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# On-Farm Demonstration of Improved Rice (Oryza sativa L) Varieties in Pawe Woreda of Metekel Zone, Ethiopia

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**Abstract**
The research activity was carried out to demonstrate and evaluate improved rice varieties in Pawe woreda. Four varieties (Hidassie, Nerica-12, Nerica 4 and Pawe-1) were used for the demonstration and evaluation in farmers' field under their management and resources. All data collected from demonstration plots and farmers were analyzed through Simple descriptive statistics and matrix rankings. Average yield performances that were obtained from farmers' field were 42.66 qt/ha, 34.19 qt/ha, 33.41 qt/ha and 32.23 qt/ha of Pawe-1, Nerica-3, Hidase and Nerica-12 varieties respectively. Pawe-1 variety showed better yield performance than the other compared varieties. A group of rice producer farmers were also invited in the demonstration field to evaluate the performance of the verities based on their criteria. In the ranking, Pawe-1 was selected as the best-preferred variety than Nerica-3, Hidase and Nerica-12 varieties. Based on farmers' perception, Pawe-1 variety was ranked first as it produces a good yield, high tillering capacity, white color and preferred at the market with good price. This result indicates Pawe-1 variety is farmers' best preferred and top performed variety which can be considered as a promising variety to be widely produced by rice farmers in the study area. The yield under demonstration plots was higher than the local check and the use of research recommended rice cultivation method can reduce the technology gap to a considerable extent. Thus, offices of agriculture and research centers need to provide technical support to the farmers through different educational and extension method to reduce the extension gap.
**Keywords:** Demonstration, Evaluation, Rice
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## 1. Introduction

In Ethiopia, agriculture is the leading sector which contributes to nearly 36. 7% of GDP. It also serves as the main source of food and generates 88.8% of the foreign exchange earnings. Crop productions contribute the lion share, according to the report of CSA (2018). From the total cultivated area, a larger area (90%) was covered by grain crops (cereals, pulses, and oilseeds).

Rice is among the major cereal crops cultivated in Ethiopia nowadays next to teff, maize, wheat and sorghum. It was introduced in the 1970s and since has been cultivated in different parts of the country. Although rice has just been recently introduced to Ethiopia, recognizing its importance as a food security crop and a source of income, and employment opportunities, the government of Ethiopia has named it the "millennium crop," and has ranked it among the priority commodities of the country. The potential rain-fed rice production area in Ethiopia is estimated to be about thirty million hectares based on GIS techniques and rice agro-ecological requirement (Tamirat and Jember, 2017). The area covered by rice during 2007 was 24,434 hectares rose to nearly 53,106 hectares in 2017 and the production from 713,160 quintals to 1,510, 183 quintals. At the same time, the number of rice farmers increased from 61,862 to more than 161,376 (CSA, 2007;2018).

Ethiopia has a huge potential for rice production especially, in the area of the Gambella region, the Fogera plain around Lake Tana and Benshangul Gumuz Regional state (BGRS). However, the productivity of the crop is very low (28.44 qt/ha) compared to the global average (CSA, 2018).

In Pawe woreda, the crop was introduced in 1985 during the resettlement program and establishment of Pawe agricultural research center (Dawit *et al.,* 2018). Currently, the woreda is one of the rice-producing areas, and it is considered as the major crop and cultivated by smallholder farmers for household consumption (injera, bread and alcoholic drinks). It is also used as a cash crop, source of feed, and house construction material.

 

