

**Review Article**

# Participatory Demonstration and Evaluation of Oat Forage Technologies in Potential Districts of West Hararghe Zone, Ethiopia

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**To cite this article:**

Adem Hirpo, Gemechu Terefe, Fekede Gemechu, Nimona Sime, Tamirat Dinkale. (2024). Participatory Demonstration and Evaluation of Oat Forage Technologies in Potential Districts of West Hararghe Zone, Ethiopia. *Advances in Applied Sciences*, 9(1), 1-5.  
<https://doi.org/10.11648/j.aas.20240901.11>

**Received:** December 4, 2023; **Accepted:** December 20, 2023; **Published:** January 23, 2024

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**Abstract:** The study was conducted at Habro, Chiro and Tullo districts of West Hararghe zone in 2020/2021 cropping season with the objectives to evaluate the performance of Oat forage under farmer's condition, to create awareness and linkage among different stake holders and to collect farmers' feedback on its production and management. From each location; four farmers and one FTC; totally twelve farmers and three FTCs were selected. Bareda oat variety was evaluated with Bate (standard check) on 5m\*5m side by side simple plots. Training was given prior to activity implementation for twelve farmers, five DAs and nine SMSs. On the other hand, Three DAs, six SMS and eight three farmers were participated on mini field day organized at Gara kufa kebele. Training and field day participants, grain yield and farmers preference data were collected by using checklist, data record sheet and field observation. The result of farmers' preferences showed that, Bareda variety was selected by plant Height, plot cover, lodging tolerance, stand vigor, disease tolerance, early flowering, early maturity, Biomass and palatability. The result of grain yield was also revealed that, 30.19 Qtha<sup>-1</sup> and 25.6 Qtha<sup>-1</sup> were recorded by Bareda and Bate respectively with 17.79% yield advantage over Bate under the same management. Based on yield, yield advantage and farmers' preferences result, Bareda variety was recommended for pre-scaling up program in West Hararghe zone and similar agro-ecologies to improve production and productivity of oat forage and to solve problem of animal feed.

**Keywords:** Bareda, Bate, Grain Yield, Oat, Yield Advantage

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## 1. Introduction

Oat (*Avena sativa*) is the main types of cereals crop which is domesticated in 2000BC by Hindu Kush [1, 10]. From 2001 to 2008 Russia 5.49, North America 5.16, Canada 3.51 and Africa 0.19 produce million tons of oats [2].

Oat is good source for human nutrition, poultry, cattle, sheep and other animals [3]. Many cultivars of oat have high feed value if cut at flowering stage for better yield and can meet the demand of rapidly growing livestock industry. 100gm of Oat contains protein (16.6g), Fat (8.1g), Carbohydrate (66.3g) and other is vitamin [4]. Similarly according to [14], 81g of Oat contains water (8.7g), protein (10.7g), carbon (54.8g), sugar (0.8g),

Fiber(8.1g), Fat(5.3g) and contribut 307 energy calories. In Ethiopia 10,502.18 ha of land was covered by Oat; on which 305,403.43 quintals of grain yield was obtained. In Oromia region, from 10,582 ha of cultivated land; 31,032.77 Qt of grain yield of oat was obtained [5].

As population number increase, food requirement also increases. Specifically meat and milk product is the major nutrition of human being. To solve food security problems rearing livestock in good manner is very essential. However in west Hararghe zone, feed shortage is the main challenge that smallholder farmers faces to meet this goal. Particularly in highland areas, due to variety shortage, farmers use different crop residue for animal feed that has low nutrient content. To solve this, Mechara Agricultural Research Center has been conducting

