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Research Article

# Pre-Extension Demonstration of Improved Bread Wheat Technologies at Highlands of Guji Zone, Oromia, Ethiopia

**Basha Kebede*; Tekle Bobo; Dembi Korji**
Oromia Agricultural Research Institute, Bore Agricultural Research Center, Ethiopia

***Corresponding author: Basha Kebede**
Oromia Agricultural Research Institute, Bore Agricultural Research Center, P.O. Box 21, Bore, Ethiopia.
Email: bashakbd48@gmail.com

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## Abstract

Increment of human population with the depletion of natural resources is challenging agriculture-based economy of developing countries. Hence, it is mandatory to find possible solutions to feed the increasing population. Ethiopian government has a vision the motto of food self-sufficiency by wheat production. for surplus production breeders have released many bread wheat varieties for different agroecologies. Therefore, released variety must be extended to the end users. This activity was proposed to evaluate bread wheat varieties at highlands of Guji zone. Three districts were selected based their wheat production potential. Sinja, Wane and Sanate bread wheat varieties were demonstrated on 10mx10m of 21 farmers' land. Training and mini field day was organized for bread wheat promotion in selected districts. Descriptive statistics and cost-benefit analysis were used to analysis the data. The result showed that highest yield of 28.71qt/ha was harvested from Sanate followed by Wane (26.29 qt/ha) and Sinja (23 qt/ha) varieties. Production of Sanate, Wane and Sinja in highlands of Guji zone could generate 55489 birr/ha, 61263 birr/ha and 49846 birr/ha, respectively. Regardless of higher yield of Sanate experimental farmers preferred Wane variety as its color attract the market demand. Farmers witnessed the higher yield, good return and acceptance of Wane variety. Hence, Wane variety should be disseminated in highlands of Guji zone through pre scaling up and large scale production.

**Keywords:** Bread Wheat; Guji; Demonstration; Extension

## Introduction

Bread wheat (Triticum aestivum. L) is the most common cultivated wheat species-taking up to 95% of the wheat and staple food for consumers worldwide [12]. Wheat is the most important grain crop for food security and is used as a source of income for developing countries [5]. In Ethiopia, wheat is the most important cereal crop in terms of both production and use. Wheat is one of the major cereals grown for use as food and industrial raw materials in Ethiopia. Wheat grain is used to prepare different traditional food staffs, such as *injera*, bread, porridge, soup, and roasted. Besides, wheat straw is commonly used as roof thatching materials and as feed for animals [2,6]. Among 125 wheat-producing countries, Ethiopian wheat area coverage and productivity are ranked 25$^{th}$ (1.7 million hectares) and 63rd (28,126 kg/ha), respectively. Its productivity is by far lower compared to wheat-producing countries such as Ireland (101,746 kg/ha), New Zealand (98,633 kg/ha), and the Netherlands (90,936 kg/ha) [9]. Empirical studies on the assessment of wheat yield indicate that other African countries such as Egypt, South Africa, and Kenya obtained 67, 35, and 30 quintals per hectare, respectively more than Ethiopia (28qt/ ha) [4,15]. In the Guji zone wheat productivity was 32.24 qt/ha [13].

Ethiopia has huge potential and suitable agro ecology for growing wheat. In spite of the presence of wide agro ecologies wheat production is left behind by 25 to 30% of its demand because of increased demand for wheat due to population growth, urbanization, and expansion of agro-industries [11]. To feed the world's growing population, the global demand for wheat yield should increase by 50% in 2050 [3]. The demand for wheat for household consumption is achieved by popularizing and multiplying released wheat varieties on farmers' land [13]. Ethiopia is still importing about 1.6 million tons of wheat which are estimated to be 25% in deficit to fulfill domestic wheat demand by foreign currency [16]. Hence, the Ministry of Agriculture and Natural Resource plans to increase wheat productivity from 2.7 metric tons/ha in 2019 to 4 metric tons/ha by 2023 and reduce wheat import from 1.7 million metric tons in 2019 to zero by 2023 [8].




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For surplus production, the government of Ethiopia focused on wheat production both rainfed and irrigation aimed to bring household food security and income generating. However, the productivity of the crop is low mainly due to rust and a lack of improved varieties. Breeders intended to balance the wheat demand by releasing new bread wheat varieties suitable for different agro ecologies [14]. Hence, this demonstration was an entry point for promotion of released bread wheat varieties at highland areas of Guji zone. Objectives of this study were:

1. To evaluate yield performance of improved bread wheat technologies

2. To estimate profitability of the improved bread wheat technologies under farmers' conditions

3. To assess farmers' feedbacks for further development of bread wheat production at highland areas

## Materials and Methods

### Farmers and Site Selection

Three highland districts and from each district two kebeles were selected based on their wheat production potential. At each kebele there were three to four experimental farmers. Totally, there were 21 experimental farmers from the three districts.

