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Evaluation of Groundnut [*Arachis hypogaea (*L.)] Varieties for Yield and Yield Components at Jinka, Southern Ethiopia

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Abstract: A field experiment was conducted research field of Jinka Agricultural Center, South Omo Zone, Southern Ethiopia using seven groundnut [Arachis hypogaea (L.)] varieties under rain-fed conditions from 2019 to 2020 main cropping seasons. The objective of the study was to select the best performing groundnut varieties in the target area. In this study, six improved groundnut varieties Werer-961, Bahajuid, Fetene, Babile, Robe, Werer-962 and one local check were included. The experiment was carried out using a randomized complete block design (RCBD) with three replications. The data on growth parameters yield and yield-related traits were collected and analyzed using the general linear model procedures of SAS software Version 9.1. The combined analysis of variance results showed that there were significant variations observed among the tested varieties for all the studied traits except the number of primary branches per plant. Based on the combined result, grain yield ranged from 1724.052 (kg ha^{-1}) for variety Robe to 2763.558 (kg ha^{-1}) for Werer-962. The effect of varieties on grain yield was significant and the best performing varieties namely Werer-962 (2763.558 kg ha^{-1}) and Bahajuid (1979.226 kg ha^{-1}) could be recommended for the target area and other similar agro-ecologies even though further study is required over years and over locations.

Keywords: Groundnut, parameters, grain yield, varieties

1. Introduction

Groundnut [*Arachis hypogaea. (L.*)] commonly-known as peanut is a self-pollinated legume crop which belongs to family Fabaceae. It is one of the world's most important oilseed crops **(**Gebre and Shiferaw, 2017). It ranked as the 4th most important oilseed crop and the 13th most important food crop. Out of total world production of 43.19 million tones, in 2012-13, Asia and Africa produced about 64.1% and 26.3%, respectively (Raza *et al*., 2017). Groundnut is used for oil extraction, generates considerable cash income for several small scale producers and foreign exchange earnings through export for the country (Kudama, 2013).

The lowland areas of Ethiopia have considerable potential for increased oil crop production including groundnut. The estimated production area and yield of groundnut in Ethiopia during the 2018 cropping season were 80,841.57 hectares and 1,451,728.20 quintals, respectively (CSA,

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2018). Lack of adequate supply of improved varieties is the major constraint for low yield of groundnut in Ethiopia. Ground nut is one of the most important oil crops in low land areas of South Omo zone in particular. Even though the crop is important in the target areas, but the lack of improved varieties and other factors associated with edaphic and biotic factors have been appreciated as one of the primary sources of lower ground nut production in the target areas. To improve the productivity groundnut in the study areas, use of the best and suitable groundnut varieties appeared to be essential. Therefore, the present study was conducted to evaluate the performance of recently released groundnut varieties in the target area.

2. Materials and Methods

2.1. Description of the study area

The experiment was conducted at Jinka Agricultural Research Center research site, from 2019 2020 main cropping seasons. Jinka is located 729 km South West of Addis Ababa at geographical coordinate of 360 33‟-370 67‟E and 50 46‟- 6057‟N with and altitude of 1450 m.a.s.l. 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. The average annual rainfall of the area for the last ten years was 1307.3 mm with two seasons, while an average temperature ranging from 21.0 ºC of 28.0 ºC. The soil of the experimental site is sandy loam in texture with soil pH of 6.41 (Tekle and Walelign, 2014).

2.2. Treatments and experimental design

The treatments involved were six improved and one local variety of groundnut. The field experiment was laid out in a randomized complete block design with three replications. Ground nut was sown in six rows per plot with a spacing of 60 cm between rows and 20 cm between plants with a gross plot area of (5 m x 3.6 m = 18 m^2). The trial was planted immediately after the onset of the main season.

2.3. Data collection:

Plant height (cm), number of primary branches, the number of pods per plant, the number of seeds per pod, the number of seeds per plant, grain yield (kg ha^{-1}) and hundred seeds weight (gm) were measured.

