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Performance evaluation of improved hybrid and open pollinated maize varieties in potential maize producing area of Benishangul Gumuz region

Megersa Mengesha, Adise dinberu, Desta Bekele and Beyene Abebe

Ethiopian Institute of Agricultural Research Addis Ababa, Ethiopia

Abstract

During the main rainy season, seven maize genotypes were planted in RCBD with three replications each in a 5 meter by. 25 meter (row) plot to evaluate adaptation performance and identify high yielding and moisture stress tolerant genotypes adapted to Kumruk district in order to increase net national crop production in general and product diversification in maize benshangul gumuz in particular. The analysis of variance revealed that genotypes in the test differed significantly at the (p=0.05) probability level for all traits, and the maize grain yield mean value comparison or mean separation result revealed that genotype BH-549 is superior to others with 87.4qt/ha quintals grain yield per hectare value, followed by MHQ-138 and MH-140 genotypes with 70.1 and 62.7 quintals grain yield per hectare value. The superior genotype BH-549 outperformed the other genotypes by 142.78 percent and 74.8 percent, respectively, according to the productivity criterion.

Keywords: adaptation, variance, genotype, Kumruk

Introduction

Ethiopia has been growing maize for almost 500 years (Alemu *et al*., 2012) [1]. It can be found growing in all parts of the Ethiopia. Since 1985, a million hectares of land have generated roughly 17 million quintals of maize every year (Belete, 2020) [2].

Benishangul-Gumuz was previously regarded as a vital growth corridor for the country due to its wide and fertile territory. Several investors have previously worked in commercial farming, producing a range of cash crops for export, such as sesame and groundnuts (Chemura *et al*., 2021) [5]. Every year, even small-scale farmers used to produce surpluses. Residents were largely unaware of government safety-net initiatives.

Maize (*Zea mays* L.) is the second most important commodity crop in terms of area coverage, after only tef. The southern, western, and south-western regions, as well as the Hararge highlands in the east, are the main producing regions (Yami *et al*., 2020) [14]. The majority of maize is consumed by humans (Dilnesaw *et al*., 2019) [7]. In terms of yield per unit area, maize is the most productive crop (Westengen *et al*., 2019) [13]. Over the last 30 years, the area of maize hectares has steadily expanded, while the acreage of other cereals has dropped (Mutta *et al*., 2011) [11]. Maize study in Ethiopia dates back to 1952, when it began at Jima Junior Agricultural College (Westengen *et al*., 2019; Eticha, 2020) [13, 8].

There are four agro-ecologies being studied at the moment: mid-altitude sub-humid, mid-altitude moisture stress, highland sub-humid and lowland sub-humid, each with its own research facilities (Terefa, 2017) [12]. The research team includes experts in breeding, agronomy, entomology, pathology, weed science, soil science, agricultural economics, and farming systems research, as well as research and extension collaboration. Four improved populations and three hybrids were suggested for production. There is a lot of potential for maize production in Ethiopia's highlands and lowlands if the right varieties are developed. Irrigation potential and the exploitation of bimodal rainfall patterns in the Southern and Eastern areas are two more possibilities.

Crop development is critical for improving agricultural output and ensuring food and nutrition security. Climate change is exacerbating the demand for new crop kinds. To keep up with constantly changing climate conditions, farmers must replace crop varieties with better-adapted kinds (Hellin *et al*., 2014) [9]. Where acceptable modern varieties do not exist, suitable farmer varieties are required ("variety" refers to all farmed materials in this context). The issue of variety replacement has yet to be successfully addressed. One proposed remedy is to enhance variety availability by speeding up crop breeding, removing older varieties from the seed supply chain, and aggressively promoting new varieties to farmers.

We were proposed this activity to solve moisture stress that has been caused by erratic rainy type causing yield losses in the area and to address those materials to the local farmers.

Materials and Methods

Description of the study area

Agro-climatically, the Kurmuk district is divided into two zones: hot to warm moist lowland plain and hot to warm sub-humid lowland plain. This subzone's topography is mostly flat with few undulations. The average annual rainfall is between 800 and 1200 mm. The average annual temperature ranges from 25 to 30 degrees Celsius. The growth phase lasts between 121 and 180 days. The district lies between 10° 31' 59" N latitude and 34° 16' 59" E longitude, with elevations ranging from 500 to 1200 meters above sea level. It lies roughly 800 kilometers west of Addis Ababa in the direction to the north. It can be found in the Assosa Zone of the Benshangul gumuz Region, in the plain lands of the lower bordering Sudan. Nitosols, which are clay loam in nature, are thought to be the soil.