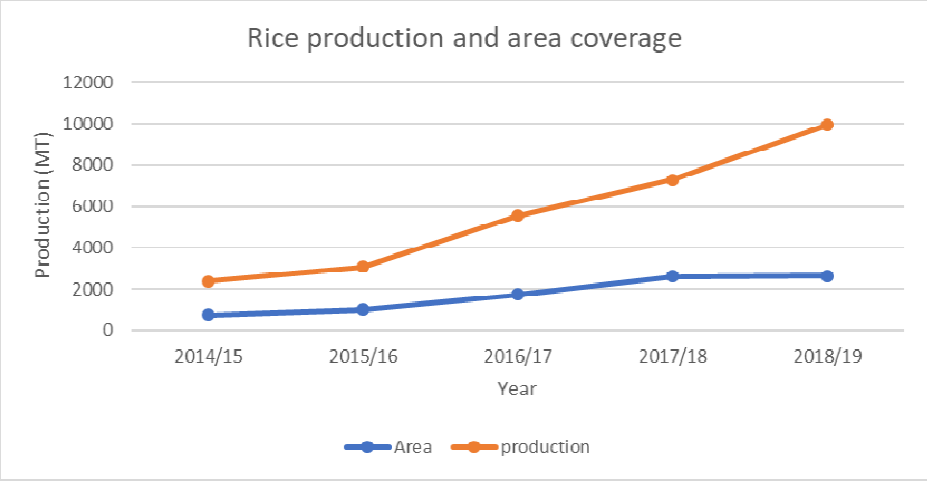


Figure 1:. Trend in rice production and area coverage in Pawe woreda
Source: PWoA (2014/15 – 2018/19)

According to the report of Pawe woreda agricultural office (PWoA, 2014/15–2018/19), the total land used for rice production and total yield over the period is increasing. However, the rice productivity (yield/ha) over the period of 2015/16 afterwards increasing at escalating way year after year. This shows even if the rice has been recently introduced to the area, recognizing its importance as a food security crop and a source of income, the area coverage, production and productivity is increasing.

Pawe agricultural research center in collaboration to other sister research centers adapted and released several high-yielding and disease-resistant rice varieties together with their associated improved agronomic practices (EIAR, 2016). Demonstration and evaluation of these varieties in the farmers' field are vital, to promote the newly released varieties and evaluate them under farmers condition. The objective of this study, therefore, is to demonstrate and evaluate the research released improved rice varieties in farmers' field, select and recommend the best-fit variety based on farmer's selection criteria for future technology scaling-ups.

## 2. Materials and Methods

### *2.1. Description of the Study Area*

The demonstration was conducted in Pawe woreda which is one of the seven woredas in the Metekel administrative zone of Benshangul Gumuz Regional state (Figure 1). It is located geographically between 36°20'-36° 32' longitude and 11°12'-11°21' latitude with an altitude of 1120 m.a.s.l. The woreda has 20 kebeles and the climate of the area is hot humid and characterized by unimodal rainfall pattern with high and torrential rainfall that exceeds from May to October. The area experiences a temperature ranging from 19.4°C to 37.6°C with a mean annual rainfall of 1586.32 mm. The woreda covers a total area of 63,400 hectares. The farming system of the woreda is characterized by a mixed crop-livestock farming system dominated by crop production. The major crops grown in the woreda include; maize, finger millet, soybean, sesame, groundnut and rice (PWoA, 2018).

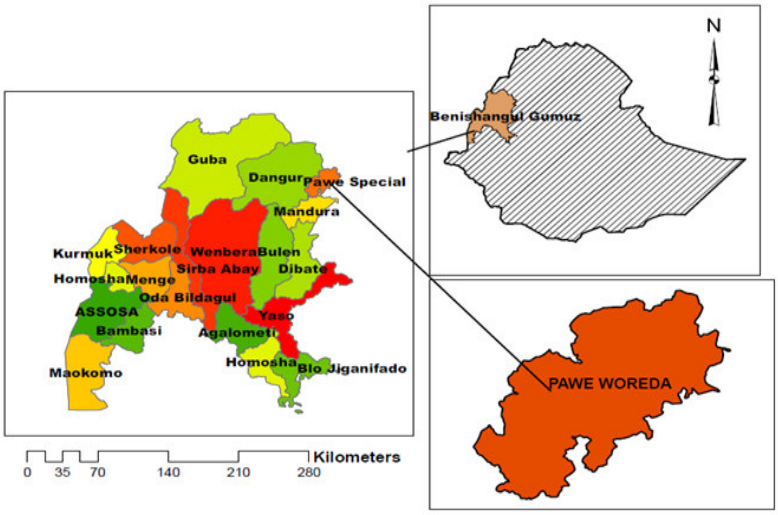


Figure 2: Location of the study area

 

### *2.2. Farmers Selection and Field Establishment*

For this activity, two kebeles (Village 17 and village 14) were purposively selected based on rice production potentials from Pawe woreda. In consultation with woreda agricultural experts, farmers who have an interest in the technology, willingness to manage and allocate field for the demonstration and willingness to collaborate with extension agents and researchers were selected for hosting the demonstration. Twenty farmers were selected and the demonstrations were established in a farmer's field were each farmer considered as a replication. For the demonstration, full technology packages of rice were provided. The varieties were planted in 0.25 hectares in each demonstration host farmers' field. Hidassie, Pawe-1, Nerica-12, and Nerica-3 varieties that have been released from the research were grown side by side to demonstrate and compare their performance with the one that farmers are using (Control /farmers practice). Before the establishment of the demonstration or planting the seeds, both practical and theoretical training was provided on the improved rice technology from production to marketing.

