materials and Methods

Description of the Study Area

The experiment was conducted during 2019/2020 cropping season at Benna Tsemay woreda (Woyito). It located South Omo Zone in Southern Nations, Nationalities and People's Regional State. It is situated between 5°01' and 5°73' North latitude & 36°38' and 37°07' East longitude with altitude of 588 meter above sea level. The rainfall distribution of the area is bimodal with main rainy season extends from January to May and the second cropping season, from July to October. It receives annual average rainfall of 876.3 mm and the monthly average minimum and maximum temperatures of 18.2 and 37.3°C, respectively. All the metrological data a given above for the location are long term averages.

Experimental Design and Treatments

Five groundnut varieties namely: Fetene, werer-961, Roba, Baha jidu, and Local, were used for current study. This experiment was laid out using randomized complete block design (RCBD) with three replications at Weyito.

Experimental Procedure and Management

The land was ploughed twice, disked and harrowed once, and ridged with 0.5m by tractor, after which corrected by labour. Two seeds per hole were sown on ridges by hand at 0.15m intra-row and 0.6m furrow spacing. Thinning was done two weeks after emergence to maintain the target intra-row spacing. The plot size was 25m^2 (5mx5m) and which accommodated ten furrow per plot. The spacing between replications and pots was 2 meter. Plots were furrow irrigated every 6-8 days from planting up to flowering and then every 9-10 days up to physiological maturity according weather condition. No any fertilizer was applied as well as agro-chemicals during growing period because all varieties were growing healthy and no diseases and insects problem were observed. The first, second and third weeding and hoeing were performed 20, 40 and 60 days after emergence, respectively. The net harvestable row was 8 (eight) excluding the border two rows.

Data Collected

Growth parameters

Plant height was measured at the time of physiological maturity from central rows as the mean height of five randomly taken plants from the ground level to the apex of each plant. Number of primary branches per plant was determined by counting primary branches of the main stem from randomly taken five plants in the central rows and average value was considered.

Yield and yield components

Number of pods per plant and seeds per pod was determined from five randomly sampled plants at central row and the average value was considered. The harvesting central rows per plot were harvested, sun dried to constant weight. Hundred seed weight (g) was weighted by taking weight of hundred randomly sampled seeds from the two harvested central rows. The shelled seed yield of each net plot was then weighed using an electronic balance.

Statistical analysis

The various data collected were subjected to analysis of variance in randomized complete block design (RCBD) using SAS software

version 9.2 (SAS, 2008) with a generalized linear model (GLM) procedure. Means were separated using least significant differences (LSD) test at 5% level of significance.

Results and Discussion

Growth Parameters

Plant height at maturity

In this study, analysis of variance as shown in table 1 indicates the effects of varieties had high significantly (P<0.01) on plant height. The tallest plant height (57.0cm) was observed for variety Roba followed Fetene variety (54.67cm), while the shortest (46.0cm) plant height was recorded from variety Werer-961 (Table 2). This variation in plant height among the varieties might be due to the existence dissimilarity the genetic make-up of the varieties.

Number of primary branches

Primary branches was high significantly (P<0.01) affected by the effects of variety. The highest number of branches 11.07 per plant was recorded from variety Roba and the lowest number of primary branches per plant (7.03) was recorded from varieties Werer-961. The difference in number of primary branches among the varieties could be most probably due to the existence dissimilarity in genetic composition among them for that facts characters may be differ in their genetic properties to response formation of branch. This result was in conformity with the study by Fikre et al. (2012) who reported that, the number of primary branches per plant was significantly difference among they used varieties.

Yield and yield components

Number of pods per plant

The analysis of variance as shown that effects of varieties had high significantly (P<0.01) effects on number of pods per plant. The highest mean number of pods per plant (61.57) was recorded for variety Roba and the lowest number of pods per plant (43.17) was recorded for variety Local (Table 2). The difference on number of pods per plant might be due the fact that the number of pods per plant regulated by the genetic make-up of varieties. This result is in line with Richard et al. (2017) who found that, pods per plant significantly difference among groundnut varieties. Similary, Berhane et al. (2017) who found that, significant difference of pods per plant among ground nut varieties.

