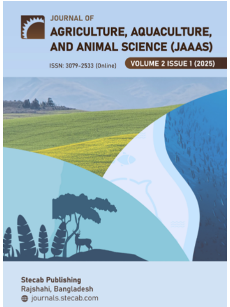


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*Research Article*

# Yield Performance of Improved Hybrid Maize (*Zea mays* L.) Varieties Under Rain-Fed Conditions in Golohajo, Gursum District, Fafan Zone, Somali Region, Ethiopia

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## About Article

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## ABSTRACT

Maize (*Zea mays* L.) is a staple cereal crop in Ethiopia, yet production remains constrained by limited access to improved varieties, particularly in the Somali Region's lowlands. To address this gap, a field experiment was conducted during the 2023 cropping season in Gursum Woreda, Somali Region, Ethiopia, to evaluate the agronomic performance of four hybrid maize varieties (MH141, Melkassa-2, BH520, and BH549). The trial followed a randomized complete block design (RCBD) with three replications, with data collected on phenology, growth, yield, and yield components. Statistical analysis (GenStat 18th edition) revealed significant varietal differences in most traits, except days to maturity and ears per plant. BH-520 achieved the highest grain yield (8.95 t/ha), outperforming other varieties, while BH-149 exhibited the longest tasseling and silking periods. The results demonstrate BH-520's superior adaptability and productivity under local conditions, suggesting its potential for scaling alongside improved agronomic practices to enhance maize production in the region.

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## 1. INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops in Ethiopia, ranking second in area coverage and first in total production. Despite its national significance, maize productivity in the Somali Region remains low. According to the 2020/2021 Agricultural Sample Survey, the region recorded an average yield of 20.17 quintals per hectare, with the Fafan Zone slightly higher at 24.67 quintals per hectare far below the potential achieved in other maize-growing areas of the country.

This persistent yield gap is largely attributed to limited access to improved maize varieties, low fertilizer use, and recurrent drought conditions. In particular, the absence of locally tested and adapted hybrid maize varieties has constrained productivity improvements in the region. Addressing this issue requires the evaluation and introduction of high-yielding, drought-tolerant maize varieties suited to the agro-ecological conditions of the lowlands.

Therefore, this study was conducted to evaluate the agronomic performance and grain yield of selected hybrid maize varieties in Gursum Woreda, Fafan Zone. The objective is to identify and recommend the most promising variety or varieties for wider adoption to improve maize productivity and food security in the Somali Region.

## 2. LITERATURE REVIEW

### 2.1. Importance of maize in ethiopia

Maize (*Zea mays* L.) is one of the most important cereal crops in Ethiopia, serving as a staple food for millions and a key source of income for smallholder farmers (CSA, 2023). It contributes significantly to food security and livestock feed, particularly in agro-pastoral regions like the Somali Regional State. According to Abate *et al.* (2015), maize accounts for nearly 30% of total cereal production in Ethiopia, with increasing adoption of improved hybrid varieties due to their higher yield potential compared to traditional open-pollinated varieties (OPVs).

### 2.2. Hybrid Maize Varieties and Their Advantages

Hybrid maize varieties are developed through controlled cross-breeding to enhance desirable traits such as high yield, drought tolerance, and disease resistance (Beyene *et al.*, 2016). In Ethiopia, popular hybrids like BH-540, BH-661, and Shala have been widely promoted due to their adaptability to different agro-ecologies (EIAR, 2020). Studies by Worku *et al.* (2017) demonstrated that hybrid maize can yield 5–10 tons per hectare under optimal conditions, compared to 2–4 tons per hectare for local varieties, making them crucial for improving productivity in drought-prone areas like the Somali Region.

### 2.3. Yield performance of hybrid maize in different agro-ecologies

Several studies have evaluated hybrid maize performance across Ethiopia, but limited research exists specifically for the Somali Region. A study in the Oromia Region by Tolesa *et al.* (2019) found that hybrid varieties such as BH-546 outperformed local varieties by 40–60% under similar management conditions. Similarly, research in South Ethiopia by Deresa and Legesse (2021) reported that hybrid maize yields were significantly influenced by soil fertility, planting density, and moisture availability. However, these findings may not fully apply to the semi-arid conditions of Golohajo, Gursum District, highlighting the need for location-specific studies.

### 2.4. Factors affecting maize yield in drought-prone areas

The yield performance of hybrid maize in dryland areas is highly dependent on Climate and Rainfall Erratic rainfall patterns in the Somali Region often lead to moisture stress, reducing grain filling and yield (Hassan *et al.*, 2018). Soil Conditions: Poor soil fertility and low organic matter content limit nutrient uptake, necessitating fertilizer use (Mengistu *et al.*, 2020). Agronomic Practices, Optimal planting time, weed control, and pest management (e.g., fall armyworm) significantly impact yield (FAO, 2022).

