Evaluation of Improved Maize Genotypes for Grain Yield and Yield Components in Chilga District, North Western Ethiopia

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Abstract: ***In order to evaluate the performance of improved maize genotypes, an experiment was conducted at Chilga district of Northwestern Ethiopia, during 2013 main cropping season. The experiment was laid out in a randomized complete block design with three replications. The data were recorded on plant height, ear height, number of ears/plot, field weight, grain yield and 1000 grain weight. All varieties showed significant differences with each other for all the traits studied. Variety P3812W had the highest grain yield of 4877 kg ha^{-1}. The highest plant height of 209.67 cm was noted in variety BH 670. The local variety had maximum ear height of 106.67cm. MH138Q had maximum number of ears which is 35. Data recorded for field weight showed that genotype P3812W had maximum field weight of 5.67kg. Maximum value for 1000 grain weight was shown by BH 660 (375.00g). These varieties had a wide genetic background, thus showing grain yield ranges from 2334 to 4877 kg ha^{-1}. Maize variety P3812W was found most promising, which has the potential to increase the average yield of maize in Chilga district and is therefore recommended for general cultivation.***

Keywords: Chilga, evaluation, grain yield, maize, variety

1. Introduction

Maize is a major food crop and source of animal feed in Africa, the Americas and Asia as well as a feed for livestock in these regions [1]. It is the third most important cereal after wheat and rice globally and the most widely distributed [2]. It is one of the most important field crops in terms of area coverage, production, and economic importance in Ethiopia.

Maize in northwestern Ethiopia is used directly for human consumption as food or local drinks. In addition, maize leaves are used for feed to animals and dry stalks are used as a fuel and for construction of fences. Both the area and volume of production of maize has been growing steadily for the last two decades throughout the region in spite of the fact that it is a recently introduced crop. However, it suffers much from low fertility, low management, lack of improved varieties, very severe infections of foliar diseases like turcicum leaf blight, high infestations of striga and stalk borers [3]. As result farmers produced a grain yield lower than 1,500 kg ha^{-1}. A number of improved varieties of maize are evaluated and released in Ethiopian agricultural research system. However, improved maize varieties especially recently released varieties were not evaluated in their genetic potential for yield and related agronomic traits in the study area.

Variability in genetic potential among varieties is a major component of variable yield. Olakajo and Iken [4] reported that maize varieties produce significantly different yields at different locations. Olaoye [5] emphasized the need to evaluate maize varieties in various agro-ecological zones for their adaptation, yield potential and disease reactions so as to release suitable varieties for cultivation on farmers' fields.

Therefore, evaluation of improved varieties of maize along with the locally adapted variety was very important in the agro climatic condition of Chilga district of northwestern Ethiopia. The overall objectives of this study were to evaluate the performance of improved maize varieties for their adaptability and to recommend a suitable one for maize growers. The results from this investigation would serve as a guide to plant breeders to initiate an improvement programme.

2. Materials and Methods

The reported experiment was conducted at Chilga district on farmer field, northwestern Ethiopia. The experimental material comprised of 19 improved maize genotypes and one local check. All the improved 19 maize varieties were obtained from Bako Agricultural Research Center (BARC), Ethiopia. The genotypes were planted during the main rainy season of 2013 in a well prepared soil under randomized complete block design with three replications. Plot size was kept at 5.1 m long with two rows having row to row and plant to plant distance of 75 and 30 cm, respectively. Sowing was done with the help of hand drill. Two seeds per hill were planted, which were thinned to one plant per hill at 4-5 leaf stage. Fertilizer in the form of Urea and DAP was applied at the rate of 200 and 150kg ha^{-1}, respectively. Standard cultural practices were followed from sowing till harvesting during the entire crop season.

Data was recorded on five competitive plants from each plot for yield related traits viz; plant height (cm) and ear height (cm) while number of ears/plot, field weight (kg), grain yield (kg ha^{-1}) and 1000-grains weight (g) were calculated for the entire plot. The data were subject to the analysis of variance techniques wherein means were compared using Duncan multiple range test (DMRT) at 0.05 level of probability [6].

3. Results and Discussion

Analysis of Variance

The analysis of variance (ANOVA) for different plant traits recorded is given in Table 1. According to ANOVA, the varieties differ highly significantly for the traits plant height (cm), ear height (cm), field weight (kg plot^{-1}) and grain yield (kg ha^{-1}) while significant difference was noted for the traits 1000 grains weight (g) and number of ears/plot (Table 1).

Plant height (cm)

All genotypes showed significant difference for plant height (Table 2). Among the tested genotypes, BH670 had the highest plant height (209.67cm) followed by local, BH661, BH660, P3812W, BH546 and 30G19 with the values of 208.67, 207.00, 200.60, 198.00 193.33 and 192.67cm respectively, while short statured plants of 128.07cm were recorded in genotype BH140. Hussain *et al.* [7] reported differential pattern of maize varieties for plant height.

Ear height (cm)

The variations in ear height (cm) in present investigations were found to be highly significant due to divergent maize genotypes. The local check had maximum ear height (106.667cm), while the shortest ear height was recorded in BHQP542 (57.60cm). These results get sufficient validation from the findings of [8] and [9].

Number of ears plot^{-1}

Significant differences were recorded among the maize varieties tested for number of ears plot^{-1} (Table 2). Genotype MH138Q produced maximum number of ears plot^{-1} (35.0), while that of genotype BHQP542 produced minimum number of ears plot^{-1} (21.00). Similar genetic variations were observed by [10] among different hybrids.

