Performance of hybrid maize (Zea mays L.) varieties at Kobo irrigation site, North Wollo, Amhara Region.

Mulugeta Mamo, Solomon Asefa, Tsegaye Gebremariam Fiseha Werede, and Yemata Beze

Sirinka Agricultural Research Center. P.O.Box 74, Woldiya, Ethiopia

Abstracts

A field experiment was conducted at Kobo sub center in Raya kobo district North Wollo zone of the Amhara Region during 2013 and 2015 cropping seasons to select high yielder and most adaptable maize variety/varieties. The trial was laid out in a randomized complete block design (RCBD) with three replications. A total of seven maize varieties were planted including the local check. DAP (100 kg ha^{-1}) was applied at planting while urea (50 kg ha^{-1}) was applied in two splits at planting and knee height. The plots were irrigated by furrow irrigation every 14 days. All data were collected following standard procedures and were analyzed using Genstat program version 14 and significant treatment mean were separated using least significant difference at 5%. The analysis of variance revealed the presence of significant difference ($P<0.001$) for days to flowering, number of ears harvested and grain yield. The mean grain yield was 4265 kg ha^{-1} ranging from 5586 kg ha^{-1} (BHQPY-545) to 3363 kg ha^{-1} (local). The hybrids BHQPY-545 and BH-661 gave the highest grain yield. Therefore; BHQPY-545 and BH-661 are recommended for Kobo irrigation scheme and similar environments.

Key words: Amhara, grain yield. irrigation, maize, Raya Kobo

Introduction

Maize (Zea mays L.) belongs to a tribe maydea of the family poacea (Graminea). It is believed that the crop was originated in Mexico and introduced to West Africa in the early 1500s by Portuguese traders (Dows well et al., 1996; McCann, 2005). According to some reports, maize was introduced to Ethiopia in 1600s to 1700s (Haffanagel, 1961). Maize stands first in production and yield among main cereals in Ethiopia and second in Amhara region (CSA, 2013). Maize has a wider range of uses as compared to any other cereal crops in the world (Singh, 2007). It is used as a human food, feed for livestock and industrial purposes (Dowswell et al., 1996). Millions of people depend on maize for their daily food in Sub-Saharan Africa (Pixley and Bjarnason, 2002).

In Ethiopia, it is used as a staple food and one of the main sources of calorie in the major maize producing regions, mainly in western, central, southern and eastern regions of the country (MARD, 2007). Maize is cultivated in the major agro-ecological zones of Ethiopia up to altitudes of 2400 m.a.s.l. It grows from moisture stress areas to high rainfall areas and from lowlands to highlands (Kebede et al., 1993). There are wider ranges of potential agro-ecologies for maize production in Ethiopia. However, maize yield levels have remained stagnant due to different challenging biotic and abiotic stresses resulting in unavailability of improved maize technologies in these agro-ecologies (Mosisa et al., 2001b). Such greater variation in environment can severely hinder the development and performance of maize cultivars suitable for extended areas of land.

Maize breeding in Ethiopia started about half a century ago and passed through distinct stages of research and development (Kebede et al., 1993). In the late 1960s and early 1970s, different promising hybrids and composite varieties of East African origin were introduced and evaluated at different locations. However, most of these varieties have been replaced by locally developed and better adapted varieties (Mossisa et al., 1994). Due to unlimited effort of national agricultural research centers and other private seed enterprises like pioneer, until now more than forty improved maize varieties were released in order to tackle the existing maize production constraints of the country. But these released varieties did not bring the expected yield increment, particularly in Amhara region where less numbers of representative sites were used, during these varieties development (Melkamu et al., 2014). Even though the crop is important in north Wollo, its productivity has been constrained by a number of factors. Lack of improved varieties, less adoption of released varieties, poor utilization of inputs (fertilizers), improper crop management and less affordability of quality hybrid seed in the required amount are the major maize production constraints (Melkamu et al.,2014). In the Kobo Girana valley, recommending high yielder maize variety or varieties is critically important since this crop covers more irrigated area than any other cereal crops grown in rotation with irrigated vegetables in the region (Yenesew et al, 2009). As a result this experiment was conducted to identify well adapted and high yielding maize variety for Kobo Girana irrigation scheme.

Materials and methods

A total of seven improved varieties were planted together with local check at Kobo under irrigation. The site is located at about 50 kilometers from Woldiya town to the north-east direction and situated at 12.080 N latitude, at 39.280 E longitudes and at an altitude of 1470 m a s l. The 15 years mean annual rainfall of the location is about 630 mm, but the rainfall during the crop growing period (at time of irrigation) was 262mm. i.e. beyond normal furrow irrigation (65mm month^{-1}) on average taking 4 month is sufficient for maturity. The soil for the experimental site is a silty clay loam type. The experiment was laid in a randomized complete block design (RCBD) with three replications. Spacing between row and between plants was 75 cm and 25 cm; respectively. The plot size was 4m by 3 meters. The amount of fertilizer used was 100 kg DAP and 50 kg urea ha^{-1}; respectively. Nitrogen was splited in to two (half at planting and half knee height stage) while DAP was applied once at planting. Data was collected for days to female flowering/silking, days to male flowering/tasseling, plant height (cm), number of harvested plants per plot, number of harvested ears per plot, ear aspect, days to maturity, biomass weight (kg ha^{-1}) and grain yield (kg ha^{-1}). Statistical data analysis was done using Genstat program version 14. Variance ratio test for homogeneity of variance was carried out to determine the validity of the individual experiment while treatment mean separation was done using least significance difference (LSD) at 5% level of significance.

