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Yield Stability of Ground Nut (Arachis hypogaea L.) Genotypes in Low Lands of Western Oromia, Ethiopia

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Abstract
In plant breeding, selecting the stable genotypes is very important; specially, for wider adaptability. Until now, there was no single improved ground nut variety released for western parts of Oromia; however, Kulki and Shulamiz varieties released nationally were adapted for the area. Fourteen ground nut genotypes have been tested through reargues breeding trial since last five years at Bako Agricultural Research Center to release the first variety (ies) that have higher yield and disease resistant and adaptable and productive for western parts of Oromia. Regional variety trials and variety verification trials of 14 genotypes were evaluated against standard check Bulki at three locations, Chewaka, Uke and Gutin. Candidate variety ICG-9097 and BARBARTON have got 21.2 % and 9.6% yield advantages over standard check Bulki and they showed more yield stability than the rest tested genotypes and they were also showed resistant to late and early leaf spot disease during 2015-16. The national variety releasing committee evaluated the candidate and waiting for decision of standing committee for possible release.

Introduction

Groundnut is one of the most important cash crops and the sixth most important oilseed crop in the world. It is the commodity that has a valuable source of all the nutrients; contains 48.2% of oil, 25.2% protein, 11.5% starches, 4.5% soluble sugar and 2.1% crude fiber and also rich with source of minerals and vitamins; on equal weight basis (Kg for Kg), groundnuts contain more protein than meat and about two and a half times more than eggs. It was believed that, South America was the place from where cultivation of groundnut originated and spread to Brazil, Southern Bolivia and North-western Argentina. Groundnut was introduced by the Portuguese from Brazil to West Africa and then to south-western India in the 16th century Gibbons et al. (1972).

Worldwide groundnut is grown on 26.4 million hectares with a total production of 37.1 million metric tons and an average productivity of 1.4 metric t/ha and averagely 0.98 t/ha in Africa (GOI, 2008). Worldwide ground nut is grown over 100 countries. The production of groundnut is concentrated in Asia and Africa with 56% and 40% of the global area and 68% and 25% of the global production, respectively. The major groundnut producing countries in the world are India, China, Nigeria, Senegal, Sudan, Burma and the United States of America. In Africa, Nigeria, Sudan, Senegal are the leading countries of this commodity production (FAO, 1998). Annually, ground nut is grown and covered approximately 40,000 hectares of arable land in Ethiopia., the major growing areas were; Eastern Hararghe, Metekel zone, and Eastern Wellega; Currently ground nut production was doubled due to its high market value and resistance to drought (EIAR, 2010). The national average yield was nearly about 0.829 ton/ha, however, productivity is very low which compared to global production.

Ground nut adaptations trial has been executed since 2013 with eight varieties which were brought from Melka Werer and sown at Chewaka, Uke and Gutin. Among these eight varieties, Bulki and Shulamith were adapted well and recommended for the areas; Variety development was also started at that time with fourteen genotypes and this year, two candidates' varieties have been sown with standard check Bulki and Bahagudo as variety verification trial.

Materials and Methods

The experiments were carried out over two seasons in 2015 and 2016 at three locations (Chewaka, Uke and Gutin). Chewaka located Ilu ababora zones and 59 km away from capital city of Eastern Wolega, Nekemte; and Uke and Gutin, 36 and 72 km away from Nekemte respectively. Fourteen genotypes of ground nut varieties were tested in RCBD with three replications with plot size of 4 rows x 0.6 m x4 m= **9.6 m^2.** All agronomic and important data were collected and two candidate varieties those having yield advantage of **21.2% (ICG-9097)** and **9.6% (BARBARTON)** during the gregarious regional variety trial were promoted to variety verification trial on plot size of 10 m x 10 m along with standerd checks Bulki and Baha-gudo (recently released variety, 2014) during 2017 growing season,

Results

The Regional Variety Trial (RVT) of ground nut showed highly significant different of grain yield across locations in 2015 and 2016. These implies, the evaluated ground nut genotypes had different yield and other potential traits. These two selected genotypes were also showed more stable and gave high mean grain yield than standard check Bulki and other tested genotypes (Fig 1). The grain yield performance and disease reaction of

these fourteen ground nut genotypes were presented in table 1 and 2 respectively.

