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# Participatory Evaluation and Demonstration of Bread Wheat (*Triticumaestivum L)* Varieties at Dugda and Lume Districts, Oromia Regional State, Ethiopia

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**Abstract:** *The activity was conducted in the rainy season 2017 at Dugda and Lume districts, of East shoa zone, Oromia, Ethiopia. Two improved bread wheat varieties (Ogolcho and Kingbird) were demonstrated as a follow up of participatory variety selection activity. The objectives were to demonstrate and evaluate the performance of improved bread wheat varieties along with their management practices under farmers' circumstances and to raise farmers' knowledge and skill on bread wheat production and management practices. Sites were selected in collaboration with respective district agricultural offices based on potential of the area for bread wheat production. Trainings were given for farmers, Development Agents and experts and other stakeholders. The Participating farmers were also capacitated through follow up exchange visits and field days. Recommended seed and fertilizer rate were used for the demonstration trial establishment. According to the results, a mean yield of 38.61 ± 2.82qt/ha and 39.24 ± 1.54qt/was harvested from ogolcho and kingbird varieties respectively. The two varieties showed no statistically significant yield difference at p<0.05 in their yield and showed better yield performance when compared to the farmers' variety. Furthermore,the financial analysis result show that an average return of 21542.3and 21998.2 Ethiopian birr per hectare can be gained from Ogolcho and Kingbird varieties respectively in one production season in the study areas.*

**Keywords:** *Bread wheat, Demonstration, Pre-extension, rift valley, East shoa zone*

## 1. Background and Justification

Wheat (*Triticumaestivum L.)* is one of the most important staple food crops in the world. Wheat is a major crop contributing importantly to the nutrient supply of the global population and also a very versatile crop; it shows wide adaptation to diverse agro-ecological conditions and cropping. The crop is grown at an altitude ranging from 1500 to 3000 meter above sea level (m.a.s.l); the most suitable agro-ecological zones, however, fall between 1900 and 2700 m.a.s.l (Bekele *et. al*, 2000).

The crop is also one of the most important staple crops grown in Ethiopia. It is third in area of cultivation following teff and maize and cultivated in Ethiopia on about 1.69 million hectares and delivering about 4.56 million tons of grain yields (CSA, 2016/17). The crop has been cultivated in the country since the time of immemorial and is the second largest wheat producer in sub-Saharan Africa, after South Africa. The country is also the major producer of wheat in eastern Africa accounting for over 70% ofz the total wheat area in the region (Bezabeh et al., 2015). Although most of the wheat grown in Ethiopia is bread wheat, both bread and durum wheat are widely grown in the country constituting about 60% and 40% of the total wheat production, respectively (CIMMYT, 2014)

Wheat is used for the manufacture of flour for different purposes such as bread, biscuits and pasta products such as macaroni, spaghetti and noodle are some of the industrial products. Wheat is known to be a major source of energy and protein. Traditionally, Wheat is used for making "dabo", "dabokolo", "gonfo", "kinche" and other types of food in the Ethiopian context.

Within the country the top wheat producing districts are primarily located in Oromia, Amhara, and Tigray regional states. Oromia accounts for the largest of all with its top producing districts located in the Arsi-Bale areas of the region (Warner et.al, 2015). According to Warner et.al, 2015, East shoa

zone is also among the top 25 wheat producing zones in the country, major producing districts within the zone being Dugda and Gimbichu.

Although the country is the major producer in sub Saharan Africa it is still reliant on foreign wheat import to satisfy its demands. The national average of wheat yield of Ethiopia is around 2.6 t/ha (CSA 2016/17), which is far below from experimental yields of over 5 t/ha. To solve this challenge and improve production and productivity efforts were made by the research and extension system of the country by releasing and demonstrating improved varieties along with their management practices. Furthermore, the yield gap of 2.4 t/ha indicates the potential for increasing productivity of wheat production through utilization of agricultural inputs, particularly using quality seed of the improved varieties and optimum fertilizers rate.

To this end, in crop improvement and others technology development and dissemination process with the involvement of the end-users may hasten the process and increase the adoption and dissemination of the new technology.

In mid rift valley areas wheat is among the major cereals produced relaying on variety released some ago with low productivity. In addition, the knowledge base of farmers about wheat production and management is limited. To improve this gap as part of its effort ATARC has conducted an on-station trails and participatory variety selections of improved varieties in the past years with support form AGP-II. The trial results conducted showed that the improved varieties activities performed well when compared with farmers' verities. Accordingly a follow-up pre-extension demonstration activity was conducted in the rainy seasons of 2017 with the following objectives

**Objective**

- To demonstrate and evaluate the performance bread wheat varieties under farmers' conditions

## 2. MATERIAL AND METHODS

### 2.1. Description of the Study Areas

The study was conducted in selected districts of East shoa zone. East shoa zone is one the administrative zones of Oromia regional state, Ethiopia. The zone has an area of 10241km$^2$and Adama town is serving as the capital town of the zone. There are 10districts within the zone among which Dugda and Lume districts are the study districts where this demonstration activity took place.

