P-ISSN: 2618-0723
E-ISSN: 2618-0731

Extension Journal

Impact Factor: RJIF 5.16
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 5; Issue 1; Jan-Jun 2022; Page No. 141-143

Received: 04-02-2022
Accepted: 24-03-2022

Indexed Journal
Peer Reviewed Journal

Cluster-based pre-scaling of improved wheat technologies in western Oromia: A case study in western Oromia, Ethiopia

[1]Geleta Gerema and [1]Kifle Degefa

[1] Bako Agricultural Research Center, P.O. Box 03, Bako, West Shewa, Ethiopia

Abstract
Wheat is widely grown in Ethiopia although production levels have not met the demand and price instability. One of the production gaps is that modern varieties cover a small portion of the total area occupied by wheat. Through the use of superior wheat technologies and pre-scaling up, the project aimed to boost wheat production and productivity for small-scale farmers. Two wheat varieties, Liban and Senate, were pre-scaled up in three zones of western Oromia. 147 farmers were addressed in ten PA and six districts. The total area addressed for wheat pre-scaling up was approximately 81 hectares. Yield and disease data were collected, as well as farmers' perceptions and interests. Thus, with an average mean of 4.5 tonsha^{-1} and 4.9 tonsha^{-1}, respectively, both types, Liban and Senate, performed better in terms of yield. However, compared to Senate variety, Liban variety demonstrated a lower response to numerous diseases. In order to sustainably increase wheat yield, scaling out of Liban varieties for the larger community across sites needs to be strengthened.

Keywords: Cluster, farmers, pre-scaling up, training, wheat

1. Introduction

Wheat is the most widely grown crop in the world, with an annual production of 779.33 million metric tons on 222.15 million hectares (USDA, 2022) [8], being grown in a wide range of environments. It ranks second in global cereal production and provides a stable food source for roughly one-third of the world's population. China, India, the United States, the Russian Federation, France, Australia, Germany, Ukraine, and Canada are among the world's largest wheat producers (FAO, 2021) [9]. Ethiopia is the third-largest wheat producer in Africa, after Egypt and Morocco, with 1.8 million hectares of land and 5.3 million tons of production volume (CSA, 2021) [2, 4]. However, the best areas for wheat production in Ethiopia are between 1900 and 2700 M.A.S.L. in the highlands, where rainfall distribution ranges between 600 and 2000 mm. It is one of the country's major staple crops and ranks second in terms of production after maize, accounting for 16.91% of total cereal grain production in Ethiopia (CSA, 2021) [2, 4]. In terms of caloric intake, it is the country's second most important food after maize (FAO, 2014) [7]. Still, crop productivity in Ethiopia, particularly in western Oromia, is low (2.9 t ha-1) (CSA, 2021) [2, 4], compared to the global average yield (3.51tonsha^{-1}) (USDA, 2022) [8]. There are several factors influencing wheat productivity in Ethiopia, including biotic and abiotic stress, a lack of access to improved wheat varieties, ineffective crop management technologies, both farmers and development agents being unaware of newly released technologies and their production systems, and a lack of financial resources to purchase inputs. The main methods for increasing crop productivity include the creation, testing, and spread of new, improved crop varieties as well as crop production and management systems (Asfaw *et al*., 2018) [1]. After new technologies have been tested and modified in research situations, the next stage is to do a demonstration on a small number of farmers' fields. Farmers are shown all whole technological packages in a participatory approach. Then, selected technologies are chosen for further popularization and scaling up in order to raise awareness about technologies and improve the livelihoods and food security of households in the mandated area (Asfaw *et al*., 2018) [1]. Thus, the goal of this study was to increase bread wheat production and productivity through participatory, popularization, transfer, and pre-scaling up; and to strengthen farmers' skills in wheat production technologies that led to its potential.

