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Research Article

Performance Evaluation of Groundnut Varieties Under Agro Ecologies of Guji Zone, Southern Ethiopia

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Abstract

Groundnut is one of the three economically important oilseeds grown in Ethiopia. This crop is usually grown as a food crop and a cash crop by smallholder farmers in the study area. The area has potential to the production of Ground nut for food and nutrition security as well as export. However, the lack of environmentally suitable varieties is one of the biggest obstacles to production. To this end, the experiment was conducted in three districts Adola Redde, Oddo Shakiso and Goro dola and two kebeles from each district but because of security problems only one kebele was selected at Goro dola. The objective of the study was to evaluate and identify the adaptable, best performing variety in agronomic traits and high yielding at study area. Ten improved groundnut varieties were evaluated using a randomized complete block design with three replications. Combined analysis of variance showed existence of statistically significant differences (P<0.01) among varieties for all traits except plant height. Sedi and Werer 961 were the earliest to maturity while Baha-gidu and Tole-1 were late matured varieties. The average kernel yield of overall locations ranged from the lowest of 1211 kg ha^{-1} for Fayo variety to the highest of 2317kg ha^{-1} for Babile-1 variety. Baha-gudo and Tole-1 were the two highest varieties in hundred seed weight but Sedi was the lowest in hundred seed weight. Babile-1 variety was the top-ranking variety to overall farmer's field followed by Werer-961 and Baha-gudo. Therefore, Babile-1, Werer-961 and Baha-gudo were identified as the best varieties to be demonstrated and popularized in the study areas and other similar agro-ecologies in respective order.

Keywords: Adaptability; Agronomic trait; High yielding; Varieties

Introduction

Groundnut (*Arachis hypogaea* L.), also referred to as peanut, earthnut, or monkey-nut, is an annual herbaceous crop that is self-pollinating and indeterminate [1]. It is one of the most important oilseed crops in the world (Upadhyaya *et al*., 2010) and ranked as the fourth most important oilseed crop and the thirteenth most important food crop (Surendranatha *et al*., 2011). Its seeds contain approximately of 50% edible oil, with the remaining 50% containing high-quality protein (36.4%), carbohydrates in the range of 6–24.9%, minerals, and vitamins [3]. Nuts can be eaten raw, roasted, or boiled, while the oil extracted from the seeds is used for culinary purposes. It also generates significant cash income for a number of small-scale producers and foreign exchange.

Moreover, it serves as an industrial raw material and animal feed [14]. Because groundnuts are legumes, they fix atmospheric nitrogen in soils, increasing soil fertility and reducing the need for fertilizer in ensuing crops. This is especially crucial in light of the growing cost of chemical fertilizers, which makes it harder for small-scale farmers to afford them (Simtowe *et al*., nd).

From 26.4 million hectares of producing area, the globe produced about 38.2 million tons of groundnuts annually. One of the five oil-seed crops that are commonly grown in Ethiopia is groundnut (Gezahagn, 2013). This crop is mostly grown by the traditional farming population in rain-fed environments. According to CSA (2018), the estimated gross annual output in Ethiopia was 1,451,728.20 quintals, equating to an area of around 80,841.57 hectares. Oromia region (41,089 ha) is Ethiopia's largest groundnut producing region, with Benshangul-Gumuz (14,759 ha) and Amhara (3,161 ha) regional states following [15]. In some areas of western Ethiopia, groundnut is cultivated in both the main season (June) and the "Belg" season (March).

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Table 1: Mean squares from combined analysis of variance over five locations for agronomic traits and kernel yield during 2019.

Source of variation	d.f	Mean Squares							
		DF	DM	PH	NB	NPPP	NSPP	HSW(g)	KY
Replication	2	0.07	6.06	10.64	5.55	64.00	0.24	6.40	631277
Variety	9	156.76**	19.13**	3.29ns	91.29*	176.00*	0.77**	1084.39**	2320765**
Error	138	1.26	1.52	13.40	39.62	102.70	0.10	8.25	378003
Total	149								

Where, ns: Not Significant at P<0.05, * significant at P<0.05; ** significant at P<0.001 probability level; df: Degree of Freedom; CV: Coefficient of Variance; DF50%: Days to 50% Flowering; DM: Days to 90% Maturity; PH: Plant Height (cm); NB: Number of Branches; NPPP: Number of Pods Per Plant; NSPP: Number of Seeds Per Pod; HSW (g): Hundred Seed Weight; KY: Kernel Yield.

