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Evaluation of Single Cross White Highland Maize Hybrids for Grain Yield and Yield Related Traits at Kulumsa, Southwestern Ethiopia

Abiy Balcha Gebre

Kulumsa Agricultural Research Center, Ethiopian Institute of Agricultural Research (EIAR), Ethiopia

Abstract: **In Ethiopia, the production of highland hybrid maize is at its infant stage. The yields of this crop in the highland area are low, due to the use of open pollinated varieties (OPVs), shortage of high yielding hybrid varieties, biotic and abiotic stresses. Thus, the present study was designed to identify superior single crosses based on their yield and agronomic performance. Fifth seven hybrids and three checks were evaluated using a 6 x 10 alpha lattice design replicated twice at Kulumsa ARC farm during 2019/-20 main season. Analysis of variance revealed that test crosses mean squares were highly significant (P < 0.001) for days to 50% anthesis and silking, plant height, plant aspect, ear aspect, ear per plant, days to maturity and grain yield. Similarly, mean squares of crosses were significant (p ≤ 0.05) for number of plants, ear height and anthesis-silking interval. Based on the mean grain yield performance, five promising single crosses, CEL08008/CEL10023, CEL08008/CEL10014, CEL13002/CEL10023, CEL08050/CEL10014 CEL08008/CEL10012 having grain yield of 7.9,7.8,7.8,7.8,7.7 ton ha^{-1}, respectively were identified as possible candidates for release after establishing the stability of their performance in multi-locational trials or that may be exploited in future breeding programs for developing three way hybrids accompanied with other desirable attributes.**

Keywords: **Grain yield, hybrids, maize, single crosses.**

1. INTRODUCTION

Maize is critical for food security in Ethiopia. More than 9 million smallholders grow maize on about 2 million ha (14% of total land area in Ethiopia) and around 88% of their production is used for food consumption [1]. In terms of calorie intake, maize is the most important staple crop for the rural Ethiopian population [2].

Over the last two decades, the maize sector in Ethiopia has experienced an unprecedented transformation. Maize yields have doubled from around 1.6 t/ha in 1990 to more than 3.7 t/ha in recent years, the highest level in sub-Saharan Africa after South Africa [3]. Important causes for the increased productivity include increased availability and use of modern inputs (e.g., modern varieties and fertilizer), better extension services and increasing demand [1].

Despite the recent progress in productivity, yield levels in Ethiopia are still very low relative to what they could be. According to the Global Yield Gap Atlas [4], the water-limited yield potential of maize in Ethiopia is on average 12.5 t/ha, implying that farmers realize only around 30% of that potential. This is in contrast with for example Latin American countries which are able to reach around 45% of potential maize yield [4].

Increasing maize yield and reducing the yield gap are essential to ensure future food security in Ethiopia. In a recent paper Ethiopia's capacity to feed itself by 2050 was analyzed [5]. The analysis showed that the country needs to continue the current observed increase in cereal yield (of which maize makes up the largest share) to maintain its present self-sufficiency rate of 95% in 2050, as by then the population will have probably more than doubled and consumption per capita levels have increased in line with a higher projected income level.

Efforts are being made to bridge the gap between the present low grain yield and the attainable grain yield by promoting the use of superior hybrid maize varieties. At present, there is a growing demand for use of hybrid seeds and this has an effect in the driving of the emergence of seed companies in Ethiopia.

In the last four decades, more than 40 improved varieties of maize including hybrids and Open Pollinated Varieties (OPVs) have been developed and released by the Ethiopian Institute of Agricultural Research (EIAR) in collaboration with the CIMMYT [6].

Despite maize suited diverse agro–climate subsists, and strategic maize breeding efforts were made, the production of maize in the country remained low; with the estimated national average yield of 3.25 t ha^{-1} [7], which is low in light of the potential productivity of the world average of 5.64 t ha^{-1} with a productivity record of 10.73 t ha^{-1} by the US for the year 2014/15 [8].

Studies have shown that single cross hybrids have uniform production, are higher yielding and more stable in performance as well as in other plant characteristics. [9] reported that single cross hybrid seed was higher yielding in many parts of the world, due to the expression of heterosis (hybrid vigor). So far, in Ethiopia, the production of hybrid maize is at its infant stage. This may be due to lack of superior hybrids as compared to open pollinated varieties, which farmers can readily adopt.

Therefore, the objective of this study was to identify superior single crosses based on their grain Yield and Yield Related Traits

2. MATERIAL AND METHOD

Description of the study area

The experiment was conducted at Kulumsa agricultural research center, during the main cropping season of 2019/20. It lies at 8°5'N latitude, 39°10'E longitude with an altitude of 2200 m.a.s.l and is located in a tepid to cool, moist plain agro-ecological zone. Rainfall data for the last 10 years (2006-2016) showed that average total annual rainfall was 830 mm which ranged from 535 to 1018 mm. Average annual maximum temperature was 23.2 °C and minimum temperature was 10 °C. The dominant soil type is luvisol/eutric nitosols with good drainage and (pH =6).