study on improved oat forage genotypes and released Bareda oat variety in 2020. Bate (standard check) recorded 23Qtha<sup>-1</sup> and 17 Qtha<sup>-1</sup> grain yield on station and on farmers' field respectively during release. Bareda recorded grain yield of 33.4 Qtha<sup>-1</sup> on station and 24 Qtha<sup>-1</sup> on farmers' field with 41.2% yield advantage. In terms of fresh biomass; Bate recorded 34.88 ton ha<sup>-1</sup> on station and 32.1 ton ha<sup>-1</sup> on farmers' field, while Bareda recorded 47.47 ton ha<sup>-1</sup> on station and 44.5 ton ha<sup>-1</sup> on farmers' field which had 38.6% of yield advantage over standard check [6]. Based on the above high performance with yield and fresh biomass, Bareda variety was recommended for demonstration in West Hararghe zone and similar agro-ecologies. So the study was designed with objectives:-

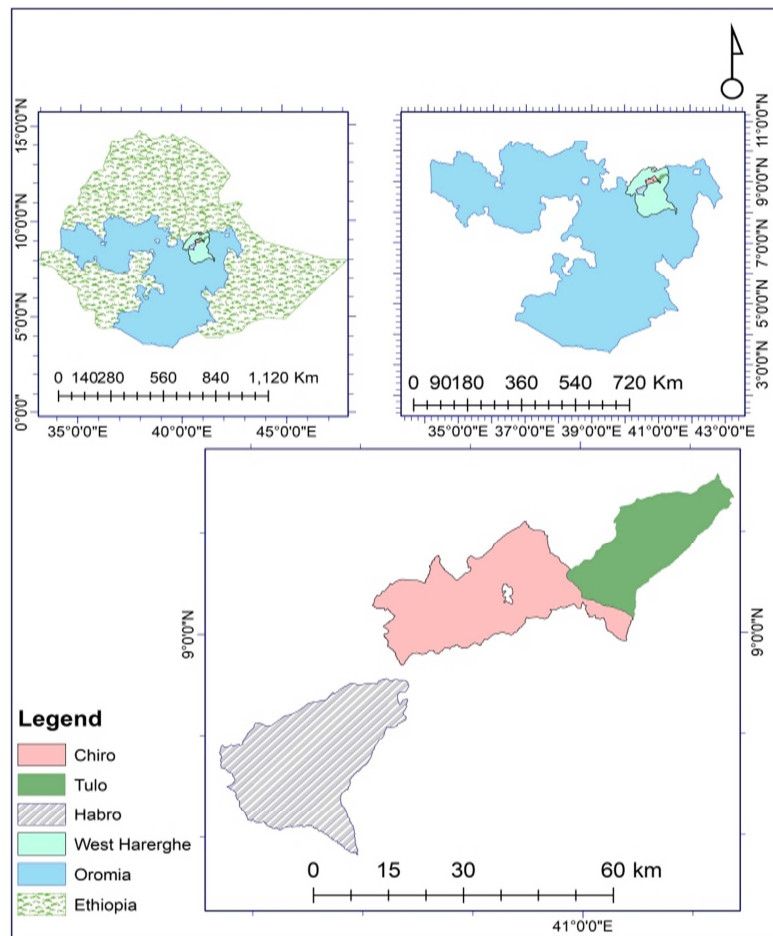
- 1) To evaluate performance of improved variety of oat under farmers' condition,
- 2) To collect farmers' feedback on oat production and management
- 3) To create awareness and linkage among different stakeholders.

