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Full Length Research Paper

Participatory Evaluation of Bread Wheat (*Triticum aestivum* L.)Varieties for its Yield Performance at Madda Walabu District of Bale Zone, South Eastern Ethiopia

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Abstract

Wheat is the cheapest source and supplies of the calories and protein in the average diet. The study was conducted in semi arid area of Bale Zone of south eastern part of Ethiopia. The experiments were conducted as a principle of PRG approach with the objectives of to Participatory evaluation of bread wheat varieties for its yield performance at Madda Walabu District of Bale Zone. The experiments were laid out in Randomized Complete Block design (RCBD) with three replications. During the experiment the PRG group was used five types of bread wheat varieties such as Paven76, Digalu, Kakaba, Ogolcha and Local bread wheat. PRG group was evaluated the varieties based on the following wheat performance effective tiller, grain per spike, spike length, weight of grain yield are the basic wheat evaluation criteria of PRG. Statistical analysis of experiment showed that all the varieties were affected significantly P<0.05. Result shows that maximum number of tillers 6/plants, 1000 grain weight (50.33g), grain per spike (37.3), spike length (7cm), and grain yield (2746kg/ha) at maturity were recorded in Ogolcha variety followed by Kakaba, paven 76 and Digalu varieties where as the lower performance was recorded at the local bread wheat which is 2000.33kg/ha. From the result Ogolcha and Kakaba varieties were non-significant effect which are 2746 Kg/ha and 2687.67Kg/ha on their yield. Therefore, among the improved bread wheat varieties PRG was selected Ogolcha variety based on its yield and recommended to the agro ecology.

Key word: Bread wheat, Improved variety, PRG, Yield

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Introduction

Wheat *(Triticum aestivum* L.*)* is among the most important food crops of the world and a member of the family Poaceae that includes major cereal crops of the world such as maize, wheat and rice. Among the food crops, wheat is one of the most abundant sources of energy and proteins for the world population and its increased production is essential for food security (Chhokar *et al*, 2006). Moreover, the largest crop area is devoted to this crop and the quantity produced is more than that of any other crop. Wheat crop occupies about 17% of the world's cropped land and contributes 35% of the staple food (Pingali *et al*., 1999).

Wheat is characterized by large genome size (approximately 17000 Mb) and 95% of wheat grown today is of hexaploid type, used for the preparation of bread and other baked products (Sanjay and Singh, 2010). It is the cheapest source and supplies of the calories and protein in the average diet (Heyne, 1987). Bread wheat is the world's leading food crop due to the visco-elastic properties of its endosperm gluten proteins (Poehlman and Sleeper, 1995). In addition to the above wheat is important in Ethiopia for preparation of Enjera and Bread.

In Ethiopia, a number of improved varieties have been released to heterogeneous environmental conditions of the country (Curtis *et al.,* 2002). As a result, wheat area has significantly increased from 0.6 to 1.4 million hectares between 1999 and 2005 and the overall grain yield potential increased by 31.6% (5.26%/year) (CSA, 2012). Despite the significant increases in area of wheat production in the country, the mean national wheat yield of 2.3 t/ha (CSA, 2012) is 24% below the mean yield for Africa and 48% below the global mean yield (Gavian and Gemechu, 1996). This relatively low productivity may be partially attributed to the prevalence of virulent crop pathogens, lack of durable resistant variety, soil nutrient depletion, insect pest and weeds in major wheat producing at the district. Despite all these factors, the crop plays a significant role in the national economy and thus, currently increasing the area and productivity of this crop is central in the strategic plan to attain sustainable grain production and food self-sufficiency. Moreover, it is one of the major cereals of choice in Ethiopia, dominating food habits and dietary practices, and is known to be a major source of energy and protein in the country (Haile and Girma, 2010). In southeastern Ethiopia, especially the highlands of Arsi and Bale Zones, generally receive reliable rainfall and characterized by extensive wheat production. For this reason, these areas are sometimes referred to as "the wheat grain belt of the country" (Mohammed *et al.,* 2000; Padmavithi *et al*., 2001). Of the total wheat production in Ethiopia, 45.4% comes from these two Zones, which covers about 36.8% of the total wheat area of the country and also maximum average yield of 2.7 and 2.4 t/ha was attained in Arsi and Bale Zones, respectively (CSA, 2012). Bale Zone alone contributes about 16.7% of the country's wheat production. Therefore, any effort to increase wheat yield in these Zones will be directly supportive to boost the overall wheat production of the country and it could be helpful to meet the food requirements for the burgeoning population. One way of sustaining the agro-pastoral and pastoral community life standard is by providing, and supporting new technology in the area to enhance production and productivity (Pandey and Singh, 1997). Then adopting newly released varieties which are drought resistant and higher yield potential than that in their hand. There are many low land bread wheat varieties that can resist drought and better yield than local seed in agro-pastoral area of Bale zone (SARC). Therefore, the experiment was initiated with the objectives of Participatory evaluation of Bread Wheat varieties for its yield and yield performance at Semi arid area of Bale Zone.

