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Pre extension and demonstration of highland maize varieties in highland areas of East Gojam Zone, Amhara, Ethiopia

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ABSTRACT

Aim: The main objective of the study was to evaluate and recommend high yielding varieties thus enabling farmers to assess the performance of improved varieties of their choice through participatory variety selection approach.
Materials and Methods: The study contained two improved highland maize varieties and two mid altitude local checks. The trial was laid out in a single plot of 10m*10m plot size with no replications at five locations. Intra and inter spacing was 25cm*75 cm , respectively.
Results: The highest combined yield was obtained from BH661 (6170.67kg/ha) followed by Jibat (6109.33 kg/ha) and BH660 (4946.67 kg/ha). The lowest yield was obtained from Kolba (4602.67 kg/ha). At Giraram, Generally, the highest total score was given to BH661 (12) followed by Jibat (9) and kolba (3), respectively. At Misleawash, Generally, the highest total score was given to Kolba (15) followed by Jibat (7) and BH661 (2), respectively.
Conclusion: It was concluded that BH661 and Jibat varieties could be the potential varieties in current use. This study has suggested that introduction, collection and extensive hybridization of maize in Ethiopia is a crucial task to enhance genetic variability and thereby to increase the chance for selecting and developing high yielding genotypes and hybrids through participatory approach.

Keywords: Ethiopia, Highland, maize varieties, selection criteria's, yield.

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Introduction

Maize production in the highland areas has been characterized by low yields due to long absence of infusion of new technologies such as improved varieties and appropriate management practices. However, the ongoing efforts to improve access to and use of available highland maize technologies with their improved agronomic practices is below the requirements in terms of area coverage and number of beneficiaries. Most studies witnessed the clear contributions of agricultural technologies to the welfare of smallholder farmers and other poor households who benefited from the enhanced adoption of technologies and improved agricultural productivity and production over time (Asfaw, et al., 2011).

To alleviate this problem Participatory Varietal Selections (PVS) has been used as an approach to provide an opportunity to the farmers a large number of varietal choices and enhances farmer's access to crop varieties and increase variety diversity. Besides, it allows varietal selection in targeted areas with less time, and this helps for easily adopt and disseminate released varieties in many areas (Mulatu and Belete, 2001; Mulatu and Zelleke, 2002 and Ahmad J and Khan FA 2019). It is worth mentioning that although farmer participation is often advocated on the basis of equity, there are sound scientific and practical reasons for farmer involvement to increase the efficiency and the effectiveness of a breeding program (Ceccarelli and Grando, 2002 and Begna T, 2021). Pair-wise ranking, one kind of Participatory Rural Appraisal technique, is a structured method for ranking the selection criteria in a consensus-oriented manner to prioritize.

Therefore, this study was conducted to demonstrate selected high yielding highland

maize varieties along with their recommended packages and to assess farmers' perception about the varieties in the highlands of east Gojam zone, Ethiopia.

Materials and Methods

The experiment consisted of four released maize varieties namely; Jibat, Kolba and BH661 and BH660. This study was conducted in 2020 main cropping season in east Gojam zone of Ethiopia. The experiment was landed on five sites viz., Debremarkos Agricutural Research Station, Yobi Farmers Training Center , Giraram Farmers Training Center , Gudalema Farmers Training Center and Miseleawash Farmers Training Center.

The experiment was laid out in a single plot with no replication and its plot size was 10m*10m, with intra and inter spacing of 25 cm and 75cm, respectively.

Agronomic management operations were done according to the locality package used with the support of the researcher.

Data Collection

Plant height (cm), ear height (cm), ear length (cm), number of ears and yield (kg/ha) were collected on five randomly taken plants from the middle rows in each plot. Disease data was scored on grey leaf spot, *turcicum* leaf blight and rust during mid flowering time with a 1-9 scale.

Farmers' Selection Criteria

A mini field day was organized mainly focusing on setting the selection criteria's and evaluating each variety against it.

First men and women farmers were grouped separately to avoid dominance and assimilation of attitudes.Focus group discussions held with 10 men and 10 women randomly selected farmers from each *kebele*. Each group of farmers listed multiple selection criteria's deemed to be important and then weighted each criteria from one to five. A pair-wise and direct matrix ranking was used to rank the criteria. All the selection criteria were tabulated in a matrix scoring table, and each selection criterion had been compared with each of the others in a pair-wise fashion. Then the farmers evaluated each variety against the selected criteria's set using pair wise ranking method again. The selection criteria from 1 to 5 (5 = very good, 4 = good, 3 = average, 2 = poor and 1 = very poor) for each variety.

Generally, Farmers' evaluation and preference data was collected on plot basis from Miseleawash and Giraram trial sites at physiological maturing stage. Six Agricultural development agents were also participated in the selection processes. A total of 40 farmers participated during the field day in variety selection in the two locations, of which 20 were men farmers, and the remaining 20 were women farmers.