Table 1. Mean seed yield (kg/ha) across locations and years in ground nut regional variety trial

Accession	Grain (kg/ha)						Over all mean	Yield advantage (%)
	2015			2016				
	Chewaka	Gutin	Uke	Chewaka	Gutin	Uke		
IGFDN	1526.3	1449	973	2217.98	387.64	975.73	1254.9	-12.6
ICG-9097	1625.9	2153	1774	2484.89	883.75	1527.9	1741.6	21.2
ICVG-86259	1663.2	1692	896	2177.33	456.72	725.2	1268.4	-11.6
ICVG87099	1339.2	1728	979	2394.53	511.27	1150.23	1350.4	-5.9
ICVG-87105	1914.9	1579	1045	1812.61	555.16	1159.91	1344.4	-6.3
ICG-67XBIGseed	962.9	1536	1455	2089.53	570.34	762.00	1229.3	-14.4
ICG-245	2363.1	1358	1333	1762.91	605.20	989.54	1402.0	-2.3
AK10	1457.2	1703	1008	1723.53	461.24	735.86	1181.5	-17.7
ICGV87187	1534.3	862	1489	2145.02	281.78	717.47	1171.6	-18.4
ICGS-37	2133.5	1165	1142	2169.25	523.53	612.91	1291.0	-10.1
ICG35	1722.7	1224	994	1916.52	552.59	925.65	1222.6	-14.8
ICG318	1348.5	1742	1708	1597.00	285.65	915.96	1266.2	-11.8
BARBARTON	2025.97	2035	1605	1992.63	634.88	1034.06	1574.25	9.6
Bulki (cheeck)	1854.2	1750	1505	1740.93	559.69	1207.99	1436.3	0
Grand mean	1676.5	1569.7	1279	2016.0	519.2	960.0	1338.1	
CV (%)	23	20	23	12	16	21		
LSD (5%)	652	527	484	712	214	456		
F – value	**	*	*	**	*	**		

Key: **= highly significant, *= significant and ns=none significant

Table: Major disease severity score of ground nut genotypes in RVT trial during 2016 growing season

Genotypes	Disease (1-9 scale) Means					
	Chewaka		Uke		Gutin	
	ELSD	LLSD	ELSD	LLSD	ELSD	LLSD
IGFDN	4 .0	4.6	4.3	5.3	4.7	3.7
ICG-9097	3.7	4.6	4.3	4.3	3.7	3.7
ICVG-86259	4.3	5.0	4.7	4.3	4.0	4.3
ICVG87099	4.3	5.0	4.3	4.6	4.3	3.7
ICVG-87105	4.0	3.7	5.3	4.6	4.7	5.0
ICG-67XBIGseed	3.3	3.7	5.0	5.0	4.3	4.3
ICG-245	4.3	4.7	5.0	4.3	4.3	4.3
AK10	5.0	5.0	4.7	4.7	4.7	4.3
ICGV87187	4.3	3.3	4.0	4.7	4.0	4.3
ICGS-37	3.3	4.3	4.3	4.7	4.0	4.0
ICG35	3.7	3.7	4.7	3.3	3.7	4.7
ICG318	3.3	4.7	4.0	4.3	4.3	3.7
BARBARTON	4 .0	4.7	4 .0	4.0	4.3	3.3
Bulki (cheeck)	3.7	4.3	4.7	4.7	4.3	3.7
LSD (0.05)	1.8	1.7	1.2	1.3	1	1
CV (%)	24	23	16.6	17.5	14.9	16

Where ELSD = Early Leaf Spot Disease and LLSD = Late Leaf Spot Disease

Grain yield stability

In the stability analysis of grain yield of the fourteen ground nut genotypes, the standard check BARBARTON (1574.25 kg/ha) was ranked 2nd after ICG9097 (1741.6 kg/ha), it had more stable yield than ICG9097 and other genotypes (Figure 1).