Design Used and Treatment Details

The design used was randomized complete block (RCB) design having three replications. The RCBD was row column arrangement for electronic data capturing with in which the plot have two rows and the column and the replication or the block are the same. There were fourteen rows (plot). The number of plants row^{-1} was 22 (twenty two). Plant spacing was 75cm and 25cm between row and plant, respectively. The Space between plots and blocks were 0.5m and 1.5m, respectively. The seed rate was 25 kgha^{-1}. The fertilizer rate was 125 kgha^{-1} NPS at planting and application of 189kgha^{-1} of Urea in 2 splits that is 1/2 at planting and 1/2 at knee height. The experiment consisted of seven improved maize varieties considering BH545 as standard check to low land (500-1500m.a.s.l) area of the selected farms. The treatments were Hybrids:-BH546, BH549, MH-140, MHQ-138 and OPVS (Open Pollinated Varieties): MOPV-2, MOPV-6Q, and MOPV-4.

Data Collection and Analysis

Plant height (cm), ear height (cm), total number of ears plant-1, number of ears per plot, and grain yield were all measured (kgha-1). SAS was used to do statistical analysis of variance on the acquired data for each character (SAS Institute, 20014). At a 5% probability level, significant means were separated using the least significant difference (LSD 0.05).

Data collection compresses

Days to 50% anthesis: the number of days from emergence to when 50% of the plants started shedding pollen.
Days to 50% silking: the number of days from emergence to when 50% of the plants in the plot produced 3cm long silk.
Days to 75% maturity: the number of days from emergence to when 75% of the plants in the plot reached physiological maturity.

Plant height (cm): Heights of five randomly taken plants from each plot measured from the ground level to the base of tassel and the average was recorded.

Ear height (cm): Ear heights of five randomly taken plants from each plot were measured from Number of ears per plant: number of ears per plant from five randomly taken plants of each plot was counted and the average was recorded.
Ear length (cm): Length of five randomly taken ears from each plot was measured using centimeter and the average was recorded

Ear diameter (cm): Diameter of five randomly taken ears from each plot was measured using calliper and the average was recorded.

Number of kernels per row: The number kernels per row from five randomly taken ears per plot were counted and the mean was recorded.

Number of rows per ear: The number of rows/ear from five randomly taken ears from each plot was counted and the mean was recorded.

1000 kernel weight: Thousands of kernels from each plot were counted by automatic seed counter and were weighed using a sensitive balance after adjusting the moisture content to 12.5%.

Adjusted yield (kg/plot): The yield of grain of each plot were weighed and adjusted to 12.5% moisture. Adjusted yield per plot= (FW×0.81) × (100-MMR)/ (100-12.5) Grain yield (kg/ha): this was calculated by converting plot yield into hectare basis. GY= (Yield per plot (g) / Plot size) X 10000 m

Results and Discussion

Rainfall and Temperature

Rainfall distribution in 2020 was not uniform or irrational, as is common. For example, it rained for at least three weeks throughout sowing season. Pollen loss and silking stress can reduce yields more than any other stage of crop development. (Dilnesaw *et al*., 2019) [7]. When the plant is very dehydrated, any silks that do emerge may soon desiccate, rendering the plant pollen-insensitive (Mutta *et al*., 2011) [11]. High temperatures can cause problems even when soil moisture is adequate, and they will worsen problems in drought-stressed maize, particularly during pollination and kernel development (Dawit *et al*., 2014; [6] Westengen *et al*., 2019 [13]; Chemura *et al*., 2021) [5].

Table 1: analyses of variance for Adaptation Improved low land moisture stress hybrid and OPM maize

No.	Genotype	PH	EH	NE	GY (t/ha)
1.	BH-549	234^{a}	114.67	29^{a}	8.74^{a}
2.	MOPV-2	229.33^{a}	113.33	19.33^{b}	5.85^{c}
3.	MOPV-6Q	183.67^{bc}	120.33	22^{b}	6.16^{bc}
4.	MH-140	231^{a}	127.67	20^{b}	6.27^{bc}
5.	MOPV-4	218.67^{ab}	115.67	12.33^{c}	3.83^{d}
6.	BH-545	171.33^{c}	123.33	22^{b}	5.60^{c}
7.	MHQ-138	207.67^{abc}	110.33	24^{ab}	7.01^{ab}
LSD -value		40.532	17.662	6.9499	1.923
CV		10.81	8.42	18.48	14.99
Mean		210.81	117.9	21.143	6.2092

Means with similar alphabets are not significantly different at $P<0.05$ using DMRT. Note: EH =Ear height, NE =Number of ear per plot, PH =Plant height & GY=Grain yield

Plant Height: Since there was not a year by maize hybrid interaction, data were combined over location for maize hybrid. BH549 produced the greatest height but not statically different from MH-140 and MOPV-2 while, BH-545 resulted in the shortest and MHQ-138 produced an intermediate height.