Results and Discussion

Yield performance of the varieties across the experimental sites

The individual location level, varieties showed performance discrepancy. The minimum yield (Kolba 2853.33) and maximum yield (BH661, 9280 kg/ha) was obtained from on-station and Giraram, respectively. This indicated that the varieties responded differently to varied environments (Table 1).

The BH661 (9280 kg/ha) and Jibat (8080 kg/ha) had nearly expressed their potential at Giraram than any other testing sites. The genotypes were not good at on-station testing site compared to other testing sites. Jibat was superior in yield to other varieties tested at Yobi enechifo, Gudalema and Misleawash. BH661 was the highest yielder at On-station and Giraram testing sites. Kolba was the lowest yielder at all locations.

As depicted, the highest combined yield was obtained from BH661 (6170.67kg/ha) followed by Jibat (6109.33 kg/ha) and BH660 (4946.67 kg/ha). The lowest yield was obtained from Kolba (4602.67 kg/ha). The range between minimum and the maximum yield was 1568.00 kg/ha. The combined mean yield difference between BH661 and Jibat was 61.34kg/ha. Koirala et al (2021) also corroborated with the findings of the present study.

Farmers' variety selection and Evaluation

At Giraram, five selection criteria were selected namely; disease resistance, stem thickness, earliness, productiveness and ear length. Based on these criteria the varieties were compared in pair-wise ranking approach. Ten men and Ten women farmers and four Development Agents (DA) participated in the selection process.

Disease resistance was one of the selection criteria and the highest score was given for the BH661 (4) and followed by jibat (2). The lowest score was given for kolba (0). This means kolba

was not resistant. In case of productivenss, the highest score was given to Jibat(3) followed by BH661(2) and Kolba(1), respectively. Generally, the highest total score was given to BH661 (12) followed by Jibat (9) and kolba (3) , respectively (Table 2). These varieties also ranked in the same as the total score. At Giraram the varieties yield yielding order and the farmers rank order had matched. Shango et al (2019) also advocated the similar findings to the present study.

At Misleawash, five selection criteria were selected namely; disease resistance, stem thickness, earliness, productiveness and Number of ears/plant. Based on these criteria the varieties were compared in pair-wise ranking approach. 10 men farmers and 10 women farmers and two, Development Agents (DA) participated in the evaluation process.

Disease resistance was one of the selection criteria and the highest score was given for the Kolba (3) and followed by BH661 (2). The lowest score was given for Jibat (1). This means Jibat was not resistant. In case of productivenss, the highest score was given to Kolba(4) followed by Jibat (2) and BH661(0), respectively (Table 3).

Generally, the highest total score was given to Kolba (15) followed by Jibat (7) and BH661 (2), respectively. These varieties also ranked in the same way as the total score. At Misleawash testing site there was a mismatching in both yield and rank ordered by the farmers. Note that in case of yield Jibat was the first yielder followed by BH661 and Kolba respectively. Tadese and Teklu (2022) also corroborated with the findings of the present study.

Table 1: Yield performance of varieties across the testing locations

Varieties	Yield kg/ha in kg					
	On-station	Yobi-enechifo	Giraram	Gudalema	Mislawash	Combined mean
kolba	2853.33	5120	4720	5600	4720	4602.67
BH661	3253.33	5600	9280	7360	5360	6170.67
Jibat	3106.67	6320	8080	7600	5440	6109.33
BH660	3173.33	6720	-	-	-	4946.67

Note that: "-" the variety was not plated at these sites.

Table 2. Farmer selection criteria and scores of the given value at Giraram (10 men+ 10 female farmers participated)

Varieties	Farmers' selection criteria							
	disease resistance	stem thickness	earliness	productiveness	ear length	total score	mean	rank
kolba	0	0	1	1	1	3	0.6	3
BH661	4	4	0	2	2	12	2.4	1
Jibat	2	2	2	3	0	9	1.8	2

Table 3. Farmer selection criteria and score of the given value at Miselawash (10 men+ 10 female farmers participated)

Varieties	Farmers' selection criteria							
	Disease resistance	productiveness	Number of ears/plant	Stem thickness	earliness	Total score	Mean	Rank
kolba	3	4	4	2	2	15	3	1
BH661	2	0	0	0	0	2	0.4	3
Jibat	1	2	2	1	1	7	1.4	2

Conclusions

In conclusion, the present study has highlighted the existence of superior varieties for the yield under the study. Both BH661 and Jibat varieties were the best yielder varieties Even though further study is important over locations and across years, BH661 and Jibat varieties could be potential varieties for current use. Since acidity is the main challenge in the highland of east Goam zone, this study has suggested that introduction, collection, and extensive hybridization of maize in Ethiopia is a crucial task to enhance genetic variability. Extensive screening of genotypes for acidity and disease should be worked out in this study area. The national maize breeding program should use marker assisted selection to quickly and effectively address the above mentioned constraints.

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