Ethiopia's groundnut production is significantly lower than the global average (1.52 ton ha-1) at less than 1.1 tons ha-1. Ethiopia has a very low seed yield, according to Amare (1987) and EARO (2000). The primary causes of this poor yield include a lack of high-yielding varieties, insufficient soil fertility, and restricted access to outside inputs.

Improved groundnut varieties are not yet being produced in the zones' potential locations, especially in the Guji zone, even though the area's soil type and weather are ideal for producing groundnuts. As a result, one of the main causes of the low yield level in the research area is the absence of high yielding and stable varieties. Therefore, it is imperative to introduce the improved variety to the zones' prospective areas. Thus, the objective of this study was to identify adaptable and high yielding improved groundnut varieties that are appropriate for the midlands to low-altitude areas of Guji zones.

Material and Methods

The test was carried out in the potential producing areas of Guji zone at Oddo Shakkiso in two kebeles' (Banti-korbo and Diba-bate), Goro-dola in one kebele (Sirba) and Adola Rede in two kebeles' (Dole and Kiltu-sorsa) during 2019 cropping season. A total of ten (10) improved groundnut varieties were evaluated for the study. It was arranged in randomized complete block design with three replications at all locations. Each entry consisted of four rows of 3m length with 60cm between rows and 10cm between plants. To reduce border effect, data was taken from the central two rows. Weeding and other management practices were done as required. Fertilizer was applied at the rate of 121kg NPS per hectare at the time of planting.

Data Collection and Analysis

Data were recorded on days to 50% flowering, number of branches, plant height (cm), days to maturity, numbers of matured pods per plant, numbers of seeds per pod, 100- seed weight (g) and kernel yield (kg/ha). The unshelled pods were sun dried for two weeks and shelled to estimate kernel yield. The analysis of variance for each location and combined analysis of variance over locations were computed using the SAS program (SAS institute, 2011) versions 9.3. The significance of mean differences was tested by Least Significant Difference (LSD) as stated in Gomez and Gomez (1984).

Results and Discussions

Combined Analysis of Variance

Pooled analysis of variance showed highly significant differences (P<0.01) among varieties for days to flowering, days to maturity, NSPP, HSW (g) and KY except plant height. There were also observed significant variations (P<0.05) in NB and NPPP. Similar result was reported by Ejigu *et al*. (2020) and Biru and Darajje (2014) who stated days to flowering, days to maturity, number of branches, NPPP, NSPP, HSW(g) and KY but in contrary to this result plant height has significant variation among varieties according to these scholars.

Mean Performances of Agronomic Traits of Groundnut Varieties

The analysis of variances revealed that there is significant variation in important traits among varieties except plant height which is statistically non-significant. According to this finding, the minimum number of days to flowering was recorded on the variety, sedi (43.67 days) which is statistically similar with werer 961 variety (44 days) followed by Fayo (45 days) whereas Roba, Babile-2, Baha-gidu and Tole-1 required maximum days to flowering (Table 2).

Mean performance of varieties in days to maturity ranged from 161 (sedi) - 166.7 (Baha-gidu) (Table 2). Mean performance of varieties in plant height showed no significant variations among varieties. Varieties showed considerable variation in number of branches, number of pods per plant and hundred seed weight which was similar to the finding of Ejigu *et al*. (2020) and Chavadhari *et al*. (2017). Wedajo and Wondewosen (2017) also reported the same finding to this result that there were significant variations among varieties in the selected agronomic traits.

Table 2: Combined mean performance of agronomic traits and yield components of groundnut varieties at five locations.