2.4. Data analysis:

All the collected agronomic data were subjected to Analysis of Variances (ANOVA) using the General Linear Model (GLM) procedure of Statistical Analysis System **(SAS)** software Version 9.1. Significance differences between and among treatments were delineated by using LSD (least significance difference) (5%).

3. Results and Discussions

The combined analysis of variance result for mean squares showed that there were significant differences observed among the tested varieties for all the studied traits except the number of primary branches per plant (Table 1). This finding is in line with the report of Chaudhari *et al.* (2017) in-groundnut.

3.1. Plant height

The combined analysis of variance result showed that there were significant variations observed among the groundnut varieties for plant height (Table 1). The longest plant height (33.67 cm) was recorded from Werer-962 and the shortest plant height (25.33 cm) was recorded from the variety Babile (Table 2).

3.2. The number of primary branches per plant

The mean values showed that the maximum number of primary branches per plant was recorded from variety Robe (11.50) and the minimum was recorded from the local check (8.67).

3.3. The number of pods per plant

The combined result depicted that there were significant variations observed among the groundnut varieties for the number of pods per plant (Table 1). Variety Werer -962 produced the highest number of pods per plant (67.33 and 68.33) in 2019 and 2020, respectively, while the lowest (46 and 48.66) were obtained from the variety Fetene (Table 2). This result agreed with the findings of Caliskan *et al.* (2008) on groundnut.

3.4. The number of seeds per pod

The combined analysis of variance result showed that there were significant variations observed among the groundnut varieties for the number of seeds per pod (Table 1).

3.5. Hundred seed weight

The combined result showed that there were significant variations observed among the groundnut varieties for hundred seed weight (Table 1). The maximum hundred seed weight (65.67 g) was obtained from variety Werer -962, while the minimum (51.00 g) was recorded from variety Babile (Table 3). The observed maximum hundred seed weight from variety Werer-962 could be probably due to its efficient utilization of assimilates and enhanced photosynthetic and metabolic activities of the plant which resulted on the formation of healthy and well-structured seed. This result confirms the finding of Caliskan *et al*. (2008) who reported that hundred seed weight of groundnut was significantly influenced by varieties.

3.6. Grain Yield

The ANOVA revealed that there were significant differences observed among varieties for grain yield (Table 1). Based on the combined result, the maximum grain yield (2987.4 kg ha^{-1}) was recorded for the variety Werer -962, while the minimum was recorded for the variety Robe (Table 3).

Table 1. Combined Mean square Values for Growth parameters, Yield Components and Grain Yield of Ground nut as Affected by Variety at Jinka from 2019 to 2020.

SoV	DF	PH	BN	PPP	SPP	HSW	GY
Year	1	1.54	0.214	9.524	0.023	3.429	2384500
Variety	6	52.040**	7.7460	262.99***	0.373*	104.984***	798227***

Rep	2	23.238	0.500	84.095	0.2142	4.952	65791
Year * variety	6	7.46	0.6032	2.35	0.134	4.651	99805
Error	26	13.341	3.935	44.685	0.1373	8.952	81074

*, **, *** indicate significance at P<0.05, P<0.01 and P<0.001, respectively and 'ns', indicate non-significant. Note that: DF = degree of freedom, PH=plant height (cm), BN= the number of primary branches per plant, PPP= the number of pods per plant, SPP= the number of seeds per pod, HSW= hundred seed weight (g), GY=grain yield (kg h^{-1}a).

Table 2. Mean Values of Growth Parameters and Yield Components of Groundnut Varieties at Jinka from 2019 to 2020.

