
RESEARCH ARTICLE

Selection of improved highland maize varieties by participatory plant breeding method for the West Harergheha zone of Eastern Ethiopia

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Abstract

The research activity was carried out with the objective of evaluating and selection of adaptable improved highland maize varieties and to assess farmers selection criteria with maize production techniques. It was executed at Chiro and Gemechis District of Western Harergheha Zone in main cropping season of 2019. A multidisciplinary team composed of breeder, pathologist, agronomist and agricultural extensionist was closely working both with the farmers and respective woreda agricultural experts and DAs. Regular visits, trainings and field days were conducted to provide for interaction among researchers, extension workers and farmers. The variety selection process was carried out from different dimensions including utilization, marketing and field performance. The major selection criteria of the farmers in the trial sites were almost similar except in very few cases where they vary in level of emphasis to a particular criterion. In general, trial farmers preferred and showed special interest to Huluka and Jibat varieties using the following important traits such as early maturity period, good biomass production, large cobe and seed size, grain color, disease and pest tolerance/resistance, market demand and better yield performance. Accordingly, as the preference of the farmers in each sites have

already been identified, it will be productive if the extension service and the maize breeding program consider farmers' preferences in varietal promotion activity. As a result, these two genotypes are recommended for production in the tested areas and similar agro ecological Zone of West Harergheha at larger scale to enhance adoption and diffusion for increasing production and productivity of the varieties.

Key words: Maize, varieties, selection, participatory plant breeding, farmers' preferences

Introduction

Maize (*Zea mays* L) is one of the worlds' three primary cereal crops. It occupies an important position in world economy and trade as a food, feed and industrial grain crop. Maize holds a unique position in world agriculture as a food, feed for livestock and as a source of diverse, industrially important products. Maize is one of the most important cereal crops in Ethiopia. It is an important field crop in terms of area coverage, production and utilization. It ranks second in area coverage and first in total production (CSA, 2018). It is grown for its food and feed values and one of the most important staples and cash crops and the main sources of calories (Wedajo *et al.*, 2015).

Ethiopia is the fifth largest producer of maize in Africa and smallholder farmers make up 94% of the crop production. The low productivity of maize is attributed to many factors like frequent occurrence of drought, declining of soil fertility, poor agronomic practice, cease/limited use of fertilizer, insufficient technology generation and adoption, lack of credit facilities, poor seed quality, disease, insect, pests and weeds. One of the major problems constraining the development of an economically successful agriculture is nutrient deficiency (CIMMYT,2004). In most parts of Western Harerghea highland small scale maize production gradually become permanent activity for different purpose. However, the production and productivity is very low. Therefore, there is strong interest from farmers to replace the currently growing low yielding variety by improved maize variety. Different research centers releases different technologies of maize. Given the great economic importance of maize, genetic breeding in this crop is very intense and mostly targeted at increasing grain yield (Vara Prasad and Shivani, 2018). However, on farm selection and demonstration of these varieties with their production package is not done widely in order to popularize the variety in the area. So, selection of maize varieties on farmers field using participatory plant breeding approach are the main tools for enhancing the adoption of technologies and to assess farmers' feedback. Therefore, this activity was designed to select and demonstrate the various improved highland maize varieties to farmers in major maize growing areas of Western Harerghea Zone, particularly, in Chiro and Gemechis districts with the objectives to evaluate improved highland maize varieties through participatory plant breeding selection and to assess farmers' selection criteria for improved maize varieties

to include in the future maize breeding program.

Material and method

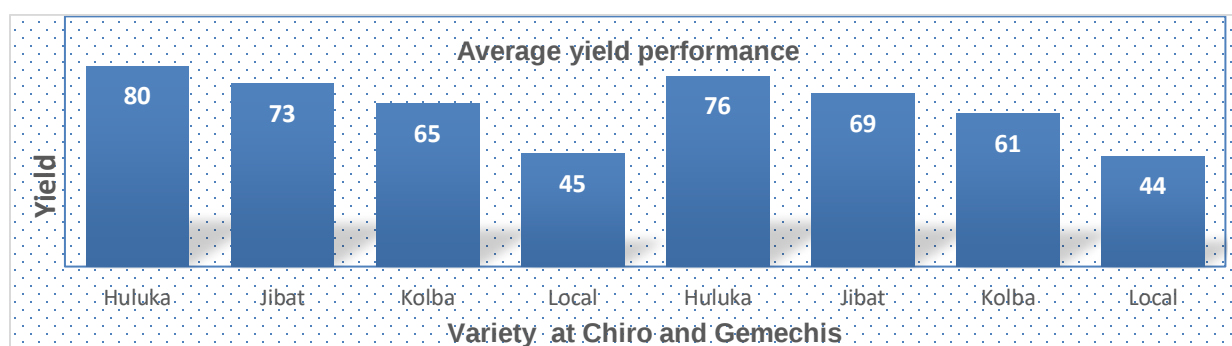
The activity was carried out in Arberekete kebele of Chiro woreda and Segenta quni of Gemechis Woreda at Western Harerghea Zone of Oromia region purposively selected based on potential in maize production. Chiro and Gemechis districts which are located in West Hararghe Zone of the Oromia National Regional state at about 324 km East of Addis Ababa. The Kebeles from the two districts used for the activity have an altitude range of 2200- 2274 masl. The area is characteried by bi modal type of rain fall. Short rainy season is from March to May and Main rainy season is from June to September. It has a maximum and minimum temperature of 23 oc and 12 oc respectively and the maximum and minimum rainfall of 1800 mm and 900 mm respectively. According to the soil map of Ethiopia the soil type is mainly black soils in the Kebeles. The trial was implemented 2019 main cropping season. There were 20 participating farmers based on their interest towards the technologies, willingness to manage and allocate field trial for the activity. Majority of the farmers were male farmers. The woreda agricultural office experts and Development Agents (DA) had also taken part in the implementation process. Multidisciplinary team composed of an Agricultural Extensionist, crop breeder and Agro-economic were in charge of this activity. Three different improved Highland maize varieties Jibat, Huluka and Kolba were used along with local check. The trial was carried out on selected farmers fields in such a way that four varieties (three improved and one local check) were planted side by side on equal sized plots (10m x 10m) replicated by the number of participant farmers. The demonstration of the trials was implemented on farmers' fields to create awareness about the maize varieties.