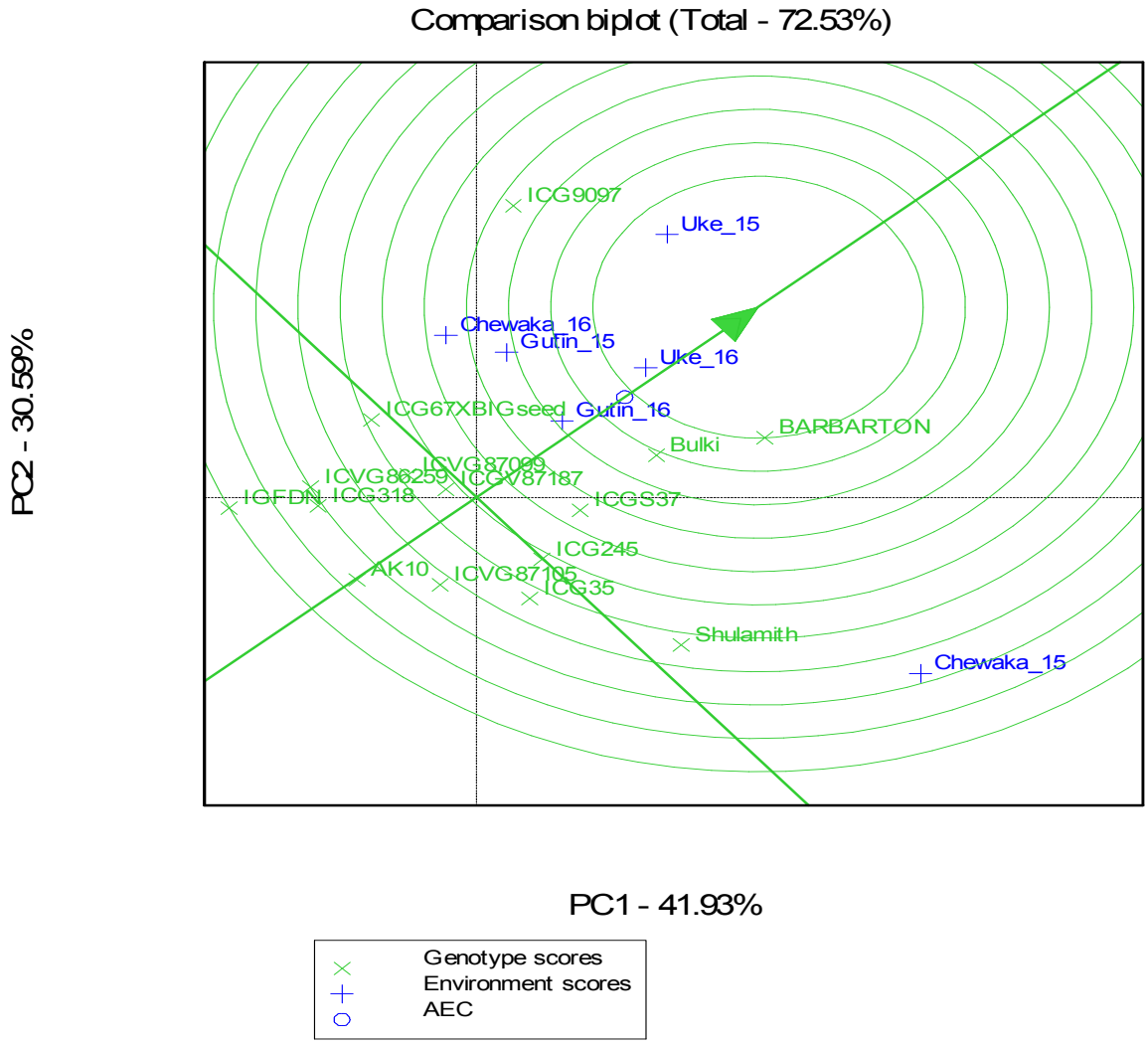

Figure 1: GGE biplot analysis showing grain yield stability and adaptability of ground nut genotypes at western Oromia, 2016 growing season

Conclusion

Developing new crop varieties are a continues activity to increase the production and productivity of that particular crop. The two evaluated new ground nut varieties to be released have a contribution for developing and promoting of this particular crop in Western Oromia in particular and earning the foreign currency for the country in general.

Recommendation

Since the two evaluated ground nut varieties (ICG 9097 and BARBARTON) have more than ten percent yield advantages (21.2 % and 9.6 %) over standard check Bulki respectively and tolerant/ resistant to leaf spot disease, they are recommended for western Oromia and the same agro ecologies.

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