



Evaluation of Wheat Yield Performance Among Smallholder Farmers: Evidences from Large Scale Demonstration Approach in West Shewa Zone, Oromia Region, Ethiopia

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Abstract

Ethiopia is one of the largest wheat-producing countries in sub-Saharan Africa. Wheat is cultivated on a total area of 1.7 million hectares annually, with a total production estimated at between 5 and 6 million tons. The research was conducted during 2022 cropping seasons in West Shewa Zone five purposively selected potential districts with the objective of popularizing and pre-scale up the improved wheat varieties and to evaluate yield performance in order to increase production and productivity for further disseminating the already evaluated and selected varieties to the farmers. The selection of Districts, kebeles and host farmers were done together with districts Agriculture Office and the extension team. Three potentials kebeles from the districts and participant farmers were selected based on their interest and availability of adjacent farm plots with a minimum 0.25 ha per head. Thus, 29 clusters were formed, 315 farmers directly participated in these pre-scaling up, and 168 ha of land was covered by selected crop. The study result indicate that the average yield obtained from the demonstrated cluster, from Dandaa variety 3.5 tons/ha, wane variety 3.41 t/ha and Kingbird 3.4 tons/ha yield was recorded respectively. The yield advantage using CSA data in the Zone, which is 3.42 tons/ha. The mean yield recorded (3.43 tons/ha) from all clustered varieties higher than the national average (3.11 tons/ha). This is due to the use full package application, better field management techniques, may be the source of yield performance variability within the study cluster. Therefore, from the researchers and farmers evaluation Wane, Dandaa and Kingbird varieties respectively were recommended for the study areas and similar agro-ecologies for further demonstration and dissemination.

Keywords: Yield performance, adjacent farm plots, demonstrations, Soil fertility.

1. Introduction

1.1 Background of the study

Ethiopia is one of the largest wheat-producing countries in sub-Saharan Africa. Wheat is cultivated on a total area of 1.7 million hectares annually, with a total production estimated at between 5 and 6 million tons. According to (Tadesse et al., (2019), wheat is the fourth most important cereal crop in the nation and is primarily grown at altitudes between 1500 and 3200 meters above sea level. Wheat is one of the most widely adapted crops grown at different altitude ranges. It plays a fundamental role in food security, and a major challenge is to meet the additional requirements with new cultivars and improved cropping technologies. Wheat is a primary source of calories and protein for 4.5 billion people in more than 100 countries (Sanjaya, R., (2015).

Wheat is grown on over 240 million hectares worldwide, this shows area coverage of wheat is more than any other crops, and over 80 percent of this land is located in the developing world. Therefore, improving yields of this crop is very important since the diets of human beings on every continent rely on this staple crop (FAO. (2018). According to the reports now a day wheat production has shown increasing rate due to increase in area coverage but, productivity in a unit area of land is not as expected.

To this end, the average production of wheat has been increasing by 1.16 percent in the world. According to the author reports (Bekele Hundie Kotu et al., (2000) even if the area coverage of wheat in Ethiopia is higher, the mean national yield is (2.1ton/ha) 19 percent and 49 percent below the mean yield for Africa and the World respectively. This relatively low mean national yield may be partially attributed to the low level of adoption of improved wheat production technologies.

Though there are high degrees of environmental variations within and between regions, based on moisture availability, cropping systems and temperature regimes, the wheat production in Ethiopia can be divided into two major production systems: (i) Rainfed and (ii) Irrigated production systems. The main wheat-producing districts in the nation are found in the national regional states of Oromia, Amhara and Tigray. The largest of all is accounted for by Oromia. According to the (CSA, (2021) report, 53% of the nation's wheat-growing land was allotted to the Oromia region for the 2022 crop season.

The trend in wheat output has never showed a rise throughout the first seven years, with the exception of the last three years of the previous 10 years, when both slight rise in area coverage and grain yield had been observed (Abiro Tigabie et al., (2018). Later years saw a rise in production, which could be attributed to better and more suited cultivars, enhanced production methods, more local demand, and better market prices.

Therefore, the Ambo Agricultural Research Center address those problems and popularized through large scale demonstration approach, the high yielding, early maturing, and disease-tolerant bread wheat types "Dandea," "Kingbird," and "Wane" varieties through pre-scaling up activities along with additional with the suggested production packages, were demonstrated and assessed in the Ambo, Toke kutaye, Dendi, Gindeberete and Abuna Gindeberete districts of the West Shewa Zone. In order to speed up the dissemination of seeds and fortify their ties to extension organizations, the effort aimed to expand farmers' knowledge and their access to better seeds. Therefore, this activity was implemented to evaluate the yield performance of improved wheat varieties, to promote the high yielder varieties and create awareness about the technology in West Shewa Zone potential districts.