### Materials to be Used

Two improved varieties, Sinja and Wane, were demonstrated with Sanate (standard check). The recommended packages of 20cm between, seed rate of 150kg/ha and 121 kg/ha NPS fertilizer were used on 10mx10m area.

### Extension Methods Used

Training was given for participating farmers, Development Agents and experts. Field day also organized in order to create wider demand and further promotion of wheat in the highlands of Guji Zone.

### Methods of Data Collection and Analysis

Field observation, participants interview and group discussions were used to collect the data. The collected data was analyzed by SPSS 20 version software. Descriptive statistics, one way ANOVA, matrix ranking and qualitative analysis of farmers' feedback was used to analyze the data. Cost benefit analysis was used to estimate profitability of demonstrated wheat in the area.

Total Revenue (TR) was calculated as yield of each variety multiplied by its price at harvesting time. During demonstration the price of variety was 3500 birr/qt for Sinja and Wane while 3000 birr/qt for Sanate. Total Variable Costs (TVCs) included were land preparation, sowing, weeding, harvesting, seed cost, fertilizer and fungicides. Fixed Cost (FC) of land was added for calculation. Cost-benefit analysis (CBA) was obtained by subtracting TVC and FC from TR as follows:

$$TR = Y^{*}P \quad (1)$$

$$CBA = TR - TVC - TF \quad (2)$$

## Results and Discussions

### Capacity Building on Bread Wheat Production

Training was organized to refresh and enhance linkage with stakeholders. Farmers, development agents, subject matter specialists and others were trained on bread wheat production at all districts. Training was organized to refresh and enhance linkage with stakeholders. Accordingly, 182 farmers, 33 DAs and 25 SMS were trained on wheat production. Mini filed day was organized at maturity stage and 51 farmers and different stakeholders were attended the mini field day. They observed that improved bread wheat varieties were accepted by the participants and they were eager to produce varieties on their land given that improved varieties were provided by research centers and/or obtained from other sources. When technology users capacitated the technology transfer from research recommendation to technology user is simple so that agricultural extension system should focus on capacity building.

**Table 1:** Farmers, development agents and subject matter specialists participated on bread wheat promotion.

| Extension method | Participants | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Farmers | | | Das | | | SMS | | | Others | | |
| | M | F | T | M | F | T | M | F | T | M | F | T |
| Training | 165 | 17 | 182 | 24 | 9 | 33 | 18 | 3 | 25 | 4 | - | 4 |
| Mini field day | 43 | 8 | 51 | 4 | 2 | 6 | 4 | - | 4 | 2 | - | 2 |
| Total | 208 | 25 | 233 | 28 | 11 | 39 | 22 | 3 | 29 | 6 | - | 6 |

M=Male, F= Female, T= Total, DAs=Development Agents, SMSs= Subject Matter Specialists

### Yield Performance of Bread Wheat at Highland Districts of Guji Zone

Among the demonstrated varieties the highest yield was obtained from Sanate (28.71 qt/ha) followed by Wane (26.29 qt/ha) and Sinja (23 qt/ha) in highlands of Guji zone (Table 2). The yield result of this demonstration was lower than the national yield of wheat (30.46 qt/ha) [7] and irrigation yield (32 qt/ha) [1]. However, the yield results of this demonstration was higher than adaptation yield of 25.19 qt/ha, 18.53 qt/ha and 18.24 qt/ha for Sanate, Wane and Sinja, respectively [10]. Sanate variety gave more yields at Ana Sora district followed by Bore and Arda Jila Mea Boko. This showed that Ana Sora district was most suitable for bread wheat production from highlands of Guji zone. Demonstrated bread wheat varieties have the lowest yield at Arda Jila Mea Boko district.