2. Material and Methods

Pre-scaling up activities were carried out in three zones of Western Oromia, in six districts, via Horro, Guduru, Hababo Guduru, Jima Rare, Chalia, and Gidda Ayyana. The selected districts received consistent rainfall and were known for their extensive bread wheat production. Based on their potential for wheat production, 1-3 wheat growing potential villages were chosen from each district. The total area addressed for wheat pre-scaling up was 81 hectares, of which 30, 20, 10, 10 6, and 5 hectares were in the districts of Jimma Rare, Horo, Guduru, Gida Ayena, Hababo Guduru, and Chalia, respectively. The Liban and Senate varieties covered 16 and 65 hectares of the total area coverage (81ha), respectively. Each village had its own group of participants, which included men, women, and young farmers. The two varieties (Liben and senate) were planted in clusters of at least 5 hectares on selected farmers' fields. Full wheat production and management packages were applied to the varieties. The seed rate was 150kg/ha, and the fertilizer rate was 100/100 kg/ha NPS/UREA, with nitrogen applied in two stages: half at planting and half at tillering. Following the packaging and distribution of wheat

technologies and other agricultural inputs, extension agents conducted regular field visits and supervision at various crop stages. Farmers, agricultural experts, development agents, and researchers worked together to evaluate crop milk. Diseases, yield data, and farmers' opinions, ideas, perceptions, interests, and points of view were all collected.

3. Result and Discussion

3.1. Training of farmers

Participatory training in the selected 6 districts of Western Oromia was provided by a multidisciplinary team of Agriculture researchers (Breeder, Agronomist, Economist, and Extensionists). Among the 178 participants, 147 were farmers and 30 were development agents/subject matter specialists. The training included full packages of wheat production technologies such as site selection and preparation, fertilizer application rate and methods, seed rate and method of planting, spacing and depth, weed, disease, and insect control, and building strong links among relevant stakeholders through a multistakeholder approach to mitigate problems in joint action taking immediate, short, and long-term measures.

3.2. Field day

After the varieties reached physiological maturity, a field day was planned with participation from district-level farmers, agricultural development offices at the zone and district levels, and other relevant stakeholders with the goal of learning about the importance of using improved wheat varieties and their management, agronomic, and other techniques. The field day drew a total of 150 participants (80 farmers, 15 development agents and experts, 50 researchers including higher officials of the Oromia Agriculture Research Institute (IQQO), and 10 administrators (from each district and zone). Participants discussed the condition of improved varieties with trial farmers, sharing their experiences and identifying criteria such as grain yield, early maturity, and resistance to diseases and pests. Based on the criteria, the Liban variety was chosen for further expansion in the districts.

3.3. Total production and productivity per unit area

In the 2019/2020 cropping year, improved bread wheat varieties (Liban and Senate) were pre-scaled up in six districts of Western Oromia zones. The wheat varieties were subjected to all of the recommended wheat production and management practices. The study found that the average yield from the Liban variety was 3.8 ton ha-1, 4.6 ton ha-1, and 5.1 ton ha-1 at Chaliya, Hababo Guduru, and Horro, with an overall mean grain yield of 4.5 ton ha-1 (Table 1). The Senate variety outperformed the tested locations in terms of grain yield. Senate yielded 5.8 tons per acre, followed by Horro (4.8 tons per acre) and Guduru (4.3 tons per acre), for an overall grain yield of 4.9 tons per acre. Despite this, the trial/participating farmers' wheat production and productivity increased in the study area when compared to local varieties due to its early maturity and high yielder. The average pre-scaled up yield of Liban and Senate varieties was nearly 1.5 times higher than the average zonal productivity of local wheat varieties, which was 2.2 tonha-1.