	PH (cm)			NPB/P			NP/P		
Variety	2019	2020	Combined	2019	2020	Combined	2019	2020	Combined
W-961	31.00	28.67	29.83^{abc}	9.00	9.00	9.00^{bc}	53.00^{ab}	54.33^{a}	53.67^{b}
Bahajuid	27.00	26.00	26.50^{cd}	11.00	10.33	10.67^{abc}	52.00^{ab}	52.00^{ab}	52.00^{b}
Fetene	26.33	29.00	27.67^{bcd}	9.667	10.667	10.17^{abc}	46.00^{b}	48.667^{a}	47.33^{b}
Babile	25.67	25.00	25.33^{d}	11.33	11.33	11.33^{ab}	50.667^{ab}	50.667^{ab}	50.67^{b}
Robe	30.67	32.67	31.67^{ab}	12.00	11.00	11.50^{a}	55.33^{ab}	54.33^{a}	55.00^{b}
W-962	34.33	33.00	33.67^{a}	11.33	11.00	11.17^{ab}	67.33^{a}	68.333^{a}	67.83a
Local	26.33	29.667	28.00^{bcd}	8.667	8.667	8.67^{c}	49.667^{ab}	52.00^{ab}	50.83^{b}
CV (%)	11.24	14.27	4.37	21.15	18.52	2.36	12.97	12.75	7.93
LSD (5%)	NS	NS	12.61	NS	NS	19.16	19.78	19.78	12.40

Note: Means with the same letter (s) in the same column are not significantly different at p<0.05; LSD = least significant difference; W-961 = Werer 961, W-962 = Werer 962, CV = Coefficient of variation, .PH= plant height (cm), NPB/P= the number of primary branches per plant, NP/P = the number of pods per plant.

Table 3. Mean Values of Yield and Yield Components of Groundnut Varieties at Jinka from 2019 to 2020.

	SPP			HSW (gm)			GY		
Variety	2019	2020	Combined	2019	2020	Combined	2019	2020	Combined
W-961	2.00	2.000	2.00^{b}	54.66^{b}	57.00^{ab}	55.83^{b}	1454.6^{b}	2030.4^{b}	1742.48^{b}
Bahajuid	2.67	2.000	2.33^{ab}	53.66^{b}	55.00^{b}	54.34^{bc}	1904.9^{b}	2053.6^{b}	1979.23^{ab}
Fetene	2.00	2.000	2.00^{b}	56.33^{b}	58.67^{ab}	57.50^{b}	1507.9^{b}	2198.4^{b}	1853.132^{b}
Babile	2.00	2.333	2.17^{b}	52.667^{b}	51.00^{b}	51.83^{b}	1613.1^{b}	2066.0^{b}	1839.54^{ab}
Robe	2.667	2.667	2.67^{a}	58.33^{ab}	56.33^{ab}	57.33^{b}	1298.5^{b}	2149.6^{b}	1724.05^{b}

W-962	2.33	2.667	2.33[ab]	65.00[a]	65.67[a]	65.33[a]	2539.7[a]	2987.4[a]	2763.59[a]
Local	2.00	2.000	2.00[b]	56.667[b]	57.67[ab]	57.17[b]	1722.9[b]	1892.1[b]	1807.51[b]
CV (%)	16.41	18.19	0.44	4.53	6.23	3.55	16.40	11.30	14.54
LSD (5%)	NS	1.137	16.74	7.338	10.18	5.24	805.19	708.19	337.91

Note: Means with the same letter (s) in the same column are not significantly different at $p<0.05$; LSD = least significant difference; CV = Coefficient of variation. SPP= the number of seeds per pod, HSW= hundred seed weight (g), GY=grain yield (kg ha^{-1})

4. Conclusion and Recommendation

The productivity of groundnut can be enhanced by selecting the improved varieties. The results of this experiment showed that Werer -962 variety produced the highest grain yield, hundred seed weight and good performance in other parameters as compared to the other varieties. Therefore, it can be concluded that variety Werer -962 and Bahajuid well performed and can be recommended for the growers in the Jinka areas and other similar agro-ecologies to improve groundnut productivity.

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