### 2.5. Research gaps and justification for the study

While hybrid maize adoption has been studied in highland and central Ethiopia, there is limited documented evidence on its performance in the Somali Region, particularly in Golohajo, Gursum District. Most existing research focuses on high-potential areas, neglecting semi-arid agro-pastoral systems. This study aims to fill this gap by evaluating the yield performance of improved hybrid maize varieties under local conditions, providing data to support farmers and policymakers in crop selection and agricultural planning.

## 3. METHODOLOGY

### 3.1. Study area and experimental design

The study was conducted during the 2023 cropping season at the Golo-Hajo site, Fafan Research Center, located in the Fafan Zone of the Somali Regional State. The experimental site was classified as having a sandy clay loam soil texture. During the cropping season (April to July 2023), a total of 676.3 mm of rainfall was recorded, with mean maximum and minimum temperatures of 28.3°C and 14.5°C, respectively, according to meteorological data.

Four hybrid maize varieties (MH141, Melkassa-2, BH520, and BH549) were tested under field conditions at the site. The trial was laid out in a Randomized Complete Block Design (RCBD) with three replications. Each plot measured 11.25 m² (3 m in length × 3.75 m in width), with inter-row and intra-row spacing of 0.75 m and 0.25 m, respectively. Two seeds were sown per hill and later thinned to one plant per hill at the two-leaf stage (V2), ensuring a uniform plant population of approximately 53,200 plants per hectare. All recommended agronomic practices were followed throughout the growing period.

### 3.2. Data collection and analysis

Data were collected on days to maturity, plant height, ear length, number of ears per plant, thousand seed weight, grain yield, and biomass yield.All collected data were subjected to analysis of variance (ANOVA) appropriate for a randomized complete block design using GenStat version 18.2. Mean comparisons were made using the Least Significant Difference (LSD) test at a 5% level of significance (Gomez and Gomez, 1984).

# 4. RESULTS AND DISCUSSION

## 4.1. The phenological and growth parameters

### 4.1.1. Days to Tasseling

The analysis of variance revealed a significant effect ($p < .05$) of maize variety on days to tasseling (Table 1). The longest duration to tasseling (73.67 days) was observed in the BH-520 variety, while the earliest tasseling (70.33 days) occurred in MH-141. These differences are likely due to genetic variation among the maize varieties. Similar findings were reported by Kusa *et al.* (2022) and Hussain *et al.* (2011), who observed significant differences in tasseling time among maize varieties.

## 4.2. Days to silking

Varietal differences also had a highly significant effect ($p < .01$) on days to silking (Table 1). The BH-549 variety exhibited the longest duration to silking (78.00 days), whereas MH-141 had the shortest (75.00 days). These variations are attributed to genetic differences among the maize varieties. This result aligns with findings by Abduselam *et al.* (2017) and Kusa *et al.* (2022), who reported significant differences in silking time among maize varieties.

## 4.3. Days to maturity

The analysis of variance indicated no significant differences ($p > .05$) among the varieties concerning days to maturity (Table 1). The MH-141 variety reached maturity in 125.0 days, while BH-549 matured in 123.0 days. Although these differences were not statistically significant, they may still reflect inherent genetic variations among the maize varieties.

**Table 1.** Mean performance of Phenological and growth parameters of hybrid maize varieties

| Treatments | DT | DS | PH | DM |
|---|---|---|---|---|
| Hybrid maize varieties | | | | |
| MH-141 | 70.33[a] | 75.00[a] | 201.1[a] | 125.0[a] |
| BH-520 | 71.67[ab] | 76.00[ab] | 254.2[c] | 123.7[a] |
| Melkassa-2 | 72.67[b] | 76.67[b] | 237.7[bc] | 129.0[a] |
| BH-549 | 73.67[b] | 78.00[c] | 225.9[ab] | 123.0[a] |
| LSD(0.05) | 2.234* | 1.290** | 25.25 | NS |
| C.V(%) | 3.2 | 2.8 | 4.3 | 2.1 |

*CV: Coefficient of variation, DTT: Days to tassel, DS: days to silking, LSD:least significance difference, means followed by different letters with in columns are significantly different by Duncan new multiple range test(p:0.05)*

## 4.4. Plant height (cm)

The analysis of variance revealed that the effect of variety on plant height was highly significant ($p < .01$) (Table 1). The tallest plants were observed in the BH-520 variety (254.2 cm), followed by Melkassa-2 (237.7 cm). In contrast, the shortest plants were recorded in the MH-141 variety (201.1 cm). These differences are likely due to genetic variation among the maize varieties. Similar findings were reported by Kusa *et al.* (2022), who observed significant differences in plant height among maize varieties.