Ear Height / Separating the means of each variety is irrelevant in all circumstances.

Number of ear: The number of ears produced was influenced by the variety, with MOPV-4 producing the most (29) and being the shortest (MOPV-4). The number of ears per plant varied greatly depending on the variety, according to the statistical analysis of variance. The BH549 variety produced more than 100 percent more ears per plant than MOPV-4, according to the mean values of the number of ears per plant in Table 1. It's probable that the genetic variances between the two types are to blame Dawit and Bedru *et al*. [6] (Beshir; Alemu *et al*., 2012) [1] revealed how the number of ears per plant is determined by genetics.

Grain Yield

Grain yield was highly (p<0.05) affected by variety. As indicated in Table 1, the maximum mean value of grain yield (8.7 t ha^{-1}) was obtained from BH549 variety whereas minimum grain yield (3.82 t ha^{-1}) was obtained from MOPV-4 (Table 1) as already known the hybrid is more prolific than open pollenated one (Kodamaya *et al*., 2007; Mutta *et al*., 2011; Beyene *et al*., 2016; Yami *et al*., 2020) [10, 11, 4, 14].

Conclusion and Recommendation

This suggests that there is a lot of phenotypic diversity and that all types differ in terms of the features they provide, signalling that more research is needed. The grain yield mean value per hectare in tons for BH549 was substantially higher (8.74), followed by MHQ-138 (7.01) and MH-140 (6.27). As can be observed, the majority of the varieties produce more than their test area. This could be related to high temperatures hastening physiological processes, as well as the clay nature of the soil, which has a higher potential for water holding capacity, supplying enough moisture when there is a water shortage.

References

1. Alemu D, Ayele G, Behute B, Beyone Y, Dewana R, Fekadu B, *et al.* Cereals Availability Study in Ethiopia, 2008. doi: 10.2788/14890. 2012.
2. Belete AS. Analysis of technical efficiency in maize production in Guji Zone: Stochastic frontier model. Agric Food Secur, 2020, 1-15.
3. Beshir B. Open Pollinated Maize Seed Systems Linkages through Farmer Research Group in Central Rift Valley of Ethiopia, 43-59.
4. Beyene LM, Shiferaw B, Sahoo A, Gbegbelegbe S. working paper, 2016-17.
5. Chemura A, Yalew AW, Gornott C. Quantifying Agroforestry Yield Buffering Potential Under Climate Change in the Smallholder Maize Farming Systems of Ethiopia. 2021;3:1-14.
6. Dawit A, Chilot Y, Adam B, Agajie T. Situation and Outlook of Maize in Ethiopia of Maize in Ethiopia, 2014.
7. Dilnesaw Z, Ebrahim M, Getnet B, Mequaninnet Y. Evaluation of Maize (*Zea mays* L.) Variety Adaptation Performance at Omo Kuraz Evaluation of Maize (*Zea mays* L.) Variety Adaptation Performance at Omo Kuraz Sugar Development Project South Omo Zone, SNNPRs, Ethiopia. 2019. doi: 10.22192/ijamr
8. Eticha AB. Contributing factors of maize production using multiple linear regressions in mizan- aman district, bench-shako zone, Southwest of Ethiopia. 2020;5:40-45.
9. Hellin J, Bellon MR, Hearne SJ Maize Landraces and Adaptation to Climate Change in Mexico, 37-41
10. Kodamaya S, Gough AE, Gladwin CH, Hildebrand PE. 242 the developing economies, 2007, 2.
11. Mutta D, Kefri PO, Pwani MP. Paper prepared for the UNU-IAS workshop on Indigenous Peoples, Marginalised Populations and Climate Change: Vulnerability, Adaptation and Traditional Knowledge, Mexico. 2011 July;1:1-16.
12. Terefa F. effect of irrigation scheduling and nitrogen fertilizer rates on growth and productivity of cabbage (*Brassica oleracea* L. var. capitata) at buyo. 2017.
13. Westengen OT, Haug R, Guthiga P, Macharia E. Governing Seeds in East Africa in the Face of Climate Change: Assessing Political and Social Outcomes. 2019. doi: 10.3389/fsufs.2019.00053
14. Yami M, Meyer F, Hassan R. The impact of production shocks on maize markets in Ethiopia : implications for regional trade and food security, 2020, 5.