2. Research Methodology

2.1 Description of the study areas

The research was conducted in West Shewa zone Potential districts in 2022 cropping seasons. West Shewa Zone were purposively selected based on agro-ecological zone as the target population for this cluster farming. From the Zone potential areas, five districts were purposively selected including Ambo, Dendi, Toke kutaye, Gindeberet and Abuna Gindeberet Districts (Ambo, Dendi, Abuna Gindeberete, Gindeberete Toke kutaye and West Shewa Zone office ARD, 2022)

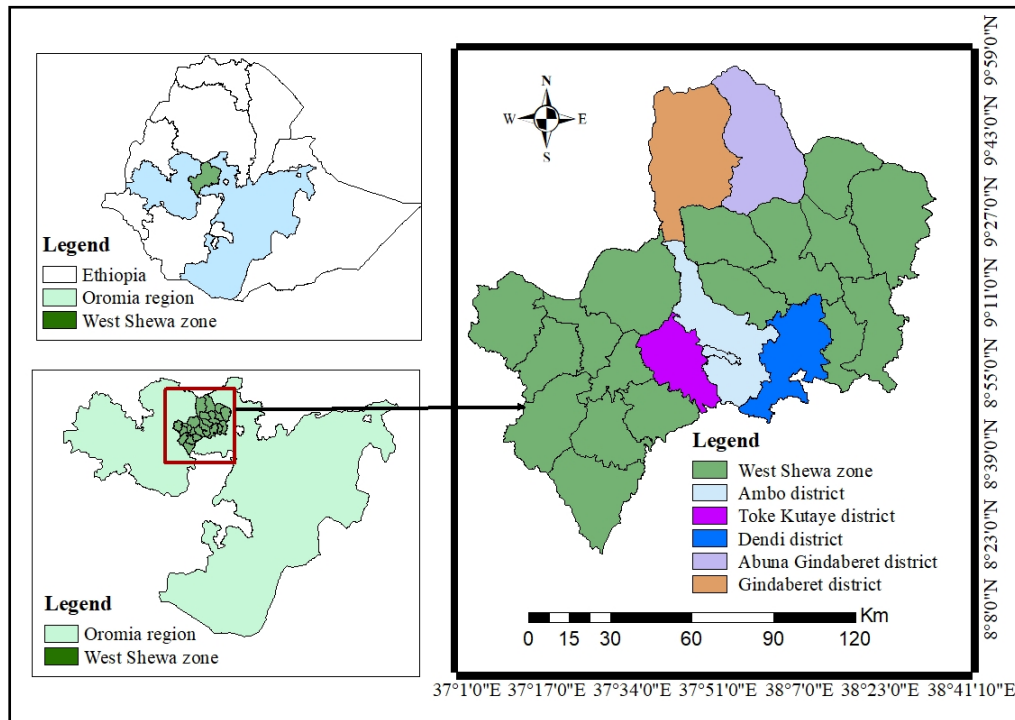


Fig. 1: Map of the study areas

2.2 Site and Farmers selection

From West Shewa Zone, districts were selected purposively based on their potential for demonstration of the crop production and accessibility for supervision. The selection of Districts, kebeles and host farmers were done together with districts Agriculture Office and the extension team. Potential Kebeles were selected in order to conduct the large-scale demonstration activity. three potential Kebeles from the districts and participant farmers were selected based on their interest and availability of adjacent farm plots with a minimum 0.25 ha per head. According to the Ambo Agricultural extension research team reports thus, 29 clusters were formed, 315 farmers directly participated in these demonstrations, and 168 ha of land was covered by selected crop.

2.3 Materials Used in the LSD

In the selected Districts three recently released wheat variety (Denda'a, Kingbird and Wane), those preferred and selected by farmers during PED were used with their full recommended practices. In organic fertilizer NPS and UREA were used with their recommendation rate of 100kg/ha. Planting was done at a seed rate of 125-150 kg ha⁻¹. Fertilizer was applied at a rate of 100/100 kg ha⁻¹ NPS and UREA, respectively. Plowing, weeding, and other management practices were applied based on the research recommendation.