Materials and methods

Description of the Study Site

This experiment was conducted in collaboration with farmers as PRG approach in Bale Zone at Madda Walabu Woreds of Mada kebele during the mini cropping season of 2017. Experimental

area was classified as Semi arid agro ecological zone of Bale District with low and short period of rain full and characterized by bimodal rainfall types and hence wheat is produced twice a year. The main cropping season was extends from March of June and mini cropping season was extends from October to December.

Experimental treatments and Design

This experiment was conducted using Randomized Complete Block Design (RCBD) with three replications with a plot size of 4x4m and intra row spacing of 20cm planting material were sown at the rate of 100kg/ha. The experiment was conducted as PRG approach and the PRG group was established based on their previous performance and activity at the location. During the experiment the following improved Bread wheat varieties used such as Paven 76, Digalu(SHA 7/ KAUZ or HAR 3116), Kakaba, Ogolcha (MoARD, 2009) and Local variety. All improved varieties were collected from Oromia Seed Enterprise of Bale Sub Branch, and local variety from PRG group. During the experiment all the packages of practices were used to raise the crop based on the recommended rate.

Data Collection

To evaluate the performance of improved wheat in Semi arid area both researched and PRG groups were made a discussion within two weeks interval. PRG Groups was taken their data based their natural knowledge and evaluated those improved wheat variety based on seed color, Seed Size, Seed weight, spike length, Seed per spike and grain weight. Through discussion both researcher and PRG groups were develop common evaluation criteria and taken the following data at experimental period. Effective tiller, spike length (cm) and grain per spike are taken at the inner six rows of net plot of ten randomly tagged plants where as grain yield was taken from net plot at crop maturity.

Statistical Analysis

Data collected during this experiment were subjected to the analysis of variance with SAS computer software version 9.1.3 (SAS, 2003). Means separation were conducted using Least Significance Difference (LSD) at 5% probability level and the PRG was evaluated and analyzed based on their natural knowledge.

Results and Discussion

Effective Tiller number

Statistical analysis of the data showed that numbers of tillers were significantly ($P<0.01$) affected by wheat variety. Maximum numbers of tillers were counted Ogolcha and Kekeba which is 6 and 5 tiller/ plant followed by Digalu and Paven76 while minimum tiller numbers were counted at the local variety which is 2 tillers per plant (Table 1). Result of Kakaba with Paven 76 and Digalu varietys were non-significant. This is may be all those bread wheat varieties were improved variety and early relising. The result was in agreement with the work of (Obsa and Yeared, 2017) has reported that number of tillers per plant was a significant difference with the means of 5.51 tiller/plant. The highest tiller was recorded at senate variety where as the lowest was tiller was recorded Mandayo variety where as the lowest tiller was recorded at the local variety. Jemal *et al*. (2015) has reported tiller numbers were significant different among bread wheat varieties.

Table 1. Evaluation of bread wheat varieties for its yield performance

Variety	Number tiller	Plant height(cm)	Spike Length(cm)	grain/ spike	1000 Grain wt/gm	Grain Wt(Kg/ha)
Ogolcha	6a	47.6a	7a	37.3a	50.33a	2746a
Digalu	4b	48.3a	4b	28.33bc	33b	2062.63c
Kakaba	5ab	44.12b	6ab	35.67a	48a	2687.67a
Paven 76	4b	48.2a	5b	30.3b	47.67a	2354.33b
Local	2c	45.2b	3.67c	22.67c	25.33b	2000.33d
LSD	1.97	1.3	1.5	7.7	11.28	180.33

Means with the same letter at the column are not significantly different

Plant height

A significant difference was recorded among the varieties at (P<0.05). Among the tested varieties, Paven76 and Digalu showed the longest height (48 cm) where as local variety exerted the shortest height (45cm). The result agrees with a report of Demelash *et al*. (2013) was also reported significance difference among the tested varieties for plant height. This character for variety evaluation is very important for selecting varieties able to withstand lodging problems. (Obsa and Yeared, 2017) has reported as plant height has significant variation among bread wheat varieties. Shahzad *et al*. (2007) reported that height of the crop is mainly controlled by genotype and it can also be affected by the environmental factors.

