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Original Research Article

Yield Performance of *Zea Mays (L.)* Varieties under Irrigation in Debub Omo, Southern Ethiopia

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Abstract

Maize (*Zea mays L.*) is one of the most important cereal crops in Ethiopia. The low productivity of maize has been partly due to the use of drought sucesptible local varieties. The trials were excuted at Dasenech, Gyngatom and Hammer woredas, Debub Omo Zone of Southern Ethiopia using four released and one farmer maize varieties under irrigated conditions in 2019. Four improved (Melkass-4, Melkassa7, MH140, MH6Q, and one local) maize varieties were involved in the treatment. The trial was carried out using a randomized complete block design with three replications under irrigation at Dasenech, Gyngatom, and Hammer during the 2019 cropping season. The combined result showed significant differences observed among the varieties for the traits under study. A maximum plant height of 196.33 cm was recorded in the local check, while the minimum plant height of 167.78 cm was noted for Melkassa-4. Ear length ranged from 21.667 cm in the local check to 27.778 cm in MH140. Hundred seed weight ranged from 28.889 g in the local check to 34.444 g for MH6Q. Seed yield ranged from 2653.9 kg ha^{-1} in the local check to 4977.4 kg ha^{-}) for MH6Q. Maize varieties MH6Q 4977.4 kg ha^{-1} and Melkassa-4 3922.6 kg ha^{-1} could be recommended for the study areas and other similar agro-ecologies for improved maize production and productivity.

Keywords: Improved maize, Local maize, Yield components, Varieties, Seed yield

INTRODUCTION

Maize is one of the most important cereals after wheat and rice in world agriculture and is widely distributed in the world [1]. It is originated in Central America and introduced to West Africa in the early 1500s by Portuguese traders [2]. Maize is the most important cereal food crop in sub-Saharan Africa (SSA), particularly in eastern and southern Africa where it accounts for 53% of the total cereal area [3], and about 30-70% of the total caloric consumption obtained from maize [4]. Maize was introduced to Ethiopia during the 1600-the 1700s [5]. It is currently grown across 13 agro-ecological zones which together cover about 90% of the country. Moreover, it is an increasingly popular crop in Ethiopia. For many years, maize in Ethiopia has been the first in production and second next to tef (*Eragrostis zuccagni (Zuccagni)* Trotter) in the area of cultivated land [6]. The importance of maize in the country's agricultural economy and household-level food security calls for increasing its production and productivity through the use of modern technologies [7].

Maize is one of the most important cereal crops in Ethiopia, ranking second in area coverage and first in total production. Although it is one of the strategic crops for the achievement of food security in the country, more than 90% of the production is handled by small-scale farmers under rain-fed growing conditions. About 40% of the total maize growing area is also located in low-moisture stress areas, where it contributes less than 20% to the total annual production. The low yield in these areas, like other sub-Saharan African countries, is mainly attributed to recurrent drought, low levels of fertilizer use, and low adoption of improved varieties.

Maize is one of the most important cereal crops in the Southern region in general and the Debub Omo Zone in particular. Even though maize is important in the study area, several factors constrained its productivity. This is due to the lack of improved varieties associated with biophysical factors that have been appreciated as one of the primary sources of lower maize production. There had no trend of using improved maize varieties in the existing production system so it is the bottleneck problem in the target area. Therefore, this study is initiated to select the best-performing maize varieties in the study area.

MATERIALS AND METHODS

Study Area Description

Field experiments were carried out in 2019 cropping season

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at Dasenech, Hammer, and Nyangatom districts under irrigated conditions in Debub Omo Zone. The altitude of the areas varies between 353 m and 606 m for Dasenech (gives GPS coordinates, longitude and latitude of the areas), 371 m and 2084 m for Hammer (GPS coordinates), and 380 m and 497 m for Nyangatom (longitude and latitude of the areas), respectively.

Treatments and Experimental Design

Five maize (Melkassa-4, MH140, MH6Q, Melkassa-7 improved, and a local check) were included in the study. Field experiments were laid out in a randomized complete block design with three replications. Maize was sown in ten rows per plot with a spacing of 75 cm between rows and 25 cm between plants with a gross plot area of (7.5 m x 10 m = 75 m^2).

Data collection

Seed Yield

Seed yield was measured from the central rows with plot areas (10 m x 4.5 m = 45 m^2). Five plants were randomly selected from the sample rows to determine seed yield and yield components.

Data Analysis

Data were analyzed using the R statistical software version 3.4.1. Means were separated using Fisher's least significant difference (LSD) test.