2.4 Capacity development

Training about improved wheat production and management was provided before the actual implementation of the activity in the selected districts and kebeles, practical orientation was given for farmers, Development agents (DAs) and woreda experts on the integrated crop management techniques, crop protection, and acidic soil management, of those selected commodities in collaboration with relevant stakeholders like BoA.

2.5 Method of Data Collection and Analysis

Data such as total amounts of inputs distributed for participant farmers, total number of farmers participated in the training and field day by gender, other stakeholders in technology dissemination, yield data and farmers perception were collected using checklists through interview and discussions. The collected data were entered in to SPSS and analyzed using simple descriptive statistics and narrating the qualitative explanation of the farmers.

3. Result and Discussion

3.1 Capacity Building and Knowledge Sharing

A comprehensive orientation was provided prior to the start of the cluster-based pre-scaling up activities. To raise awareness about enhanced wheat technologies among farmers and equip them and others with knowledge and skills about wheat and management packages, the major strategies in this respect were training on knowledge, skill, and attitude. In order to do this, Ambo Agriculture Research Center has formed a multidisciplinary team to provide training and to support wheat technology extension initiatives. The members of the team included agronomists, pathologists, breeders, socio-economists, and others.

From the selected districts, 421 stakeholders participated in both theoretical and practical training on wheat production and management packages. In particular, the trainings covered improved wheat production technologies that are currently available (varieties, agronomic recommendations and packages, etc.); input utilization; weeds and diseases and how to control them.

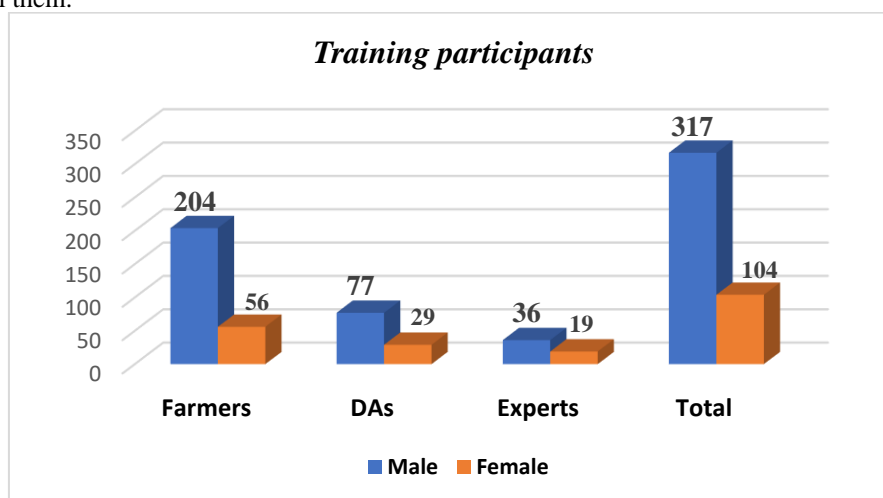


Fig 1: Number of participants on training

3.2 Cluster formation and participant farmers

This Wheat technology popularization cluster was arranged in 29 clusters and established in the Ambo, Dendi, Toke kutaye, Gindeberete and Abuna Gindeberet Districts of the West Shewa zone three producing kebeles was selected from each district to undertake the demonstration activity. Totally 315 farmers were participated in this activity based on their interest and availability of adjacent farm plots. Accordingly, 29 demonstration clusters were established on 168 ha of land in selected districts. Wheat varieties, Dendea, Kingbird and Wane was used for pre- scaling up in all selected districts (Table 1).

Table 1: Number of clusters formed and participants' farmers

No.	Districts	Land size of cluster(ha)	Host farmers	
			Male	Female
1	Toke kutaye	168	229	86
2	Ambo			
3	Dendi			
4	Gindeberet			
5	Abuna Gindeberet			
	Total			

Source: Extension research report, 2022

3.3 Input distribution

According to reports from Agricultural extension research team of Ambo Agricultural research Center, for implementation of the activity the amount of agricultural input is well distributed based on the area coverage (Table 2) for all selected districts. Improved wheat seed and fertilizers (NPS and urea) provided for host farmers based on the amount of crop land included in each district.