Results and discussions

The result showed that a significant variation ($P<0.001$) among and between varieties for days to anthesis, days to silking, number of ear, ear aspect, days to maturity, biomass (green cob) and grain yield (Table 1). The local variety and MH-130 took fewer days to anthesis/tasseling and siliking i.e 65 and 68 days; respectively (Table 1). Most of the tested hybrid varieties took longer days to flowering. These late maturing hybrid were released for areas with sufficient rainfall. The same result was reported by Jemal et al., (2015) stated hybrids released for moisture stress ecologies took lesser mean days to flower than hybrids developed for high potentials. The numbers of ears were lower for BH-140 followed by BH-540 (Table3). The best ear aspect was recorded for BH-661and BHQPY-545, respectively (Table 1). Poor performance in ear aspect was observed for the local variety (Table 2). The number of ears was higher for local variety but with low grain yield compared to other varieties (3363 kg ha^{-1}). This showed that grain filling, number of row per cob and number of kernel pe[redacted]s more important than number of ears (Table 3).

Table 1.The mean performance of maize varieties ev[redacted] for grain yield and yield related traits in 2013. (per 12m

Varieties	DT	DS	Ph	SC	CN[redacted]	CW	GY	EA
MH-130	59	63	182	64.0	64[redacted]	7833	5151	2
MHQ-138	68	70	194.3	64.0	63[redacted]	5667	4130	3
BH-140	70	74	201.7	64.0	49[redacted]	4723	4207	3
BH-540	69	71	210.7	64.0	59[redacted]	7444	4902	2
BHQPY-545	67	69	199.7	61.7	66[redacted]	8278	6131	1
BH-660	76	79	218	58.7	58[redacted]	4333	3609	3
BH-661	74	77	237.3	64.0	67[redacted]	6833	5177	1
Local(Emawaysh)	59	62	214	64.0	69[redacted]	6111	3627	4
CV (%)	1.6	1.4	4.5	3.7	9[redacted]	9	10.5	1.2
LSD (5%)	1.9	1.8	16.27	ns	9[redacted]	1208	837	1.2

combined over years was recorded by BHQPY 54[redacted]wed by BH 661 (Table 3). Consistently BHQPY-545 gave the highest grain yield and cob [redacted] followed by bH-661 (but dominated by MH-130 only for cob weight during 2013) while t[redacted]st was from the local variety (Table 3). This result is in agreement with Melkamu et al., (2[redacted] which farmers around western Amhara selected this variety for its' earliness. The main re[redacted]r poor protein quality of normal maize is the relatively high concentration of prolamines[redacted]) storage proteins (50-60%) which are devoid of lysine and tryptophan (Mertz, 1992). Th[redacted]y revealed that BHQPY-545 performed

(2015).

Table 2. The mean performance of maize varieti[redacted]uated for grain yield and yield related traits in 2015.

Varieties	DT	DS	Ph	SC	CN	MD	CW	GY	EA
MH-130	72.0								

MHQ-138	80.7	81.7	179.7	53.7	59.7	130	9333	3964	3.5
BH-140	82.7	84.0	183.3	49.3	46.0	136	8389	3285	3.5
BH-540	83.7	84.7	136.7	49.3	44.0	140	8223	3769	3
BHQPY-545	82.7	84.0	186.3	57.0	62.7	133	10723	5041	2
BH-660	85.7	87.3	230.7	50.7	51.3	148	10139	3840	2.5
BH-661	83.0	84.7	219.0	61.7	61.7	148	10778	4652	2
Local	71.7	74.3	194.0	55.0	61.7	119	6389	3099	4.5
Mean	80.3	81.9	184.6	54.1	54.6	134	8878	3914	2.8
CV	2.2	2.3	20.4	10.7	14.3	5.2	14.6	13.3	2
LSD(5%)	3.0	3.2	65.0	10.1	13.6	12.	2715	912	1.5

DT= days to tasseling, DS= days to silking, ph=plant height, SC=stand count (per 12m^2) CN=cob number (per 12m^2), CW= cob weight (kg ha^{-1}), MD=days to maturity, GY=grain yield (kg ha^{-1}), EA=ear aspect.

Table 3.The combined mean performance of maize varieties evaluated for grain yield and yield related traits in 2013 &2015.

Varieties	DT	DS	Ph	SC	CN	MD	CW	GY
MH-130	65.7	68.7	164.5	59.8	56.7	119	7833	4406
MHQ-138	74.3	76.0	187.0	58.8	61.3	129	5667	4047
BH-140	76.3	79.0	192.5	56.7	47.7	135	4723	3746
BH-540	76.2	77.8	173.7	56.7	51.5	139	7444	4336
BHQPY-545								

mean grain yield 5586 kg ha^{-1} and 4915 kg ha^{-1}; respectively. Therefore, BHQPY-545 and BH-661 maize varieties are recommended for Kobo under irrigation under irrigation for grain yield.

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