Seeds per pod

The analysis of variance showed that the effects of varieties had non significance (P<0.05) effects on seeds per pod. The pod of the varieties has the capacity of producing statistically similar number of seeds. In general, the seed number pod-1 of groundnut ranged from two to two point eight. This result confirms the finding of Berhane et al. (2017) who pointed out that seeds per pod was not significantly affected by groundnut varieties.

Source	Degree of freedom	Plant height	Primary branch	Pods per plant	Seeds per pod	Shelled grain yield	Hundred seeds weight
Replication	2	4.77^{ns}	0.68*	2.385*	0.01*	10306.9*	1.579*
Varieties	4	66.248**	6.21**	170.71**	0.35ns	79438.6**	329.94**
Error	8	2.77	0.69	10.777	0.11	7126.2	1.065
CV (%)		3.25	9.22	6.31	13.6	4.8	1.64

Ns= non-significant, *=significant, **= highly significant, ***= very highly significant at P<0.05, CV=Coefficient of variance

Table 1: *Mean square for growth, yield and yield components of sunflower varieties tested at Weyito) in 2019/20.*

Grain yield (kg/ha)

In this study, analysis of variance as shown in table 1 indicates the effects of varieties had high significantly (P<0.01) on grain yield. The highest grain yield (1924.0kg/ha) was recorded from Fetene variety followed Werer-961 variety (1905.0kg/ha), while the lowest (1549.7kg/ha) grain yield was recorded from local variety (Table 2). The possible reason for differences observed among the varieties might be due to existence dissimilarity in genetic composition among them, for that fact characters may be differ in their genetic properties. Moreover, environmental influences might be the possible causes. The result of this study is in agreement with the research finding of Fikre et al. (2012) who observed a significantly difference among groundnut varieties. Similarly, David et al. (2015) who studied on evaluate of genotype of groundnut found that, a significantly difference at in genotypes.

Varieties	Plant height	Primary branch	Pods per plant	Seeds per pod	Shelled grain yield(kg/ha)	Hundred seeds weight (g)
Fetene	54.67a	9.83ab	61.57a	2.57a	1924.0a	70.33b
Werer-961	46.00c	7.47c	57.50ab	2.83a	1905.0a	49.10e
Baha jidu	47.53bc	8.80bc	46.77cd	2.23a	1775.0ab	58.40d
Roba	57.00a	11.07a	51.33bc	2.700a	1643.7bc	61.33c
Local	49.63b	8.03c	43.17d	2.00a	1549.7c	76.00a
LSD(0.05)	3.13	1.57	6.18	1.1	158.94	1.94

Means in columns and rows followed by the same letter(s) are not significantly different at 5% level of significant; LSD (0.05) = Least Significant Difference at 5% level

Table 2: *Means values of growth, yield and yield components of groundnut varieties tested at Weyito in 2019/2020.*

Hundred Seeds weight (g)

The analysis of variance showed that the effects of varieties had significance ($P<0.01$) on hundred seeds weight. The highest of hundred seeds weight (76.0g) was recorded for variety local and the lowest of hundred seeds weight (49.1) was recorded for variety Werer-961 (Table 2). The possible reason for the existence of significant difference in hundred seed weight among the varieties might be due to the differences in their seed size allied with differences in genetic inheritance. This result confirms the finding of Bale et al. (2011) who pointed out that hundred seed weight of groundnut was significantly affected by variety. Moreover, Caliskan et al. (2008) reported that varieties significantly influenced hundred seed weight of groundnut.

Conclusion and Recommendation

Groundnut is an important oil crop in the world. However, the yield of this crop is limited mainly due to shortage of improved varieties suited to specific area. This field experiment was conducted to evaluate groundnut varieties for grain yield production at Weyito in South Omo Zone, Southern Ethiopia. The experiment contains five varieties namely: Fetene, Werer-961, Roba, Baha jidu and Local. The experiment was conducted using randomized complete block design with three replications. Data were collected on plant height, primary branch, pods per plant, seeds per pod, grain yield and hundred seed weight and subjected to analysis of variance using SAS software program. The result of this study revealed that, there was significant different among varieties on all traits expect seeds per pod. The highest (1924kg ha^{-1}) and (1905 kg ha^{-1}) grain yield were recorded from Fetene and Werer-961 varieties, respectively among tested treatments. Fetene and Were -961 varieties well performed at study area. However, the experiment has to be repeated by including more released varieties and across over location as well as seasons with consideration of farmer's preference of the ground nut varieties to reach at conclusive recommendation.

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