No	Variety	Parameters						
		DF	DM	PH (cm)	NB	NPPP	NSPP	HSW(g)
1	Roba	55.00a	165.0b	26.80	16.92a	21.25a-c	2.08d	61.00c
2	Baha-gudo	46.67b	164.7b	24.92	12.14a-c	20.64a-c	2.00d	85.33a
3	Wer-er961	44.00d	161.7c	24.64	7.14bc	32.94a	2.50bc	44.00d
4	Ba-bile-1	45.67bc	164.3b	25.61	8.61a-c	31.00ab	2.08d	79.00b
5	Ba-bile-2	55.00a	165.0b	25.53	16.16a	25.22a-c	2.00d	78.33b
6	Baha-gidu	55.00a	166.7a	24.95	14.81a-c	25.44a-c	2.00d	59.00c
7	Sedi	43.67d	161.0c	24.72	6.53c	22.39a-c	3.08a	33.00e
8	Tole1	55.00a	166.0ab	26.03	15.08ab	14.94c	2.17cd	83.67a
9	Fayo	45.00cd	165.0b	26.30	8.47a-c	23.75a-c	2.50bc	48.33d
10	Nc-4x	46.67b	165.3ab	24.92	12.86a-c	18.58bc	2.58b	45.33d
Mean		49.17	164.47	25.44	11.87	23.62	2.30	61.80
LSD (0.05)		1.359	1.493	ns	7.307	11.762	0.363	4.928
CV (%)		2.3	0.7	14.4	53.0	32.9	13.6	

Means assigned with the same letter shows no significant difference among them. LSD: Least Significant Difference; CV: Coefficient of Variation; DF50%: Days to 50% Flowering; DM: Days to 90% Maturity; PH: Plant Height (cm); NB: Number of Branches; NPPP: Number of Pods Per Plant; NSPP: Number of Seeds Per Pod; HSW (g): Hundred Seed Weight.

Table 3: Mean Kernel yield (kg ha^{-1}) of groundnut varieties at five locations and combined mean during 2019 and their rank on yield performance.

Treatments	Locations					combined Mean	Rank
	Diba Bate	Banti-korbo	Sirba	Dole	Kiltu-sorsa		
Roba	1580^{a-c}	1449^{b-d}	931	1174^{cd}	1625^{c}	1352^{cd}	7
Baha-gudo	2051^{a}	2104^{ab}	1826	1319^{c}	3000^{ab}	2060^{ab}	3
Werer-96	1906^{ab}	2521^{a}	1340	2444^{b}	2139^{bc}	2070^{ab}	2
Babile-1	2198^{a}	1806^{a-c}	1764	2444^{b}	3375^{a}	2317^{a}	1
Babile-2	2149^{a}	2097^{ab}	1531	1035^{cd}	2007^{c}	1764^{bc}	5
Baha-gidu	1851^{ab}	2292^{ab}	1427	1417^{c}	2146^{bc}	1826^{a-c}	4
Sedi	927^{cd}	1917^{ab}	913	3090^{a}	1528^{c}	1675^{b-d}	6
Tole-1	1118^{b-d}	1410^{b-d}	1288	757^{d}	1729^{c}	1260^{d}	8
Fayo	892^{cd}	615^{d}	1264	1500^{c}	1785^{c}	1211^{d}	10
Nc-4x	587^{d}	868^{cd}	1403	1208^{cd}	2174^{bc}	1248^{d}	9
Mean	1525.97	1707.78	1368.75	1638.89	2150.69	1678.417	
P-value	0.001	0.001	0.08	0.001	0.004	<.001	
LSD (0.05)	696.87	661.44	587.39	451.49	839.92	443.91	
CV (%)	26.6	22.6	25.0	16.1	22.7	36.6	

Means assigned with the same letter shows no significant differences. LSD: Least Significant Difference; CV: Coefficient of Variation

Mean Yield Performances of Groundnut Varieties

The analysis of variance revealed that there was highly significant difference ($p<0.01$) among varieties in mean kernel yield. Mean performance of varieties for kernel yield ranged from 1211-2317Kg/ha. The significantly highest kernel yield (2317kg) was recorded on the variety Babile-1 followed by Werer-96 (2070kg/ha) which was statistically similar with variety Baha-gudo (2060kg/ha) whereas the significantly lowest kernel yield was observed on the variety Fayo (1211kg/ha). This result was concurrent with Habte *et al*. (2020) who reported that there were significant variations among varieties in kernel yield. Biru and Darajje (2014) also reported the same finding in that significant variation among varieties in kernel yield was recorded. Moreover, Ejigu *et al*. (2020) and Wedajo and Wondewosen (2017) stated the existence of the genetic variability of different varieties in their yielding potentials.