Table 1: Grain yield of improved bread wheat varieties pre-scaled up at western Oromia

Zones	District	PA's	Variety	No of farmers addressed	Area coverage(ha)	Grain ha^{-1}
Horro Guduru Wallaga	Horro	Doyyo-Bariso	Liban	12	10	5.1
		Kombolcha	Senate	13	10	4.5
	Jimma rare	Tarkanafata	Liban	14	10	5.6
		Karra Konte	Senate	15	10	6.0
		Jawissa		13	10	5.8
	Hababo Guduru		Liban	9	6	5.0
	Guduru		Senate	14	10	4.3
East Wallaga	G.Ayyana	Gaba Jimata	Senate	6	5	4.8
		Gute Gudina	Senate	6	5	4.0
West Shawa	Chaliya	Chobi Tulu Chori	Liban	11	5	3.8

3.4. Reaction to the Major Wheat Diseases and Quality Traits

Diseases are the other parameters used in the evaluation of varieties in the pre-scaling up of bread wheat. According to the evaluation, the Liban variety performed better against major wheat diseases such as stem and yellow rust, Septoria tritici, and Fusarium head blight (Table 2). Senate produced higher yields but performed poorly against certain diseases such as yellow rust and Fusarium head blight (Table 2).

Table 2: The varieties reaction against major wheat diseases

Zones	District	Variety	Steam Rust	Yellow Rust	Septoria Tritici	Fusarium Head Blight
Horro Guduru Wallaga	Horro	Liban	MR	-MR	32	2%
		Senate	10R	S	32	25%
	Jimma Rare	Senate	5MS	5MR-15MS	32	20%
	H.Guduru	Liban	10R	5MS	22	15%
	Guduru	Senate	10R	10MS	22	30%
East Wallaga	G.Ayyana	Senate	-	10mr	32	30%

4. Conclusion and Recommendations

Pre-scaling of improved bread wheat varieties was carried out in six districts of western Oromia's highlands to increase wheat production and productivity through pre-scaling and to strengthen farmers' knowledge of wheat production technologies. The pre-scaling up results confirmed that improved wheat varieties with full technology packages provided better quality and quantity benefits. Farmers and other agricultural development professionals who have popularized the technologies under consideration are in high demand. According to the findings, the improved Liban wheat cultivar with its full package should be expanded to other similar agro ecologies. Similarly, in order to meet emerging technology demands, seed producer and marketing cooperatives should be established and actively involved in order to make the Liban seed multiplication and exchange system viable.

5. Reference

1. Asfaw A, Simane B, Bantider A, Hassen A. Determinants in the adoption of climate change adaptation strategies: evidence from rainfed-dependent smallholder farmers in north-central Ethiopia (Woleka sub-basin). Environment, Development and Sustainability. 2019 Oct;21(5):2535-65
2. CSA. (Central Statistical Authority). Report on Area and Production of Meher Season Crops for Private Peasant Holdings. Ethiopian Agricultural Sample Survey (2020/21) – Volume 3. Statistical Bulletin 590. Addis Ababa: Central Statistical Agency; c2021. p. 3.
3. CSA. (Central Statistical Authority). Report on Area and Production of Meher Season Crops for Private Peasant Holdings. Ethiopian Agricultural Sample Survey (2019/20). Statistical Bulletin 590. Addis Ababa: Central Statistical Agency; c2020. p. 5.
4. CSA. (Central Statistical Authority). Agricultural sample survey 2017/18. Report on area and production of major crops for private peasant holdings, main cropping season, Central statistical agency, Addis Ababa, Ethiopia; c2021.
5. FAO. Analysis of price incentives for wheat in Ethiopia. Technical notes series, FAO (Food and Agriculture Organization), (2015) Food Balance Sheets; c2014.
6. FAO. Plant Production and Protection Series. Accessed Oct 2020; c2016. at http://www.fao.org/
7. FAO. World Food and Agriculture-Statistical Yearbook. Rome; c2021. https://doi.org/10.4060/cb4477en
8. United States. Department of Agriculture. Economics, Statistics Service, United States. Foreign Agricultural Service, United States. World Food, Agricultural Outlook, and Situation Board. Global Market Analysis; c2022.