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Performance Evaluation and Adaptability Study of Durum Wheat (*Triticum turgidum* var. durum) Varieties in Moisture Stress Areas of East Hararghe, Oromia

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Abstract

Seven Durum wheat varieties were evaluated at Faddis Agricultural Research Center (FARC) at Boko research station during 2013/14 cropping season. The results revealed that the tested Durum wheat varieties differed significantly for grain yield, plant height, spike length and seed per spike. Among the varieties Mangudo, Ude, Dembi and Asassa produced higher grain yield (3387.5, 3345.8, 3112.5 and 3101.4kg ha-1, respectively). Durum wheat varieties Yerer recorded maximum spike length (6.5cm) variety Mangudo recorded minimum spike length (4.5cm) whereas variety Mangudo recorded maximum seed per spike followed by Ude (58 and 54 respectively). Among the tested varieties Mangudo, Ude and Dembi recorded higher grain yields and maximum seed per spike and were good performing varieties in the study area.

Keywords: Grain yield; Durum wheat; Varieties; Cropping

Introduction

Wheat (Triticum spp.) is widely produced in the highlands and mid-altitudes of Ethiopia. In Ethiopia, it is one of the major cereal crops grown between 6 and 14o N latitudes; and between 35 and 42o E longitude ranging in altitude from 1500m to 3200m. Wheat is the fifth most important cereal crop in area of production, after teff, maize, barley and sorghum and in total grain production, it ranks 4th after maize, teff and sorghum. In productivity, wheat ranks 2nd next to maize and accounts for more than 15 percent of the total cereal output. Ethiopia is the second largest producer of wheat in Sub-Saharan Africa. It is an important crop commodity, which could contribute a major part in achieving the country's agricultural policy objective of food grain self-sufficiency.

Bread wheat (Triticum aestivum) and durum wheat (Triticum turgidum ssp. durum L.) are the two major species of wheat cultivated in Ethiopia. Durum wheat (Triticum durum Desf.) is derived from a tetra-ploid hybrid of the diploid T. monococcum (einkorn) and a diploid wild grass of unknown origin [1]. It is traditionally grown on heavy black clay soils (vertisols) of the highlands. A premium price is paid for durum wheat containing a high amount of protein. The demand for high protein durum wheat (in excess of 13%) stems primarily from pasta manufacturers in Europe, Japan and North America (ESSO Farm-Tek, 1997). Some cultivars inherently produce more protein; however, protein content is influenced more by environment than genotype. Proper fertilization may help to increase the protein levels. For example, both grain and total nitrogen uptake increased with split nitrogen applications in Ethiopia, where continuous cropping has depleted the soil [2].

Traditionally, durum wheat is an economically important crops used for bread, biscuits and pasta products such as macaroni, spaghetti and noodles are some of the industrial products. In Ethiopia wheat is known to be a major source of energy and protein. Traditionally, durum wheat is used for making "dabo", "dabokolo","ganfo", "kinche" and other types of food. The straw is good source for animal feed and is also used for thatching roofs. The potential of wheat will be its entry into the export market, if production is expanded and productivity is increased. This will save the foreign currency used to import wheat.

However, owing to its economic importance, the area under durum wheat production has been lower as compared to bread wheat production. The reasons for this were:

a. The use of traditional production system.

b. The influence of biotic (e.g. diseases) and abiotic factors.

c. The unavailability of production inputs (e.g. improved seeds) and/or suboptimal use of recommended packages.

In the past in Ethiopia, phenotypic-genetic variations and environmental influence studies for disease resistance and yield on durum wheat have been reported [3]. It was well adapted to the steppes or semi-arid regions, which typically have hot, dry days and cool nights with winter rains and dry summers [4]. It is especially well adapted to droughty areas such as the Mediterranean region of the Syrian wheat belt, which receives only about 300-400mm of rainfall annually [5].

In Ethiopia there are also different varieties of improved durum wheat released from research center. However, seed of this cultivar and other cultivars were multiplied and distributed all over the regions thus were being produced on limited scale by the research centers and some farmers. The something is true to Eastern Hararghe, these varieties were not produced and known by the farmers. In the case of Faddis, it was uncommon to grow durum wheat in the area. So, people in the area used to grow local sorghum which took around eight months to mature without rotating year after year. Therefore, this activity designed to make adaptation of these different durum varieties and select the most adaptable, high yielder and different disease and insect pest resistance.

General objective

a. To select the most adaptable durum wheat varieties in moisture stress areas of E. H.

Materials and Methods

Description of the experimental site

The experiment was conducted on a location of Faddis district of Boko research station of Eastern Hararghe Zone of Oromia region. Faddis district has latitude between 8°22' and 9°14' North and longitude between 42°02' and 42°19' East, in middle and low land areas: altitude range is from 1200-1600m. a. s. l, with a prevalence of lowlands. The district receives average annual rain fall of 400-804mm; the minimum and maximum air temperature of 20-25 °C and 30-35 °C, respectively [6].

Experimental materials and design

The experiment was conducted in 2014/15 cropping season at Faddis Agricultural Research Center (FARC) on Boko research station in moisture stress areas of Eastern Hararghe zone which. Seven (7) genotypes of durum wheat including one standard check had been planted at Faddis on station to see their adaptability and their yield performance [7-9].