## 2. Methodology

### 2.1. Description of the Study Area

The experiment was conducted in Habro, Chiro and Tullo

districts of west Hararghe zone in 2020/21 cropping season. Habro district is found in West Hararghe Zone of Oromia Regional State, eastern part of Ethiopia. The district is 410 km far apart from Addis Ababa, that capital city of Ethiopia and 78 km from Chiro town, the capital of West Hararghe Zone. Geographically, Habro district is located at 8.57° N to 8.91° N latitude and 40.34° E to 40.69° E longitude. Gelamso town is the administrative capital of the district and is bordered on the south by Daro Labu, on the west and north by Guba Koricha, on the northeast by Kuni, and on the southeast by Boke. According to [7] total population of the woreda is 190,455, from 98,593 were men and 91,862 are women; 25,233 or 13.25% of its population were urban dwellers. The majority of the inhabitants were Muslim, that reach 84.92% of the population, while 14.52% of the population practiced Ethiopian Orthodox Christianity [7, 12]. The elevation of the district ranges from 1400 to 2400 m.a.s.l with mean annual rainfall of 966.7mm and the mean annual temperature was 19.97°C. Vertic Luvisols, Rendzic Leptosols, Haplic Luvisols, Eutric Vertisols and Eutric Leptosols are main soil type Habro district. Vertic Luvisols occupy a major portion of the area followed by Rendzic Leptosols, Eutric Leptosols, Haplic Luvisols and Eutric Vertisols [8, 9].



Source (our arc design, 2021)

**Figure 1.** Mapp of study areas.

Chiro is another districts of west Hararghe zone. The capital of the district is called Chiro and 325 km far apart from Addis Ababa. It was located 9°05'N and 40°52'E. The elevation of district is 1826 m.a.s.l with mean annual rain fall range 900mm to 1800mm and annual temperature 12°C-23°C. According to [7, 13], total population of the district is 169,912. From this 87,003 are men and 82,909 were women. The majority of the inhabitants were Muslim, which accounts 83.68% from total population, while 15.4% of the population practiced Ethiopian Orthodox Christianity.

Tullo is one of the Woredas of West Hararghe Zone of Oromia Regional State of Ethiopia and is bordered on to the north by Doba, to the south by Masala, to the east by the East Hararghe Zone, and to the west by Chiro; its town is called Hirna. According to [7] reported total population for this woreda is 147,384, from this 75,254 were men and 72,130 are women; 13,768 or 9.34% of its population were urban dwellers. The majority of the inhabitants were Muslim, that account 78.72% from total populations, while 20.04% of the population practiced Ethiopian orthodox Christianity [7, 11].

## 2.2. Site and Farmer Selection

The experiment was conducted for one year in Habro, Chiro and Tullo districts of West Hararghe zone. Bareda kebele from Habro, Arba rakate from Chiro and Gara kufa kebele from Tullo district were selected purposively based agro-ecology and potential of oat productions. It was done with collaboration of DAs and SMS woreda agricultural offices. Accordingly, from each kebele four farmers and one FTC were selected and total of twelve farmers and three FTCs involved. Farmers selection was done based on criteria like willingness and interest, ability to allocate land, ability and interest to share information for other farmers and promise to manage the field.

## 2.3. Experimental Design

Demonstration plots were arranged on 5m\*5m area; with the distance between plots and rows 1m and 30cm respectively and planted by drilling. For the two varieties; 50m<sup>2</sup> plot size was provided by each farmer; totally 750 m<sup>2</sup> land area was used to implement the activity. Accordingly, Bareda variety was compared with Bate (standard check). The activity was conducted by employing the recommended agronomic practices; 100 kg ha<sup>-1</sup> seed rate, 50 kg ha<sup>-1</sup> Urea and 100 kg ha<sup>-1</sup> NPSB fertilizers.

## 2.4. Data Collected

1. Training participants
2. Field day participants
3. Farmers preferences
4. Grain yield

## 2.5. Method and Tools of Data Collection

1. Check list
2. Data record sheet
3. Field observation
4. Interview

## 2.6. Method of Data Analysis

Quantitate data were analyzed by SPSS software and T-test, while qualitative data were analyzed by score ranking method and present in tabulation.

# 3. Results and Discussions

## 3.1. Method of Awareness Creations and Communications

Training was organized and delivered at Mechara Agricultural research center for the selected, 12 experimental farmers, 5 Extension workers and 9 SMSs.

