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Participatory Variety Selection of Improved Bread Wheat Varieties for High Land Guji Zone, Southern Ethiopia

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Abstract
So far many improved bread wheat varieties have been tested for their adaptability and recommended for high land agro-ecologies of Guji Zone. However, all of these varieties were not evaluated by participating the intended users during the adaptability study. As a result, the recommended varieties were not get acceptance by the farmers as such in most cases. Because, the varieties were not selected according to the user's desires. Therefore, study was conducted in 2015 cropping season at two high land districts of Guji Zone(Bore and Ana Sora) to select and recommend high yielding, early maturing and diseases resistant improved bread wheat varieties through Participatory variety selection. Five improved bread wheat varieties with one local check were used as treatments. The treatments were arranged in randomized completed block design with three replications for mother trial and farmers were used as replication for baby trials. The analysed result of agronomic data indicates presence of significant variance among the tested varieties for most of the characters studied except days to heading and TSW. Varieties Senate, mandayo and Hidasie were highest yielding and relatively resistant to diseases than the local check. Farmers were also involved in selecting the varieties using their own criteria. Accordingly, two varieties(Senate and Hoggana) were selected by farmers. From the two ways studies, it's observed that there is combat result. Therefore, to conclude the result of the study, it's requisite to consider and accept the farmers decision instead of considering the trial finding. Thus, based on both ways finding varieties senate and Hoggana were recommended for the studied areas and similar agro-ecologies of Guji Zone.
Keywords: Participatory variety selection, Bread wheat, improved varieties

Introduction

The attainment of food security with its sustainability can be addressed through the use of environmentally and economically sounded improved agricultural technologies. Because, today population growth and climate change are the two great challenging factors of our globe. Particularly, the population growth phenomenon in developing countries, diversity of foods, and their high consumption in the advanced countries have led to an increase in the global demand for food to an unprecedented level in the history (Khabiri *et.al.*, 2012). With this regard, the use of more productive, profitable agricultural production in fostering food security, generating local employment, raising local incomes, and thus alleviating poverty particularly in developing world, where it serve as an economic source is incomparable (Reeves *et al.,*1999). In view of this, increasing cereal crops productivity plays a great role as they are an important source of human nutrition since pre-historic times, dating back to 8000 B.C (Curtis,2002). Cereals account for approximately two-thirds of all human energy intake and are grown on roughly half of the world's crop land USAID (2013). Today, eight cereal crops viz., wheat, rice, maize, barley, oat, rye sorghum and millets collectively accounts 99% of the world cereal production (FAO, 2011).This also true for Ethiopia where the major cereal crops; tef, maize, wheat, sorghum and barley have the largest share of cultivated land and production(CSA,2013). In 2012/2013 cropping season, out of the total grain crop area, 79.34% (9.59 million hectares) was under cereals. In terms of production, cereals contributed 86.06% which is about 188.10 million quintals of the grain production. This may be due to the significant importance of these crops in sustaining food security. Because, the lively hoods of the Ethiopian people is directly or indirectly dependant on these crops. Among cereals, wheat accounts 15.5% (29.16 million quintals) grain (CSA, 2012). The productivity of the crop remains low (1.8 ton ha^{-1}) in the country as compared the world average yield (3.19 ton/ha) (FAO, 2011).

In Ethiopia, efforts have been made to develop and popularize various improved crop varieties across different locations through PVS (Getachew *et al*., 2008, Asaye *et al.,* 2013; Tesfaye Tadesse, 2013, Tafere *et al*., 2012. However, the farmers' selection criteria for these crops were not adequately assessed and well documented from all parts of the country especially in the Guji Zone of Oromia region. For the last 3-4 years, adaptation trial of various improved bread wheat varieties have been conducted at Bore Agricultural Research Center. From the conducted activities, several technologies were promoted to the users after testing their adaptation at multi-location both on station and farmers field. Feed backs on the prominence and draw backs of the promoted technologies are raised from the farmers that didn't address their preference which could serve as a basic tool for research. From these out puts, it was observed that gap was made while conducting these activities. Because, in previously conducted research activities, farmers of the area were not majorly participated in selecting and recommending technologies for their specific area through providing their indigenous knowledge. In that time, technologies are taken to demonstration after evaluated by researchers alone. As a result, it's

observed that some recommended technologies didn't get acceptance by farmers from various point of view. This shows the gaps made by not participating farmers in selecting and recommending varieties, that means it's a conventional research method that limit farmers interaction in research at certain stages. Rigid release requirements and unrepresentative testing conditions lead to mismatches between what is offered by breeders and what is desired by farmers (Witcombe and Virk 1997). Thus, to solve such problems, it's obvious that farmer's participation has a significant place in selecting and promoting improved agricultural technologies. Participatory varietal selection in agriculture of developing-country is the existence of important cropping systems in marginal regions of the countries where the adoption of modern improved varieties is low or negligible(Walker,2006). So, participating farmers in research especially, in convectional research is the pre-eminent method to meticulously work with farmers through integrating their indigenous knowledge in variety selection. Therefore, this activity was conducted to address the following objectives.