Table 2: The distribution of agricultural inputs

No.	Districts	Area coverage (ha)	Host farmers		Amount of Input distributed				
			M	F	Seed (Qt)	NPS (Qt)	UREA (Qt)	Chemical (Lt)	Lime (Qt)
1	All selected districts	168	229	86	239.2	143	145.5	-	896
	Total	168	229	86	239.2	143	145.5		896

Source: Extension research report, 2022

3.4 Yield performance and Farmers preferences

Yield performance of Varieties

The yield data of the popularized three wheat varieties were to evaluate the performance of the varieties under management of farmers with close supervision of researchers, DAs and agricultural experts. The yields obtained across the location for the distributed varieties were varied from location to location. Based on wheat productivity potential and CSA data, an overview of the LSD activity yield performance is provided. Table 3, shows that the average yield obtained from the demonstrated cluster Dandaa variety was 3.5 tons/ha, wane variety was 3.41 t/ha and Kingbird 3.4 tons/ha was recorded respectively. The yield advantage using CSA data in the Zone, which is 3.42 tons/ha (CSA, (2021). The mean yield recorded (3.43 tons/ha) from all clustered varieties higher than the national average (3.11 tons/ha) (CSA, (2021). This is due to the use full package application, better field management techniques, may be the source of yield performance variability within the study cluster. Generally, the yield obtained from those varieties of different commodities performed better than the local variety of each crop in all study area.

Table 3. Yield performance Wheat varieties at clustered districts

District	Variety	Area (ha)	Potential yield (tons/ha)	Demonstration yield (tons/ha)	Farmers Yield (tons/ha)	% Yield increases over farmers practices
All clustered Districts	Danda'a	68	50-60	3.50	2.15	62.8
	Kingbird	45	40-50	3.40	2.12	60.4

	Wane	55	47-63	3.41	2.45	39.2
		Mean		3.43	2.24	54.13
Total		168				
% age yield increases	=	Demonstration yield(tons/ha) – farmers practices(yield) (tons/ha) x 100				
		Farmers practices(yield) (tons/ha)				

3.5 Field Day

Field day was among the means used to share experience among stakeholders. Accordingly, field day was organized in all districts in order to share experience among agricultural stakeholders. During field day a total of 856 stakeholders out of whom 660 were male and 196 were female attended.

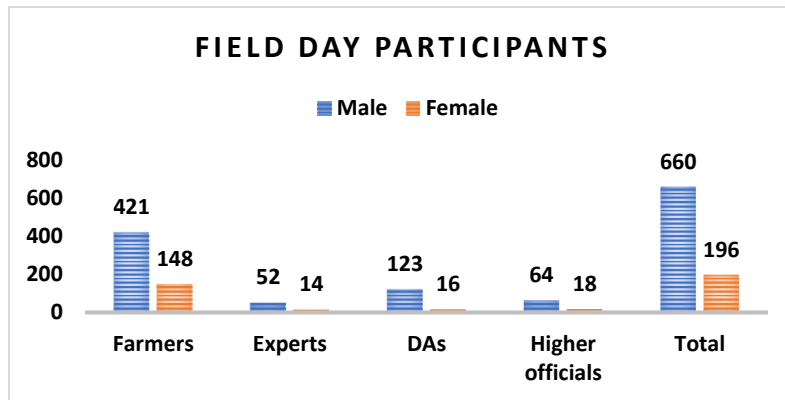


Fig.2: Field Day participants

4. CONCLUSION AND RECOMMENDATIONS

Using a cluster strategy, the initiative aimed to promote and popularize three bread wheat varieties called Danda'a, kingbird and Wane that had already been assessed, proven, and favored by farmers. This Wheat technology popularization cluster was arranged in 29 clusters on 168 ha of land in the Ambo, Dendi, Toke kutaye, Gindeberete and Abuna Gindeberet Districts of the West Shewa zone. From each district three wheat potential kebeles was selected to undertake the demonstration activity. Totally 315 farmers were participated in this activity based on their interest and availability of adjacent farm plots. The yield performance result indicates that an average yield obtained from the demonstrated cluster Dandaa variety was 3.5 tons/ha, wane variety was 3.41 t/ha and Kingbird 3.4 tons/ha was recorded respectively. The yield advantage using CSA data in the Zone, which is 3.42 tons/ha. The mean yield recorded (3.43 tons/ha) from all clustered varieties higher than the national average (3.11 tons/ha). This is due to the use full package application, better field management techniques, may be the source of yield performance variability within the study cluster. Generally, the yield obtained from those varieties of different commodities performed better than the local variety of each crop in all study area.

According to the results, the varieties produced a higher yield than both farmer practices in all selected districts. Furthermore, the training sessions, field trips, and study days gave many stakeholders a chance to learn more about the varieties and wheat production in the study areas as a whole. In general, it was discovered that the varieties played a significant role in raising the income and productivity of the involved farmers. Thus, it is advised that larger scaling up efforts be carried out going forward with stakeholder participation.

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