Conclusion and Recommendation

The experiment was conducted in three districts Adola Redde (Dole and Kiltu-sorsa Kebeles), Oddo Shakiso (Diba Bate and Banti-korbo Kebeles) and Goro dola (Sirba Kebele) at five locations (Kebeles). In the present study, ten improved varieties of ground nut in randomized complete block design with three replications were used. Generally, the study entails the significant variations among ground nut varieties. The results revealed that Baile-1 (2317 kg/ha) variety was ranked first in kernel yield and Werer-961 (2070 kg/ha) was ranked second whereas Baha-gudo (2060 kg/ha) was ranked on the third. The varieties Sedi and Werer-961 were relatively early matured varieties since behaving the lowest number of days required to flowering and maturity Whereas Babile-1 and Baha-gudo were observed medium matured varieties with better agronomic performances in the study area.

The high yielding potential of the varieties may be on account of having good performances in pods per plant, number of primary branches, and number of seeds per pod and also seed quality (hundred seed weghit) existed in Babile-1, Werer-961 and Baha-gudo. Moreover, the present study indicated that good phonological traits and high yielding performances were recorded in the variety Babile-1 followed by Werer-961 and Baha-gudo. Therefore, these varieties were selected as the best performing varieties recommended for the farmers around the study area and similar agro ecologies.

Author Statements

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References

1. Adinya IB, Enun EE, Ijoma JU. Exploring profitability potentials in groundnut production through agroforestry practices: a case study in Nigeria. J Anim Plant Sci. 2010; 20: 123-31.
2. Amare. Effect of inoculation and nitrogen fertilization on yield of common bean in Ethiopia. In: Proceedings of the a workshop on bean research in eastern Africa. CIAT African workshop series. Mukono, Uganda. 1987; 152-9.
3. Baraker B, Jha SK, Wani SP, Garg KK. Efect of balanced fertilizer management practices on factor of productivity on Groundnut (Arachis hypogaea L.) cultivation. Int J Chem Stud. 2017; 5: 1288-91.
4. Biru A, Daraje A. Adaptation Study of Improved groundnut (Arachis hypogaea L.) Varieties at Kellem Wollega Zone, Haro Sabu, Ethiopia. J Biol Agric Healthc. 2014; 4.
5. Central Statistical Agency (CSA). Agricultural sample survey 2017/18: report on area and production of major crops (private peasant holdings, main season). Addis Ababa: CSA. 2018; 1.
6. Chavadhari RM, Kachhadia VH, Vachhani JH, Virani MB. Genetic variability studies in groundnut (Arachis hypogaea L.). Electron J Plant Breed. 2017; 8: 1288-92.
7. EARO. Lowland pulses research strategy. Ethiopia: Addis Ababa. 2000; 1-39.
8. Ejara E, Kitaba K, Misganaa Z, Gabisa M, Tesama G. Performance Evaluation of Early Maturing Ground Nut Varieties in West Guji lowland, Southern Ethiopia. J Agric Crops. 2020; 6: 73-7.

9. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd ed. Singapore: John Wiley & Sons. 1984.

10. Berhanu H, Hunduma A, Dalasa M, Getachew A. Performance evaluation of groundnut varieties in eastern parts of Ethiopia. Food Science and Quality Management. 2020; 102.

11. Kudama G. Economics of groundnut production in east Hararghe Zone of Oromia regional state, Ethiopia. Sci Technol Arts Res J. 2013; 2: 135-9.

12. SAS Institute. SAS/STAT user's guide. Cary, NC: SAS Institute Inc; 2011. Available from: http://support.sas.com/kb/42/384.html.

13. Wedajo G, Wondewosen S. Performance evaluation of ground nut varieties in lowland areas of south omo, southern ethiopia. Int J Res Stud Sci Eng Technol. 2017; 4: 6-8.

14. Garko MS, Mohammed IB, Yakubu AI, Muhammad ZY. Performance of groundnut [Arachis hypogaea (l.)] Varieties as influenced by weed control treatments. Int J Sci Technol Res. 2016; 5: 134-40.

15. Musa H, Ahmed HM, Mesfin SA, Wendmagegn M, Amare K. Adoption of improved groundnut seed and its impact on rural households' welfare in Eastern Ethiopia. Cogent Econ Fin. 2016; 4: 1-13.