General objective

- To improve production and productivity of the study area through selecting and promoting improved bread wheat varieties

Specific problems

- To evaluate and recommend high yielding, early maturing and diseases resistant improved bread wheat varieties through PVS
- To assess farmers' selection criteria for improved bread wheat varieties and
- To identify the most important criteria for future bread wheat improvement work in the area.

Materials and Methods

Description of the study area

The experiment was conducted at two high land districts of Guji Zone(Bore and Anna Sora) to select and recommend high yielding, early maturing and diseases resistant improved bread wheat varieties through PVS. The climatic condition of both districts comprises an annual rain fall of 1250mm and 1750mm/annual, mean temperature of 15-24 and 17.5-28 ^{o}c respectively. The two districts are selected for this experiment based on their potentiality for the production of bread wheat. Five improved bread wheat varieties with one local check were used as treatments.

The treatments were arranged in randomized completed block design with three replications for mother trial(planted on station) and farmers were used as replication for baby trials. For this purpose, one farmer field was used as replication for baby trials in which selected farmers plant materials in one replication and the other host farmers were planted the two non-replicated trials. At both trial site, the materials were planted on a plot size of 6 rows, 2.5mX1.2m with 20 cm between rows. In puts (seeds, fertilizers) and management practices were applied as recommended for wheat production. Data was collected in two ways: agronomic data & farmers data. For agronomic data phenological, Growth, yield and it's component were collected following their own principles.

Data collected from mother trials was subjected to ''SAS' 'software (version 9.0) to evaluate the variability of the tested varieties. This was done through computing analysis of variance for all characters studied according to the method given by Gomez and Gomez (1984). For data's collected from baby trials, matrix ranking suggested by De Boef *et al*.,(2007) was employed.

Result & Discussion

The analysed result of agronomic data indicates presence of significant variance among the tested varieties for most of the characters studied except days to heading and TSW. As the study result indicated, Early maturity was revealed by variety Hoggana(144.33days) and local check(145.67days) whereas late maturity was depicted by Senate(159 days). This also directly related with grain filling period which shortly showed by variety Hoggana and Longley by Senate.

Plant height: Among the tested varieties, Senate showed the longest height(92.63) where as variety Hidassie exerted the shortest height(76.57). Demelash *et al*.,(2013) was also reported significance difference among the tested varieties for plant height. Considering this character for variety evaluation is very crucial as it help for selecting varieties able to withstand lodging problems.

Peduncle length*:* Significance differences was obtained among varieties for the character peduncle length. The longest peduncle length was revealed by variety senate(43.87),Hidassie(44.6) and local check(43.73). However, variety Mandayo exerts shortest peduncle length(36.6) followed by ETBW6095(38.73).

Spike length: From the study result, significant difference was observed among the tested varieties for spike length which was ranged from 5.9 to 8.27. Accordingly, variety ETBW6095 followed by Senate showed maximum spike length whereas variety Mandayo followed by local check showed minimum spike length.

Tillers per plant*:* As the study result indicates, significant difference was observed among the tested variety for number of tillers per plant with the mean value of 5.51 tillers/plant. the highest tiller/plant was revealed by senate where as the lowest was showed by variety Mandayo(**Table 1**)

Grain yield(GY): significant variability was observed among the tested varieties for grain yield qt/ha, which was ranged from 18 to 59.07 qt/ha with the mean value of 33.8 qt/ha and coefficient of variation 11.25%. The highest grain yield (59.07) was recorded for Senate followed by Mandayo (38.67qt/ha). But, low yield of 18qt/ha was obtained from local check followed by hoggana (26.67qt/ha) (table1) . highly significant difference for grain yield among bread wheat varieties under grandmother trial was also reported by Asaye et al.,(2013).