The Experiment was laid out in RCBD design with three replications in plot size of 3m x 4m and path between plots 1m. The seeds were sown in row with drilling methods with a row spacing of 25cm. The management practice had been undertaken as per the recommendation. Data on days to 50% emergence, days to 50% flowering, days to maturity, plant height, Average Kernel size, protein content in the laboratory, grain yield per plot and thousand seed weight had been collected. Disease such as leaf spots, rusts, scab (Fusarium head blight), black point, root and crown rots, powdery mildew and smuts had also recorded in 1-5 scale. The stands of the varieties were evaluated in team [10,11].

All agronomic data, disease and insect records had been collected and the collected data were subjected to the analysis of variance (ANOVA) and evaluated for significance of treatments and the means had been compared and ranked by using Least Significance Difference (LSD) in order to select the most adaptable varieties.

Results and Discussion

Analysis of variance (ANOVA) indicated that there was significance difference among durum wheat varieties for grain yield, spike length and seeds per spike tested at 5% probability level. However, no significance difference was observed between varieties for days to 50% heading, days to 50% flowering and days to physiological maturity.

Grain yield (kg ha-1)

The analysis of variance (ANOVA) revealed that there was significant difference among varieties for yield (Table 1). The grain yield ranged from 3387.5kg/ha to 1759.7kg/ha and grand mean of 2573.6kg/ha. The highest yield (3387.5kg/ha) was gained from Mangudo variety followed by the varieties Ude (3345.8kg/ha), Dembi (3112.5kg ha-1) and Asassa (3101.4kg ha-1) while the lowest yield (1759.7kg/ha) was obtained from local check (Kronis) variety. Statistically, significance difference was not observed among durum wheat varieties of Mangudo, Ude, Dembi and Asassa. The variation in grain yield of the tested varieties showed the difference in adaptability of these varieties to the moisture stress areas of the study. The highly performed varieties revealed that the most adaptability to this environment.

Plant height (cm)

Analysis of variance revealed highly significant difference ($p<0.01$) among varieties for plant height (Table 1). The plant height ranged between 52.3cm to 83.5cm. The highest height was given by variety "Quamy" while the lowest was by variety "Kronis".

As the data indicated; Quamy, Asassa and Ude were taller standing: 83.50, 78.1 & 63.3cm respectively, while Dembi & Kronis were shorter standing: 58.9, 52.3cm respectively. Even though, plant height has no direct relation with grain yield, the tallest plant is important for its highest biomass which is desirable for different purposes. From this study, spike length had no significant effect on grain yield recorded. The shortest spike length was recorded by the variety Mangudo but highest yield was obtained by this variety.

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Spike length (cm)

Analysis of variance (ANOVA) indicated that significance difference was observed among varieties tested (Table 1). The spike length ranged between 6.5cm and 4.5cm. The highest spike length was recorded by variety Yerer (6.5cm) and the lowest was recorded by variety Mangudo (4.5cm). Varieties Yerer, Kronis and Quamy revealed the longest spike length while Mangudo and Ude had the shortest head size respectively.

Table 1: Mean Comparison of grain yield and other parameters of durum wheat variety trial at Faddis on station.

TRT	Identification	DH	DF	DM	PH	SL	SPS	YKGHA
1	Quamy	57	65	111	83.5	5.1	36	2943.1
2	Asassa	55	63	111	78.1	4.9	42.67	3101.4
3	Yerer	61	69	115	61	6.5	46.67	2945.8
4	Ude	57	65	115	63.3	4.7	53.67	3345.8
5	Dembi	62	70	110	58.9	4.9	51.67	3112.5
6	Mangudo	57	65	121	61.7	4.5	57.67	3387.5
7	Kronis	57	65	111	52.3	5.5	36.67	1759.7
	CV%	8.1	7.2	3.5	5.7	8.5	15.1	12.7
	5%LSD	8.4	8.4	7.11	6.7	0.8	10.96	663.6
	P value	NS	NS	NS	**	*	*	*

**p<0.01 (highly significant), *p<0.05 (significant) and NS (Not significant)=p>0.05, DH= Days to heading, DF= Days to flowering , DM= Days to mature, PH= Plant height, SL= Spike length, SPS= Seed per spike and YKGHA= Yield kg per hectare.

Seed per spike

Significance difference was recorded among the tested materials and the seed per spike ranged between 57.67 and 36.00. The highest seed count was obtained from Mangudo (57.67), Ude (53.67) and Dembi (51.67) and the fewest seed count was obtained from Kronis (36.67) and Quamy (36.00) respectively. As the data of study indicates, seed per spike has significant effect on grain yield and thus the highest seed per spike gave the highest grain yield and similarly, the lowest seed per spike recorded the lowest grain yield (Table 1).

Conclusion and Recommendation

The finding of this study showed that the durum wheat varieties responded differently to drought stress study area. The analysis of variance revealed significant (P<0.05) differences in the parameters studied of all durum wheat varieties were observed at the study area. The results revealed that the highest grain yield and seed per spike was recorded by variety Mangudo and while the standard check revealed the lowest. The longest plant height was obtained from varieties of Quamy, Asassa and Ude and the lowest was observed from Dembi and Kronis varieties respectively.

Generally, it can be concluded that Durum wheat varieties Mangudo, Ude and Dembi resulted the best results in terms of yield and yielding component (seed per spike). Therefore, increasing production and productivity of farmers and improve sustainable durum wheat in the study area these varieties were recommended and need to be demonstrated with standard check for further evaluation along with their improved production packages.

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