Dugda district is located at 135km from the capital city of Ethiopia, Addis Ababa and 100km from Oromia region's and East shoa's zonal capital Adama. The district covers 5.2% of East shoa zone with area of 751km$^2$. Dugda has 18 Kebele's among which one kebele was used for this study. The district has an average 636mm annual rainfall and 26$^o$caverage temperature. The major crops produced are wheat, teff and maize

Lume districts capital is located 88km from the capital, Addis Ababa and 25km from zonal capital Adama town. The district covers 9.8% of East shoa zone with area of 870km$^2$. Lume has 38 Kebele's among which two kebele were used for this study. The district's annual rainfall ranges from 500-1200mm andtemrature ranging from 18 to 28 degrees. The major crops produced includeteff, wheat, chickpea and lentil.

### 2.2. Site and Farmers Selection

The demonstration was conducted in selected Kebeles of Lume and Dugda districts of East Shoa zone. Two Kebele's from lumedistrict (Bika and Ejersa) and one kebele from Dugdadistrct (Tephochoroke) were selected based on their wheat production potential. Farmer's research and extension group (FREG) approach was followed to select farmers and group under trial farmers. FREG is a participatory research approach whereby multidisciplinary team of researchers, extension workers, group of farmers and other pertinent actors jointly conduct research on farmers' field on selected topics (Bedru B et al, 2009). A total of 6 FREG's were organized having 68 male and 37 female members. Among the FREG member a total of eight (8) interested trial farmers were selected in both districts. The trial farmers were used as replications and selected based on their previous wheat production experience and willingness to contribute a land size of 0.125ha. Packaged production technologies (seed rate, seed treatment, spacing, fertilizer management and weed

management) recommended for the bread wheat production was used to establish the trials. Seeds were sown at the recommended rate of 85 kgha-1 in rows (20cm between rows). Urea (46 % N) was used as a source of nitrogen fertilizer. 2/3 of N fertilizer was applied within the rows as basal application at planting. The remaining 1/3 dose of nitrogen fertilizer was top-dressed at tillering stage. Plots will kept free of weeds. Field days and field visits were also be organized at the maturity and harvesting stage of the crops.

### 2.3. Planting Material

Two adaptable early maturing bread wheat varieties (*Ogolcho and Kingbird*) and were used. Planting material (Seed) were prepared in advance from Kulumsa Agricultural Research center.

**Table1.** *Characteristics of bread wheat varieties used for the evaluation*

| Characteristics | Kingbird | Ogolcho |
|---|---|---|
| Days to maturity | 90-120 | 102 |
| Altitude | 1500-2200 | 1600-2000 |
| Rainfall | 500-800 | 400-500 |
| Yield ($Qtha^{-1}$) | 33-52 | 33-50 |

### 2.4. Technology Gap and Technology Index

For this study technology gap and index were also calculated. The technology gap shows the gap in the demonstration yield over potential yield. The observed technology gap is attributed to dissimilarities in soil fertility, salinity and erratic rainfall and other variability of weather conditions (Dhaka et.al, 2010). According to Dhaka et.al, 2010 its contribution is to narrow down the gap between the yields of different varieties, and to provide location specific recommendations. Furthermore, the yield gaps can be further categorized into technology index which is used to show the feasibility of the variety at the farmer's field. The lower the value of technology index the more the feasibility of the varieties.To this end, the technology gap and technology index of demonstrated varieties in this study(*Ogolcho*and*Kingbird*) was calculated using the following formulas.

Technology gap= Potential yield qt/ha – demonstration yield

$$\text{Technology index \%} = \frac{\text{Potential yield} - \text{demonstration yield}}{\text{Potential yield}} \times 100$$

### 2.5. Data Collected

Agronomic characteristics like plant height, tiller per plant, grain yield, thousand seed weight, spike length, and effective tiller were recorded. Costs and income gained involved were collected.

### 2.6. Data Analysis

The collected agronomic and financial data was analyzed using SPSS ver 20 and present edusing tables. The technology gap and technology index were calculated using the formulas as given by (Samui et al., 2000), as shown above.

## 3. Result and Discussion

### 3.1. Yield Performance of the Varieties Demonstrated

The following table shows the combined analysis result on yield performance of the varieties demonstrated in both Dugda and Lume districts. According to the result a mean yield of38.61 ± 2.82qt ha and 39.24 ± 1.54was harvested from *ogolcho* and *kingbird* varieties respectively. There was no significance yield difference observed among the varieties at ($p<0.05$).