*Table 1. Training participants.*

| Districts | Stakeholders participated |   |     |   |      |   |       |   |    |
|-----------|---------------------------|---|-----|---|------|---|-------|---|----|
|           | Farmers                   |   | DAs |   | SMSs |   | Total |   |    |
|           | M                         | F | M   | F | M    | F | M     | F | T  |
| Chiro     | 4                         | 0 | 1   | 0 | 3    | 0 | 8     | 0 | 8  |
| Habro     | 4                         | 0 | 2   | 1 | 3    | 0 | 9     | 1 | 10 |
| Tullo     | 4                         | 0 | 1   | 0 | 3    | 0 | 8     | 0 | 8  |
| Total     | 12                        | 0 | 4   | 1 | 9    | 0 | 25    | 1 | 26 |

Source: Own result, 2021

At all locations experiment were supervised continuously and best preformed site Gara kufa kebele was selected and field day was organized.

*Table 2. Mini field day participants at Tullo district.*

| Location (kebele) | DA | SMS | Farmers | Others | Total |
|-------------------|----|-----|---------|--------|-------|
| Gara Kufa         | 3  | 6   | 83      | 9      | 101   |

Source: own result, 2021

During the mini field day, different participant stakeholders have got awareness as well as raised lots of questions related

to utilization, accessibility and management of the technology and the answer is forwarded by biological researcher to the whole participants and 50 leaflets were distributed for the participants.

#### Farmers' Preferences

Stakeholders and farmers participated on mini field day

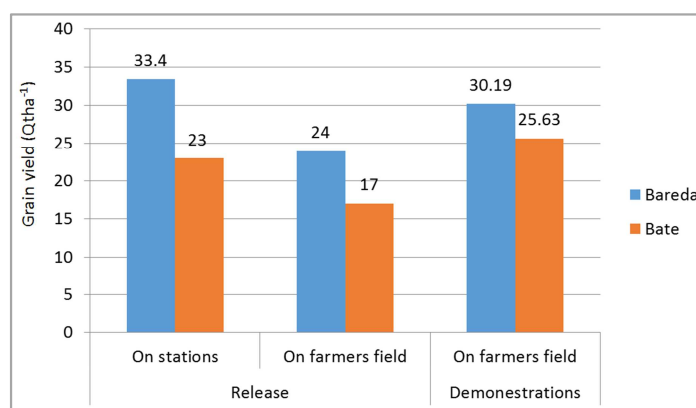
have set own criteria to choose the best variety from the two alternatives. Accordingly, Bareda oat variety was selected by plant height, plot cover, lodging tolerance, stand vigor, disease tolerance, early flower, early maturity, biomass and palatability.

**Table 3.** Farmers' preference by simple score ranking (1-5).

| Variety | Parameter |      |      |      |      |      |      |      |      | Total score | Mean score | Rank |
|---------|-----------|------|------|------|------|------|------|------|------|-------------|------------|------|
|         | PH        | PC   | LT   | SV   | DT   | EF   | EM   | BM   | PL   |             |            |      |
| Bareda  | 4.87      | 4.74 | 4.50 | 4.74 | 4.84 | 4.95 | 4.89 | 4.79 | 4.79 | 43.11       | 4.79       | 1    |
| Bate    | 3.76      | 3.55 | 4.00 | 4.03 | 4.37 | 3.82 | 3.71 | 4.11 | 3.92 | 35.26       | 3.92       | 2    |

Note: scale 5= excellent, 4= very good, 3= good, 2= fair and 1= poor

Where plant height (PH), plot cover (PC), lodging tolerance (LT), stand vigor (SV), Disease tolerance (DT), early flower (EF), early maturity (EM), Biomass (BM) and palatability (PL)



Source (result of release and demonstration's, 2021)

**Figure 2.** Performances of Oat forage during different stages.

### 3.2. Grain Yield (Qtha<sup>-1</sup>)

Bareda Oat variety gave different yield at different stages (release and demonstration) both on farmers' field and on station. During release, it gave 24 Qtha<sup>-1</sup> on farmers' field and 30.19 Qtha<sup>-1</sup> during demonstration. But Bate variety gave 17 Qtha<sup>-1</sup> during released and 25.63 Qtha<sup>-1</sup> during demonstrations. From this, Bareda variety tried to show its potential on farmer's field under good management.