## 4.5. Ear length (cm)

The analysis of variance indicated that variety had a highly significant effect ($p < .01$) on ear length. The BH-520 variety produced the longest ears (32.33 cm), while the shortest ears were observed in Melkassa-2 (29.93 cm). These variations are attributed to genetic differences among the maize varieties. This result is consistent with the findings of Kinfe *et al.* (2017), who reported that ear length differences among maize varieties are influenced by genetic variation.

## 4.6. Number of ears per plant

The analysis of variance showed no significant differences ($p > .05$) among the varieties concerning the number of ears per plant. This finding aligns with the results of Kandil *et al.* (2017), who also reported non-significant differences among maize varieties for this trait.

## 4.7. Thousand seed weight (g)

The analysis of variance revealed that maize variety had a highly significant effect ($p < .01$) on thousand seed weight (Table 2). The BH-549 variety recorded the highest thousand seed weight at 340.0 g, while MH-141 exhibited the lowest at 293.3 g. These differences are likely due to genetic variations among the maize varieties. Similar findings were reported by Taye *et al.* (2016), who observed significant differences in thousand kernel weight among maize varieties.

**Table 2.** Mean performance of yield and yield component parameters of hybrid maize

| Treatments | NEPP | EL (cm) | TSW (g) | GY (qt/ha) | BMY |
|---|---|---|---|---|---|
| Maize varieties | | | | | |
| MH-141 | 1.33a | 29.60a | 293.3a | 44.54a | 192.6a |
| BH-520 | 1.400a | 32.33b | 326.7b | 89.47c | 192.6a |
| Melkassa-2 | 1.267a | 27.93a | 320.0ab | 42.50a | 224.7a |
| BH-549 | 1.333a | 30.20ab | 340.0b | 62.51b | 296.3b |
| LSD(0.05) | NS | 2.232** | 26.85 | 16.06 | 68.22 |
| C.V(%) | 7.5 | 3.7 | 4.2 | 10.6 | 7.4 |

*CV: Coefficient of variation, NEPP: number of ears per plant, TSW: Thousand seed weight, EL: days ear length, BY: biomass yield, GY: grain yield, LSD:l east significance difference, means followed by different letters with in columns are significantly different by Duncan new multiple range test (p:0.05)*

### 4.8. Biomass yield (Qt/ha)

The analysis of variance revealed a significant difference ($p < .05$) in biomass yield among the hybrid maize varieties. The highest biomass yield was recorded for BH-520 (392.6 Qt/ha), while the lowest was observed in MH-141 (192.6 Qt/ha). These variations are likely due to genetic differences among the maize varieties.

### 4.9. Grain yield (Qt/ha)

The analysis of variance indicated that the grain yield of maize was highly significantly influenced by variety ($p < .01$) (Table 2). The highest grain yield was obtained from BH-520 (89.47 Qt/ha), whereas the lowest was recorded for Melkassa-2 (42.50 Qt/ha). These differences are likely attributed to genetic variations among the different maize varieties. This finding aligns with Gelaye and Kassie (2019), who reported significant differences in grain yield among various maize varieties. This finding aligns with (Gelaye & Kassie, 2019), who reported significant differences in grain yield among various maize varieties.

## 5. CONCLUSION

The field experiment conducted at Golo-Hajo during the 2023 cropping season revealed significant differences in grain yield performance among the evaluated hybrid maize varieties. The observed variability highlights the opportunity for selecting and promoting high-yielding and adaptable maize varieties suited to the agro-ecological conditions of the study area and similar environments. Among the varieties tested, BH-520 exhibited the highest grain yield (89.47 Qt/ha), followed by BH-549 (62.51 Qt/ha), demonstrating their superior performance relative to the other varieties evaluated. Based on these findings, BH-520 and BH-549 are recommended for sustainable maize production in Golo-Hajo and comparable agro-ecological zones within the Fafan Zone and beyond. To enhance adoption, it is essential to conduct participatory demonstrations involving local farmers, where these improved varieties are showcased alongside commonly grown local varieties, supported by the recommended agronomic practices. Additionally, to ensure broader applicability and stability of the results, further research involving multi-location and multi-year trials is strongly encouraged. Such efforts will help to validate the consistency of varietal performance across diverse environments and production seasons, thereby informing future scaling-up strategies. Strengthening extension services and integrating farmers' feedback into the evaluation process will also be critical for accelerating the dissemination and adoption of improved maize technologies in the region.

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