Table 1.Mean separation of different agronomic characters for six BWV evaluated in mother trial(Bore on station)

Treatments	DTH	DTM	GFP	PHT	PL	SL	TPP	NPTPM	SPPS	KPS	TSW(gm)	GY(qt/ha	Diseases data		
													YR	LR	SR
Senate	72.00^{a}	159.00^{a}	77.67^{a}	92.63^{a}	43.87^{a}	8.23^{a}	6.53^{a}	290.00^{a}	19.47^{a}	65.33^{a}	46.67^{a}	59.07^{a}	0	0	0
Hoggana	71.33^{a}	144.33^{d}	64.00^{c}	83.6^{bc}	38.73^{bc}	7.50^{ab}	5.2^{b}	244.67^{b}	14.97^{b}	48.0^{c}	40.00^{a}	26.67^{cd}	30s	0	5ms
Local	72.33^{a}	145.67^{d}	68.33^{b}	81.67^{bc}	44.60^{a}	5.90^{cd}	5.6^{ab}	250.00^{b}	14.90^{b}	40.67^{d}	40.00^{a}	18.00^{d}	60s	30s	80s
ETBW6095	72.33^{a}	150.67^{b}	70.33^{b}	83.6^{bc}	42.60^{ab}	8.27^{a}	5.2^{b}	218.67^{c}	15.60^{b}	53.33^{b}	40.00^{a}	28.27^{bcd}	30s	0	30s
Hidasie	71.67^{a}	148.67^{c}	68.67^{b}	76.57^{c}	43.73^{a}	6.93^{bc}	5.4^{ab}	216.00^{c}	14.60^{b}	53.0^{b}	40.00^{a}	32.13^{bc}	t	30ms	20mr
Mandayo	71.33^{a}	151.33^{b}	70.33^{b}	84.27^{b}	36.60^{c}	5.87^{d}	4.9^{b}	246.00^{b}	13.80^{b}	63.67^{a}	40.00^{a}	38.67^{b}	0	t	t
Mean	71.83	149.94	69.89	83.72	41.69	7.11	5.51	244.22	15.56	54.00	41.11	33.80			
CV	0.92	0.67	3.12	4.76	6.22	8.15	11.08	4.79	10.53	3.59	11.47	18.30			
LSD (5%)	1.19	1.84	3.97	7.25	4.71	1.05	1.11	21.28	2.98	3.53	8.58	11.25			

Keys: DHT: Days to heading, DTM: Days to maturity, GFP: grain filling period, PHT: plant height, PL: peduncle length, SL: spike length, TPP: tillers per plant, NPTPM: Number of productive tillers, SPPS: Number of spiklets per spike, KPS: kernels per spike, TSW: thousand seed weight, Gy: grain yield

Farmers variety selection criteria's

Farmers were allowed to evaluate the varieties using their own criteria. before selecting varieties, they were informed to set criteria for selecting best bread wheat according to their area. This was done by making group discussion among the farmers which comprises elders, women and men. After setting the criteria they were informed to prioritize the criteria according to their interest. By doing this, farmers were allowed to select varieties by giving their own value. The following table(2) indicated the results obtained from farmers' evaluation. Accordingly, variety Senate and Hoggana were selected by farmers due to their best performance for their own criteria.

Table 2. Farmers' preference scores and ranking on baby trial

Varieties	Farmers selection criteria												
	DR	SC	YLD	PH	THR	SST	MT	SL	TC	KPS	SS	total score	Rank
Senate	5.0	5	4.8	5	5	5.0	4.2	4.8	4.4	5.0	5.0	53.2	**1**
Hoggana	4.8	5	4	4.6	5	4.3	4.6	3.8	3.6	4.5	5.0	49.2	**2**
Local	1.0	3.4	2.4	4.8	5	1.3	3.4	2.6	4.2	1.0	1.0	30.1	**6**
ETBW6095	2.8	4.4	3.2	3.8	4.6	3.7	4.6	4.0	3.2	3.5	4.0	41.8	**5**
Hidasie	3.0	4.4	3.6	4.8	5	4.3	4.0	4.4	3.0	4.0	4.5	45.0	**3**
Mandayo	4.0	4.4	3.2	3.2	5	4.7	4.2	3.8	3.6	3.5	4.5	44.1	**4**

DR=Diseases resistant, SC=Seed colour, YLD=yield, PH=plant height, THR=thresiability, SST=strength of stem, MT=maturity, SL=Spike length, TC=tillering capacity, KPS=kernel per spike, SS=seed size

Conclusion

In areas where improved technologies are not widely addressed like Guji Zone of Southern Oromia, it's paramount to take immediate action towards setting appropriate research methods. In such case, Participatory variety selection is an effective tool in facilitating the adoption and extension of the improved technologies. Because, the users are allowed to participate in selecting appropriate technologies by employing their own indigenous knowledge. As the result, the current study was also verified that farmers were able to participate in selecting improved bread wheat varieties through employing their own selection criteria. Thereby, two improved bread wheat varieties i'e Senate and Hoggana were selected by the farmers and recommended for the study areas and similar agro-ecologies.

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