In the demonstration plots, farmers used a row spacing of 20 cm and 80 kg/ha seed rate. Fertilizer application, insect pest control, and other necessary practices were applied as per the rice production package (EIAR, 2016). The date of planting was maintained the same for all varieties. Follow-ups and essential advice from respective researchers and agricultural experts have been given to demonstration host farmers. During each visit, discussions were made with the farmers and DAs right on the demonstration plot to jointly evaluate the performance of the varieties on the field. During the visit, both farmer's and development agent's data recording format were checked to observe how they handled the information gathering process.

### *2.3. Data Collection and Analysis*

The activity data were collected by the researchers directly from the field. Farmer's perception of the varieties was recorded from focus group discussion during the evaluation process. The collected data were analyzed using descriptive statistics and preference ranking based on farmers' set criteria. Finally, the extension gap, technology gap, technology index along with the benefit-cost ratio were worked out. 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 another variability of weather conditions and used to provide location-specific recommendations (Samui *et al.,* 2000).

**Technology Gap** = Potential yield - Demonstration yield
**Extension Gap** = Demonstration yield - Farmer yield

## 3. Result and Discussion

### *3.1. Training of farmers and other stakeholders*

Training on rice production and management practices were given to demonstration host farmers (twenty) and development agents (four) who were working in the study site. This includes both theoretical and practical types of training. During regular visits, there were gaps identified by researchers. To fill the observed gap, field-level training was given by grouping farmers into small groups and discussed issues raised by farmers.

### *3.2. Yield Performance*

For the study period from demonstration plots, yield data were collected from twenty farmer's field. The mean yield of Pawe-1 variety was (42.66 qt/ha) which is found higher than that of Hidassie (33.41 qt/ha), Nerica-12 (32.23 qt/ha), Nerica-3 (34.19 qt/ha) and that of the local check (28 qt/ha).

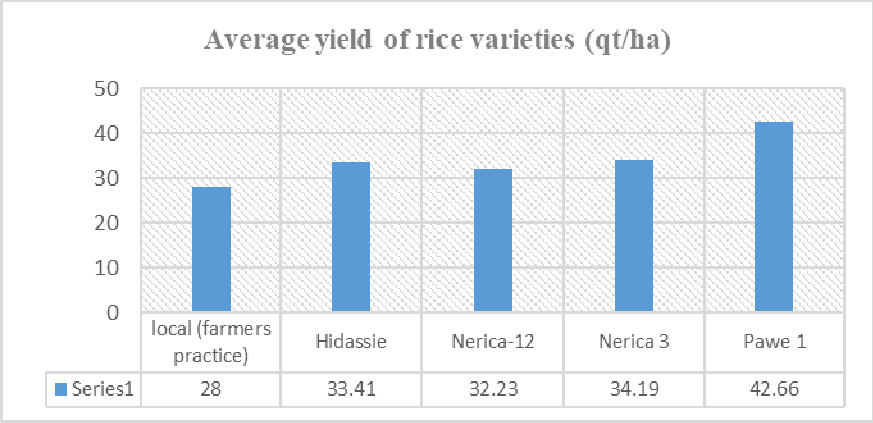


Figure 3: Average demonstration yield of rice varieties

This implies, the research released varieties with the recommended production practice gave a higher yield than the farmer's practice in the study area. The result conforms with (EIAR, 2016) and suggests the positive

 

effects of demonstrations over the existing farmers practice towards enhancing the yield of rice with its positive effect on yield attributes. The comparison of the productivity level of each demonstrated variety is shown in figure 3.

### *3.2. Yield gap and Advantage*

The highest yield increment (14.66 qt/ha) was recorded by Pawe-1 variety of a 52. 36% yield advantage over the local (farmers practice). Comparing with the farmer's practice, all varieties have a yield advantage and yield increments; Hidassie (5.41 qt/ha) and, Nerica-12 (4.23 qt/ha) and Nerica-3 (6.19 qt/ha). The difference in yield between the demonstrations and potential yields of the varieties was also well noted (Table-1). The technology gap showed the difference between demonstration yields and potential yield. The highest gap was found in Nerica-3 variety (10.81 qt/ha) and the minimum difference found with Pawe-1 variety (2.34 qt/ha). The difference in the yield result confirms the productivity of rice varieties registered (EIAR, 2016). The technology gap could also be because of varying soil fertility, rainfall and unpredictable weather conditions. Generally, the varieties demonstrated yielded better to that of the control/ farmers practice. From the demonstration result, it can be concluded that the adoption of high yielding improved varieties can result in improved productivity and food security.