Field weight plot^{-1}

Scrutiny of the data regarding field weight plot^{-1} revealed significant differences for the parameter among the studied genotypes (Table 2). According to the mean values genotype P3812W had maximum field weight (5.67kg) while the genotypes BHQP542 and BHQPY545 showed minimum field weight with the values of 2.77 and 2.73 kg, respectively (Table 2).

Grain yield (kg ha^{-1})

Data pertaining to grain yield are shown in Table 2. Significant differences were revealed for grain yield among different genotypes used in this study. Genotype P3812W showed higher grain yield (4877kg ha^{-1}), while the genotype BHQPY545 produced lower grain yield (2334kg ha^{-1}). Similar results were reported by [11] and [12] who evaluated and identified high yielding maize varieties among different genotypes tested.

1000 Grain weight (g)

Grain weight is an important yield parameter and is vary from genotype to genotype. Data pertaining 1000-grain weight (g) of the 20 genotypes (Table 2) were significantly different. Maximum value for 1000-grain weight was shown by BH660 (375.00g), while the minimum value was recorded in genotype MH138Q (233.33g). These results are in line with the finding of [10] and [9].

The possible reason for the observed differences for all the traits recorded could be because of variation in the genetic makeup of the studied varieties. In support of this finding, different researchers have reported significant amount of variability in different maize populations studied. Grzesiak [13] observed considerable genotypic variability among various maize genotypes for different traits. Significant genetic differences for morphological parameter for maize genotypes were also reported [10].

4. Conclusion

After estimating the genetic diversity of 20 different maize genotypes, it is concluded that the genotype P3812W remained superior in terms of yield production as well as in other important yield components. It is, therefore suggested that P3812W could be recommended for general cultivation in the agro-climatic condition of Chilga district. It is also suggested that this variety should be brought forward for testing across the various ecology of north western Ethiopia in particular and the country at large. The present study revealed considerable amount of diversity among the tested populations which could be manipulated for further improvement in maize breeding.

Table 1: Analysis of variance for plant traits of maize genotypes planted at Chilga district of Northwestern Ethiopia, during 2013.

Source of variation	Plant Height (cm)	Ear Height (cm)	No. of ears /plot	Field weight (Kg plot^{-1})	Grain yield (kg ha^{-1})	1000 grains weight (g)
Mean	181.25	77.01	28.65	4.00	3396	295.20
CV (%)	12.63	11.33	17.69	18.55	18.17	14.51
F Value	2.49**	8.89**	1.87*	2.82**	3.09**	2.05*

*Significant different at 5%, ** significance different at 1%.

Table 2: Mean performance for plant traits of maize genotypes planted at Chilga district of North western Ethiopia, during 2013.

Varieties	Plant Height (cm)	Ear Height (cm)	No. ears/plot	Field weight (Kg plot^{-1})	Grain yield (kg ha^{-1})	1000 grains weight (g)
BH670	209.67A	101.67AB	34.33AB	4.67ABC	3683BC	308.33ABCDE
Local	208.67A	106.67A	24.33BCD	3.87BCDE	3038BCDE	358.33AB
BH661	207.00A	94.33ABCD	28.00ABCD	5.13AB	4068AB	312.50ABCDE
BH660	200.60A	97.27ABC	24.00CD	4.00BCDE	3124BCDE	375.00A
P3812W	198.00A	70.33FGHIJ	34.33AB	5.67A	4877A	283.33BCDE
BH546	193.33A	82.00CDEFG	31.33ABC	4.07BCDE	3370BCDE	275.00BCDE
30G19	192.67A	68.00GHIJ	26.00ABCD	4.20BCDE	3483BCDE	300.00ABCDE
BH540	189.33AB	77.67EFGH	31.00ABC	4.20BCDE	3757ABC	262.50CDE

BH543	188.00AB	90.67BCDE	29.67ABCD	4.07BCDE	3381BCDE	291.67ABCDE
AMH760Q	186.33AB	85.67CDEF	28.33ABCD	3.13DE	2710CDE	300.00ABCDE
Gibat	183.33AB	76.00EFGHI	31.67ABC	4.53ABCD	3990AB	291.67ABCDE
SCDUMA43	176.67AB	64.67HIJ	32.00ABC	4.13BCDE	3707BC	325.00ABCD
MH138Q	173.00AB	60.67IJ	35.00A	4.13BCDE	3870ABC	233.33E
BH547	172.67AB	79.00DEFGH	28.67ABCD	3.63CDE	3080BCDE	300.00ABCDE
BHQPY545	170.00ABC	67.67HIJ	24.67BCD	2.73E	2334E	250.00DE
Wenchi	169.67ABC	64.33HIJ	27.33ABCD	3.87BCDE	3412BCDE	283.33BCDE
BHQP542	166.27ABC	57.60J	21.00D	2.77E	2409DE	258.33CDE
SC627	165.67ABC	65.80HIJ	27.00ABCD	4.07BCDE	3589BCD	341.67ABC
MH130	146.00BC	54.67J	31.33ABC	4.13BCDE	3616BCD	266.67CDE
BH140	128.07C	75.50EFGHI	23.00CD	3.07DE	2424DC	287.50BCDE

Different letters showed significant while same letters showed non-significant variation at 0.05% probability level of DMRT

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Author Profile

Daniel Tadesse received his B.Sc. degree in Biology in 2004. He has also received his M.Sc. degrees in Plant breeding in 2010. Both degrees were obtained at Bahir Dar University, Ethiopia. During 2005-2008, he worked as teacher at preparatory school. He has also worked as a junior researcher at Hawassa maize research center of Ethiopia for a short period of time. From November 2010 till now, he is working as a lecturer and researcher at University of Gondar, Ethiopia.