**Table 2:** Yield of bread wheat variety at highland districts of Guji.

| District where demonstration was conducted | | Varieties | | |
|---|---|---|---|---|
| | | Sinja (qt/ha) | Wane (qt/ha) | Sanate (qt/ha) |
| Arda Jila Mea Boko | Mean | 22.29 | 25.14 | 27.71 |
| | N | 7 | 7 | 7 |
| | Std. Deviation | 2.215 | 1.77 | 1.98 |
| Bore | Mean | 22.13 | 25.88 | 27.88 |
| | N | 8 | 8 | 8 |
| | Std. Deviation | 2.48 | 3.04 | 2.36 |
| Ana Sora | Mean | 25.00 | 28.17 | 31.00 |
| | N | 6 | 6 | 6 |
| | Std. Deviation | 5.33 | 6.80 | 4.73 |
| Total | Mean | 23.00 | 26.29 | 28.71 |
| | N | 21 | 21 | 21 |
| | Std. Deviation | 3.52 | 4.16 | 3.30 |

**Table 3:** Cost benefit analysis of bread wheat production.

| Parameters | N | Mean | Std. Dev. |
|---|---|---|---|
| Yield of Sinja (qt/ha) | 21 | 23.00 | 3.521 |
| Yield of Wane (qt/ha) | 21 | 26.26 | 4.152 |
| Yield of Sanate (qt/ha) | 21 | 28.71 | 3.304 |
| Total Revenue of Sinja variety (birr/ha) | 21 | 80500.00 | 12324.772 |
| Total Revenue of Wane variety (birr/ha) | 21 | 91916.67 | 14532.578 |
| Total Revenue of Sanate variety (birr/ha) | 21 | 86142.86 | 9911.033 |
| Total variable cost of Sinja variety (birr/ha) | 21 | 22796.43 | 401.986 |
| Total variable cost of Wane variety (birr/ha) | 21 | 22796.43 | 401.986 |
| Total variable cost of Sanate variety (birr/ha) | 21 | 22796.43 | 401.986 |
| Fixed cost (birr/ha) | 21 | 7857.14 | 231.455 |
| Cost Benefit Analysis of Sinja variety (birr/ha) | 21 | 49846.43 | 12327.716 |
| Cost Benefit Analysis of Wane variety (birr/ha) | 21 | 61263.10 | 14533.476 |
| Cost Benefit Analysis of Sanate variety (birr/ha) | 21 | 55489.29 | 10000.987 |

**Table 4:** Farmers' preference on bread wheat variety.

| Variety | Rank | Preference criteria |
|---|---|---|
| Wane | 1 | Good seed color, easily thresh able |
| Sanate | 2 | High yielder but the dark color didn't attract the farmers |
| Sinja | 3 | Not easily thresh able and on field the performance didn't attract farmers due to dark color |

### Cost-Benefit Analysis of Bread Wheat Production at Highlands of Guji Zone

Among demonstrated bread wheat varieties Wane variety generated an income of 61263 birr/ha followed by Sanate (55489 birr/ha) and Sinja (49846 birr/ha) at highland districts of Guji zone (Table 3). This revealed that demonstrated bread wheat varieties generated a visible return which could maximize farmers business in their livelihood.

### Farmers' Preference on Bread Wheat Variety

Farmers have certain preference for variety production. During this demonstration, farmers' preference on bread wheat variety was assessed and they preferred Wane variety. The reasons for preference of Wane over other varieties were thresh ability, color and relative yield. Farmers gave more attention to seed cover regardless of high yield of Sanate. Sanate variety didn't attract the market demand due to its dark color. This indicates that high yield variety not necessarily mean high acceptance of variety by farmers. As breeders favor for increment of yield the farmers preference can be beyond breeders' recommendations. Tolerance to disease Wane and Sinja was relatively affected at vegetative stage and Sanate was had not shown on vegetative but highly devastated after milking stage. Wane, Sanate and Sinja varieties have similar maturity stage. Thus, farmers prefer to produce Wane variety.

## Conclusions and Recommendations

Agriculture is the main Ethiopian economy as food security, raw materials, employment and livelihood. The role of bread wheat in fulfilling food security in the agriculture-based economy is indispensable. For this reason, breeders were envisioned to release new bread wheat varieties for the increment of wheat production either rain fed or irrigation. In line with the release of new and adapted varieties reaching farmers through demonstration and popularization are the main target of extension services in Ethiopia in general and Guji zone in particular. Wane, Sinja and Sanate bread wheat varieties were demonstrated at three highlands of Guji zone. It was concluded that regardless of higher yield of Sanate variety Wane variety was more preferable than Sanate and Sinja varieties by farmers. In addition, production of Wane variety generated a visible income for farmers than other bread wheat varieties. Hence, Wane variety should be disseminated in highlands of Guji zone through pre scaling up and large scale production.

## Author Statements

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