The demonstration of the trials was followed selection of participatory plant breeding approach by involving FRGs, development agents and experts at different growth stage of the crop. During crop growth data like yield of the crop and farmers preference toward the crop were collected through supervision and organizing mini field day by researchers and Development agent of the respective kebeles. The collected data (quantitative data) were analyzed by using average and frequency distribution while qualitative data were analyzed using descriptive statistics and preference ranking.

Results and discussion

During each visit discussions were made with the farmers and DAs right on the trial field in order to jointly evaluate the performance of the varieties on the field. During the visit both farmer's and DAs' data recording format were checked to observe how they handled the information gathering process. The varieties ranked from first to second in respective trial sites (Table 2). At the two districts , the varieties selected just by using their physical (color, size), chemical (taste, cookability) and market also exhibited outstanding field performance.

Figure 1: Average yield of maize varieties, in the Chiro and Gemechis districts



	Chiro District				Gemechis District			
	Huluka	Jibat	Kolba	Local	Huluka	Jibat	Kolba	Local
On-farm yield (Qt/ha)	80	73	65	45	76	69	61	44

In the two districts the varieties tested with twenty trial farmers as indicated earlier were Jibat, Huluka Kolba and local varieties. As shown in fig 1, Huluka had the highest (77% at Chiro and 72% at Gemechis) yield advantage over the local followed by Jibat (62% at Chiro and 56% at Gemechis). Although both varieties were appreciated for being high yielder, its susceptibility to fall army worm was expressed as a concern by the farmers. The local variety was comparatively found poor both in yield and

uniformity. Based on the criteria set by the farmers, these varieties were ranked in order from most to least preferred. The ranking process was done by identifying farmers' response (from most preferred/very good (score 1) to least preferred/poor (score 3) against each one of the selection criteria. Based on discussion with the trial farmers the following selection criteria were identified. At all the stages farmers preferences were given priority.

These include maturity period ,disease and pest tolerance, biomass production, cob size, seed size, grain color, suitability for Injera and bread, demand in the local market which is basically a reflection of the combination of preferences for

certain physical and chemical characteristics. Based on these selection criteria farmers in each sites ranked the maize varieties as indicated in Table 2.

Table 2: Rank of different maize varieties as evaluated by the FRG farmers

Chiro and Gemechis District farmers (N-60)							
		Cob size	Disease resistant	Market preference	Sweetness	Yield	Rank
Huluka	20	30	35	35	30	37	1
Jibat	18	20	15	15	20	20	2
Kolba	15	8	10	10	10	3	3
Local	7	2	0	0	0	0	4

The major variety selection criteria of farmers in the trial sites were almost similar except in very few cases where they vary in level of emphasis to a particular criterion. In general, color, cob size, taste and market demand were identified as important farmer criteria. The other important criteria were related to field performance of the variety that includes: yield and tolerance to disease and pest followed by maturity period. The farmers have identified, using the above criteria, the varieties that suits their respective location. Accordingly, the trial farmers selects Huluka and Jibat improved highland maize varieties.

In conclusion we would like to emphasis on the special interest showed by the farmers and preferred preferred traits such as early maturity period, good biomass production, large cobe and seed size, grain color, disease and pest tolerance/resistance, market demand and better yield performance. Based on the criteria cited most of the farmer's preferred Huluka and Jibat

varieties. Despite the high yield potential of preferred varieties in respective sites, absence of enough market information system leaves no option for incentive to continue production. Thus, there need to be a mechanism put in place to provide market information for the farmers. The trial farmers have now developed a better capacity in identifying best varieties and management practices of maize, thus they should be given the opportunity to share their experience to other farmers thereby strengthen farmer to farmer extension. Accordingly, as the preference of the farmers in each sites have already been identified, it will be productive if the extension service and the maize breeding program consider farmers' preferences in varietal promotion activity. As a result, these two genotypes are recommended for production in the tested areas and similar agro ecological Zone of West Harerghea at larger scale to enhance adoption and diffusion for increasing production and productivity of the varieties.

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