Spike length

Bread wheat varieties were a significant different at P<0.05. From the result the higher spike length was recorded at Ogolcha (7cm) and Kakaba (6cm) followed by Paven 76 and Digalu where as minimum spike length was recorded at the local variety (Table 1). This is due to the local variety was not genetically modified as to the location. From the result Ogolcha and Kakaba varieties were not significant this is may be both varieties were genetically modified to the location and drought tolerant. The result was line with the work of (Obsa and Yeared, 2017) who has reported significant difference was observed among the tested bread wheat varieties for spike length. Otteson *et al*. (2007) has reported that individual genotypes of wheat responded differently for spike length.

Grains per spike

The result has a significant (P<0.05) effect on number of grains per spike. Highest numbers of grains per spike were counted at Ogolcha (37.3) and Kakaba (35) followed by Paven76 and Digalu where as minimum grain per spike was recorded at the local variety which is (22 grains per spike) (Table 1). From the result Digalu and local wheat variety was not significant this is may be effect the environmental and moisture stress tolerance capacity of improved wheat variety. Jemal et al, (2015) has reported that Shorima and Kakaba variety were the higher seed per kernel and followed by Digalu where as the lowest seed per kernel was recorded by Danda'a. Hussain *et al*. (2001) has reported that the higher grain numbers were recorded in the lowest seed rate this may be be more light penetration through plant canopy. Similar to this result, Baloch *et al*. (2002) reported that the increased plant spacing considerable to increase in number of grain per panicle.

1000 Grain weight

The result shows that 1000 grain weight of bread wheat varieties were significant difference (P<0.05). From the result the higher 1000g weight was recorded Ogolcha (50. 33g) followed by Kakaba and Paven76 with the mean of 48g and47.65g respectively where as minimum grain weight was recorded from local and Digalu varieties which is 25g and 33g respectively

(Table 1). Non significant result was recorded at Ogolcha, Kakaba and Paven 76 this is may be all those improved varieties were appropriate and recommended to arid and sub arid agroecology as the same to Digalu was not significant to the local variety this is due to agroecology or environmental effect. The result was not agree with work of (Obsa and Yeared, 2017) reported that bread wheat yield 1000g weight was not significant difference among variety. Jemal *et al*, (2015) has reported 1000 grain weight was a significant variation among bread wheat varieties. Baloch *et al*. (2002) reported that the increased plant spacing increase thousand grain weights in rice crop.

Grain Yield

Statistical analysis shows that significant variegation was observed among the varieties of bread wheat $P<0.05$. Maximum grain yield was recorded at an improved bread wheat of Ogolcha and Kakaba which is 2746 Kg/ha and 2687.67Kg/ha followed by Paven 76 and Digalu variety where as the lowest grain yield was recorded at the local variety which is 2000.33kg/ha. The yield of improved bread wheat varieties were varied is may be genotypic deference and tolerance of moisture stress where as the local variety lower yield this due to loss of high yielding gen. the result was agree with work of Asaye *et al*. (2013) who has reported that highly significant difference for grain yield among bread wheat varieties under grandmother trial. (Obsa and Yeared, 2017) reported that bread wheat yield was significantly varied from variety to variety. Jemal *et al*. (2015) has reported that Shorima variety was the higher grain yield followed by Kakaba and Danda' varieties were the higher seed per kernel where as the lowest grain yield was recorded Digalu variety.

Conclusion

PRG group was evaluated the improved bread wheat varieties based on the following criteria tiller number, grain per spike, spike length and grain yield as the main criteria. As PRG was evaluated both Ogolcha and Kakaba bread wheat varieties were among the best performing improved variety followed by Paven76 and Digalu respectively. As compare to the improved wheat variety local bread wheat was not performing well and recorded lower yield. Therefore, among the improved bread wheat varieties currently the PRG was selected Ogolcha bread wheat variety based on its Seed size, grain weight, Plant color and yield performance and recommended the same agro ecology.

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Conflict of Interest

This participatory experiment is our work and conducted on the approval of PCDP project at Oromia level and we are got recognition from Bale zone PCDP Coordination office.

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