#### 3.2.1. Grain Yield by Location

As shown in the table 4 below, the mean yield in Qtha<sup>-1</sup> of Bareda variety at Chiro, Habro and Tullo was; 32.4, 15.2 and 42.3 respectively and at Bate variety; 26.5, 12.2 and 37.9 respectively as well. From this, we can concluded that, Tullo district could be an excellent area for oat production, Chiro district is moderately the good area and Habro district is relatively less conducive environment for this forage

production.

**Table 4.** Yield across location.

| Districts | Verities | Yield (Qtha <sup>-1</sup> ); N=15 |         |           |      |
|-----------|----------|-----------------------------------|---------|-----------|------|
|           |          | Maximum                           | Minimum | Std. Dev. | Mean |
| Chiro     | Bareda   | 38.4                              | 28      | 4.5       | 32.4 |
|           | Bate     | 27.6                              | 25.2    | 1.0       | 26.5 |
| Habro     | Bareda   | 22.8                              | 6.8     | 6.8       | 15.2 |
|           | Bate     | 21.6                              | 3.5     | 9.0       | 12.2 |
| Tullo     | Bareda   | 45.1                              | 38.7    | 3.3       | 42.3 |
|           | Bate     | 42.8                              | 32.8    | 5.0       | 37.9 |

Source: own result, 2021

#### 3.2.2. Grain Yield by Variety

Both varieties were planted by respecting the same agronomic principle with the same management at all locations. However from the analyzed result, Bate variety was gave 25.63 Qtha<sup>-1</sup>; while Bareda variety gave 30.19 Qtha<sup>-1</sup> with 17.9% yield advantage over Bate variety. (Table 5)

**Table 5.** Yield summary of Oat forage (N=15).

| Varieties | Yield ( Qtha <sup>-1</sup> ); N=15 |       |       |           |                |
|-----------|------------------------------------|-------|-------|-----------|----------------|
|           | Min                                | Max   | Mean  | Std. Dev. | Yield Adv. (%) |
| Bareda    | 9.76                               | 45.12 | 30.19 | 12.06     | 17.79          |
| Bate      | 3.52                               | 42.8  | 25.63 | 11.6      |                |

Source: own result, 2021

### 3.3. T-Test

So far; two varieties of oats (Bareda and Bate) had been tested under the same agronomic practices and management on farmers' field. The t-test result revealed that, there is significant difference at less than 1% between the two varieties.

**Table 6.** Paired sample t-test result.

| Variety | t-test   |        |
|---------|----------|--------|
|         | t- value | Sig.   |
| Bareda  | 3.294    | 0.009* |
| Bate    |          |        |

Source: Own result; 2021

## 4. Conclusions and Recommendations

The experiment was conducted with objectives to demonstrate and evaluate performance of Oats forage under farmers' condition and to create awareness and linkage among different stake holders. From the analyzed result; Bareda variety gave 30.19 Qtha<sup>-1</sup> and Bate variety gave 25.63 Qtha<sup>-1</sup>. Bareda variety had 17.79% yield advantage over Bate variety (Table 6). Farmers' preferences result also indicated that, Bareda variety was selected by participants during field day by using different criteria. In addition, the t-test result also showed that there is a significant difference between the two varieties at less than 1% probability level. Therefore, Bareda Oat variety was recommended for pre scaling up program in West Hararghe Zone and similar agro-ecologies to improve production and productivity of Oats forage as well as to overcome feed shortage problem.

## Conflicts of Interest

The authors declare that there is no conflict of interest.

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