Table 1: Productivity, technology gap and extension gap in rice under on farm demonstration

| Varieties | Yield potential | Demo. Yield | Control Yield | Yield increment | % increase over control | Technology gap (qt/ha) | Ext. gap (qt/ha) |
|---|---|---|---|---|---|---|---|
| Pawe-1 | 45 | 42.66 | 28 | 14.66 | 52.36 | 2.34 | 14.66 |
| Nerica-12 | 41 | 32.23 | 28 | 4.23 | 15.11 | 8.77 | 4.23 |
| Nerica-3 | 45 | 34.19 | 28 | 6.19 | 22.11 | 10.81 | 6.19 |
| Hidase | 42 | 33.41 | 28 | 5.41 | 19.32 | 8.59 | 5.41 |

### *3.3.* Rice farmers considered varietal traits and ranking

Farmers have their preference criteria to accept and use a specific variety or technology (Semagn *et al.,* 2017). The finding of this study suggests that farmers in the area seek specific varietal traits, such as yield potential, tolerance to disease better price and color. The farmers' perceptions of improved rice varieties specific characteristics significantly limit the acceptance and decisions to use the specific technology (Hailemariam, 2016). Therefore, the research centers have to give more attention to participatory research which considers farmers' priorities and needs.

Overall varietal traits and farmers preference of rice varieties categorized largely in terms of grain color, grain yield, marketability, pest/ disease resistance, maturity, bio-mass as discussed briefly below. The varieties were evaluated at crop maturity stage by a group of rice grower farmers. During preference ranking, selected farmers were asked to set their priority selection criteria. Selection criteria of farmers in the study area were based on an extensive discussion and agreement. The criteria were; Marketability, grain yield, grain color, seed size, maturity and tillering capacity.

Farmers who can represent the kebeles and who have long experience in rice farming were selected and participated in the evaluation of the demonstration plots/ varieties. In the preference ranking, Pawe-1 was the best-preferred variety than the others in the demonstration. This result indicated Pawe-1 is farmers' best preferred and top performed variety which can be considered as a promising variety to be widely produced by rice farmers in the study area. Based on farmers' perception, Pawe-1 variety was ranked first as it produces a good yield, white color, preferred at the market with good price. Farmers also reported that during the focus group discussion, Nerica-3 variety was early maturing but susceptible to bird attack in addition to the lower yield potential. It may be important to note at this point that proper practices are also potential factors for differences in yield (Table 2).

Table 2: Farmers preference ranking of the rice varieties

| Varieties | Marketability | Grain Yield | Grain color | Seed size | Maturity | Tillering capacity | T. Score | Rank |
|---|---|---|---|---|---|---|---|---|
| Pawe -1 | 4 | 4 | 4 | 3 | 4 | 4 | 23 | 1st |
| Hidasie | 2 | 2 | 3 | 1 | 3 | 3 | 14 | 2nd |
| Nerica -12 | 1 | 1 | 1 | 4 | 2 | 2 | 11 | 4rd |
| Nerica -3 | 3 | 3 | 2 | 2 | 1 | 1 | 12 | 3th |

NB: preference ranking scale 1-4 (4= highest score/preferred and 1= lowest score/preferred)

## 4. Conclusion and Recommendations

From the findings of this research, it was observed that there was a difference among the varieties used for the demonstration in the study area. Hence, Pawe-1 was found as the best rice variety as it produces a higher yield

 

than Nerica-3, Nerica-12 and Hidasie verities. Similarly, farmers also show their preference to Pawe-1 and Hidasie varieties than Nerica-12 and Nerica-3 varieties based on good yield, white color, preference at the market places in addition to its productivity. The yield under demonstration plots was higher than the local check and the use of research recommended rice cultivation method can reduce the technology gap to a considerable extent. Thus, offices of agriculture and research centers need to provide technical support to the farmers through different educational and extension method to reduce the extension gap. As the preference of the farmers in each site has already been identified, it will be productive if the extension service considers farmers' preferences in varietal promotion activity.

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