RESULTS AND DISCUSSIONS

Plant height

The combined result revealed significant variations observed among the maize varieties for plant height **(Table 1)**. This result is in line with the report of Tekle (2014) on lowland maize varieties, which coincides with results reported by Wedajo and Tekle (2014) on midland maize varieties. Similar results were reported by the previous findings [8,9] on maize, indicating that there existed significant variations among the maize varieties in this study. The maximum plant height of 241 cm was recorded for the local check at Gyngatom while the minimum of 143 cm was obtained for Melkass-4 at Dasenech **(Table 2)**. Plant height ranged from 167.78 cm for Melkassa-4 to 196.33 cm for the local check **(Table 3)**.

Table 1. Mean Square Values for Plant Height, Ear Length, Hundred Seed Weight, and Seed Yield of Maize at Debub Omo Zone, in 2019.

Source of Variations	DF	PH (cm)	EL (cm)	HSW (gm)	GY (kg ha^{-1})
Rep	2	214.47*	9.34*	36.60*	247146*
Variety	4	1112.81*	46.80***	48.14*	6887973***
Location	2	1346.47	16.16	8.60	596099
Location*Variety	8	241.66	16.60*	11.54	515431
Error	28	364.80	6.1175	12.12	326368

*Note that: *, ** and *** indicate significance at p<0.05, P<0.01 and P< 0.001, respectively.*

Table 2. Mean Values of Plant Height, Ear Length, Hundred Seed Weight, and Seed Yield of Maize at Debub Omo Zone, in 2019.

Varieties	PH (cm)	EL (cm)	HSW (gm)	GY (kg ha^{-1})
Melkassa-4	167.78b	26.33a		3922.6b
MH140	186.22ab	27.78a	30.11ab	3168.9c
MH6Q	181.56ab	24.78ab	34.44a	4977.4a
Mekkassa-7	173.44ab	25.67a	29.56b	3759.7b
Local	196.33a	21.67b	28.89b	2653.9d
Mean	181.07	25.24	30.400	3696.5
CV (%)	10.55	9.80	11.45	15.45
LSD (0.05)	26.232	3.40	4.78	784.61

Table 3. Mean values for Plant Height, Ear Length, Hundred Seed Weight, and Seed Yield of Maize at Dasenech, Hammer and GYngatom Districts, in 2019.

Variety	PH (cm)				EL (cm)				HSW (g)				GY (kg ha^{-1})			
	Dasenech	Hammer	Gynagatom	Mean	Dasenech	Hammer	Gynagatom	Mean	Dasenech	Hammer	Gynagatom	Mean	Dasenech	Hammer	Gynagatom	Mean
Melks.-4	143	161	193	165	27	23	26	25	37	24	38	33	5068	2647	4190	3969
MH140	163	180	219	187	30	24	29	28	35	30	34	33	3761	2081	3770	3204
MH6Q	154	209	204	189	24	27	25	25	32	32	40	34	5070	3958	5660	4896
Melks.7	175	185	197	186	29	21	29	26	32	25	37	31	4163	1725	4848	3579
Local	182	182	241	202	23	22	27	17	31	25	32	29	3162	2667	1692	2507
CV (%)	4	12	4	7	3	5	3	4	5	3	5	5	23	12	10	15
$LSD_{(0.05)}$	8	41	18	22	1	2	2	2	2	2	3	2	844	588	715	715

Melks.-4= Melkassa-4, Melks.7= Melkassa-7.

Ear length

The result exhibited that there were significant differences noted amongst the varieties for ear length **(Table 1)**. Maximum ear length of 30 cm was recorded for MH140 at Dasenech while the minimum 21 cm was noted for Melkassa-7 at Hammer **(Table 3)**. Ear length ranged from 21.66 cm for the local check to 27.78 cm for MH140 **(Table 2)**.

Hundred seed weight

The result indicated that siginificant variations observed among varieties for hundred seeds weight **(Table 1)**. The maximum hundred seeds weight of 40 g was noted for

MH6Q at Gyngatom while the minimum 24 g was recorded fromr Melkassa-4 at Hammer **(Table 3)**. Mean values for hundred seeds weight ranged from 28.89 g for the local check to 34.44 g for MH6Q. Based on the present findings, it could be concluded that the highest 100 seeds weight observed from the improved varieties might be credited to the highest seed yield noted for the improved varieties over the local check.

Seed Yield

The result showed significant variations among the varieties for seed yield **(Table 1)**. This result agreed with the report of Akbar [10], Ahmad [11], Hussain [9], McCutcheon [12]. While, contrasting result was reported by Olakojo and Iken [8]. The maximum seed yield of 5660 kg ha^{-1} was recorded for MH6Q at Gyngatom and the minimum 1692 kg ha^{-1} was noted for the local check at Hammer **(Table 3)**.

CONCLUSION AND RECOMMENDATION

The result indicated significant variations observed among the varieties for all the studied parameters. Based on the overall mean yield, the best-performing varieties such as MH6Q 4977.4 kg ha^{-1} and Melkassa-4 (3922.6 kg ha^{-1}) would be recommended.

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