**Table2.** *Grain Yield per hectare (GY) in quintal of the demonstrated varieties*

| Variety | N | Mean | Min | Max | SD |
|---|---|---|---|---|---|
| Kingbird | 8 | 39.24 ± 1.54 | 35.00 | 47.50 | 4.35400 |
| Ogolcho | 8 | 38.61 ± 2.82 | 24.75 | 53.50 | 7.97581 |

The demonstration result obtained was higher than what was reported during the participatory variety selection (PVS) stage of the varieties conducted in the rainy season of 2016. The PVS result was

reported as 23.8qt/ha for *kingbird* and 23.7qt/ha for *Ogolcho* (Dagnachew et, al 2017) varieties. This increment in yield could be associated with the rainfall availability during the duration of the activity compared with the PVS stage. Furthermore, the average yield gained from the demonstrated varieties has an increment from farmers variety (Hawi) which was 22.6qt/ha in the same production season. These shows that these varieties have 73.6% yield advantage over the farmers' variety (Hawi).

### 3.2. Technology Gap and Technology Index

The observed technology gap and technology index of demonstrated varieties in this study (*Ogolcho* and *Kingbird*) was calculated using the formulas given above. The following table describes the results.

**Table3.** *Technology gap and index for ogolcho and kingbird bread wheat varieties at Dugda and Lume districts*

| Parameter | Bread wheat Varieties | |
|---|---|---|
| | Ogolcho | Kingbird |
| Yield gap (qt/ha) | 11.39 | 12.76 |
| Technology index (%) | 22.78 | 24.53 |

As it can calculated from the above table the average technology index percentage is 22.78 and 24.53 for *ogolcho* and *kingbird* varieties respectively. Similarly both varieties show resemblance in their average yield gap yield performance between this demonstration and the potential of the varieties, having 11.39qt/ha and 12.76qt/ha for *ogolcho* and *kingbird* respectively. This indicates that both varieties are feasible if produced in the study areas.

## 4. FINANCIAL ANALYSIS

In terms of profitability the financial analysis result show that an average return of 21542.3Birr and 21998.2 birr per hectare can be gained from *Ogolcho* and *Kingbird* varieties respectively in one production season in the study areas. Yet, this financial analysis considered land as a fixed cost; considering there are farmers who rent in land at a fixed cost. However, for those farmers who own land the additional income of 2500 and 2800 at Dugda and Lume districts could be added to their return.

| FINANCIAL ANALYSIS | | | | | |
|---|---|---|---|---|---|
| Location : Dugda | | | Location: Lume | | |
| **Parameters** | Variety | | **Parameters** | Variety | |
| | Ogolcho | Kingbird | | Ogolcho | Kingbird |
| Yield qt/ha (Y) | 38.8 | 39.85 | Yield qt/ha (Y) | 38.29 | 38.21 |
| Price (P) per quintal | 1000 | 1000 | Price (P) | 1000 | 1000 |
| **Total Revenue (TR)= TR= YxP** | 38800 | 39850 | **TR= YxP** | 38290 | 38210 |
| **Variable costs** | | | **Variable costs** | | |
| Seed cost | 1350 | 1350 | Seed cost | 1350 | 1350 |
| Fertilizer cost | 2140 | 2140 | Fertilizer cost | 2140 | 2140 |
| Chemicals | 2800 | 2800 | chemicals | 2800 | 2800 |
| labor cost | 5500 | 5500 | labor cost | 5500 | 5500 |
| Combiner harvesting | 2328 | 2391 | Combiner harvesting | 2297.4 | 2292.6 |
| Cost of transport, sacks | 250 | 250 | Transport, sacks | 250 | 250 |
| Total variable costs (TVC) | 14368 | 14431 | TVC | 14337.4 | 14332.6 |
| **Fixed costs** | | | **Fixed costs** | | |
| Cost of land | 2500 | 2500 | Cost of land | 2800 | 2800 |
| Total fixed costs (TFC) | 2500 | 2500 | TFC | 2800 | 2800 |
| Total Cost (TC) = TVC+TFC | 16868 | 16931 | TC = TVC+TFC | 17137.4 | 17132.6 |
| Gross Margin (GM) = TR-TVC | 24432 | 25419 | GM = TR-TVC | 23952.6 | 23877.4 |
| **Profit= GM-TFC** | 21932 | 22919 | **Profit= GM-TFC** | 21152.6 | 21077.4 |

## 5. CONCLUSION AND RECOMMENDATION

As a follow-up of participatory variety selection (PVS) activity,this study focused mainly on demonstrating farmers preferred bread wheat varieties on a bigger land size than PVS stage. The results indicated that both varieties demonstrated gave promising yield having 73.6% yield advantage over farmers' variety (*Hawi)*.

Furthermore, both varieties' were evaluated in their economic return. The results indicate that both varieties are profitable.In addition the technology index and yield gap analysis also shows as the varieties are feasible for farmers in the study area.

Therefore, both varieties can be used for further scaling up activities in dugda and lume districts taking into consideration their comparable yield and economic return.

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