Experimental material, design and management

The experiment consisted of 60 maize single crosses hybrid (including three commercial checks (AMH850, AMH851 and AMH853). The single crosses were developed at Ambo Agricultural Research Center during the main season of 2018/19. The list and pedigrees of the single crosses and the standard checks used for the study are presented in Table 1.

The single crosses were planted along with three commercial checks (AMH850, AMH851 and AMH853) to made available to evaluate in an alpha lattice design (6x10) arrangement with two replications of one row plot in 2019/20 rainy season.

Each plot had one row of 5 meter length (21 plants). Each genotype was planted at 75 cm between rows and 25 cm within row spacing. Two seeds were planted per hill on 23th of April and later thinned to one plant per hill providing a uniform stand of about 53,333 plants ha^{-1}.

All cultural practices like weeding and cultivation were done manually throughout the entire growing season as required. Data of 11 quantitative traits were collected *viz.*, days to 50% anthesis, common rust, days to maturity, days to 50% silking, ear aspect, ear height, ear per plant, number of plants, plant height, plant aspect and grain yield later converted to mean values.

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Table1: List of highland single cross maize hybrid used at Kulumsa during Main season of 2019/20

Entry number	Single crosses	Origin
1	CEL08050/CEL08050	AMB18MLND-6/AMB18MLND-7
2	CEL08050/CEL08025	AMB18MLND-6/AMB18MLND-8
3	CEL08050/CEL08030	AMB18MLND-6/AMB18MLND-9
4	CEL08050/CEL13002	AMB18MLND-6/AMB18MLND-10
5	CEL08050/CEL08008	AMB18MLND-6/AMB18MLND-11
6	CEL08050/CEL10018	AMB18MLND-6/AMB18MLND-13
7	CEL08050/CEL10012	AMB18MLND-6/AMB18MLND-14
8	CEL08050/CEL10014	AMB18MLND-6/AMB18MLND-15
9	CEL08050/CEL10023	AMB18MLND-6/AMB18MLND-16
10	CEL08050/CEL10023	AMB18MLND-6/AMB18MLND-17
11	CEL08050/CEL08025	AMB18MLND-7/AMB18MLND-8
12	CEL08050/CEL08030	AMB18MLND-7/AMB18MLND-9
13	CEL08050/CEL13002	AMB18MLND-7/AMB18MLND-10
14	CEL08050/CEL08008	AMB18MLND-7/AMB18MLND-11
15	CEL08050/CEL10018	AMB18MLND-7/AMB18MLND-13
16	CEL08050/CEL10012	AMB18MLND-7/AMB18MLND-14
17	CEL08050/CEL10014	AMB18MLND-7/AMB18MLND-15
18	CEL08050/CEL10023	AMB18MLND-7/AMB18MLND-16
19	CEL08050/CEL10023	AMB18MLND-7/AMB18MLND-17
20	CEL08025/CEL08030	AMB18MLND-8/AMB18MLND-9
21	CEL08025/CEL13002	AMB18MLND-8/AMB18MLND-10
22	CEL08025/CEL08008	AMB18MLND-8/AMB18MLND-11
23	CEL08025/CEL10018	AMB18MLND-8/AMB18MLND-13
24	CEL08025/CEL10012	AMB18MLND-8/AMB18MLND-14
25	CEL08025/CEL10014	AMB18MLND-8/AMB18MLND-15
26	CEL08025/CEL10023	AMB18MLND-8/AMB18MLND-16
27	CEL08025/CEL10023	AMB18MLND-8/AMB18MLND-17
28	CEL08030/CEL13002	AMB18MLND-9/AMB18MLND-10
29	CEL08030/CEL08008	AMB18MLND-9/AMB18MLND-11
30	CEL08030/CEL10018	AMB18MLND-9/AMB18MLND-13
31	CEL08030/CEL10012	AMB18MLND-9/AMB18MLND-14
32	CEL08030/CEL10014	AMB18MLND-9/AMB18MLND-15
33	CEL08030/CEL10023	AMB18MLND-9/AMB18MLND-16
34	CEL08030/CEL10023	AMB18MLND-9/AMB18MLND-17
35	CEL13002/CEL08008	AMB18MLND-10/AMB18MLND-11
36	CEL13002/CEL10018	AMB18MLND-10/AMB18MLND-13
37	CEL13002/CEL10012	AMB18MLND-10/AMB18MLND-14
38	CEL13002/CEL10014	AMB18MLND-10/AMB18MLND-15
39	CEL13002/CEL10023	AMB18MLND-10/AMB18MLND-16
40	CEL13002/CEL10023	AMB18MLND-10/AMB18MLND-17
41	CEL08008/CEL10018	AMB18MLND-11/AMB18MLND-13
42	CEL08008/CEL10012	AMB18MLND-11/AMB18MLND-14
43	CEL08008/CEL10014	AMB18MLND-11/AMB18MLND-15
44	CEL08008/CEL10023	AMB18MLND-11/AMB18MLND-16
45	CEL08008/CEL10023	AMB18MLND-11/AMB18MLND-17
46	CEL10018/CEL10012	AMB18MLND-13/AMB18MLND-14
47	CEL10018/CEL10014	AMB18MLND-13/AMB18MLND-15
48	CEL10018/CEL10023	AMB18MLND-13/AMB18MLND-16
49	CEL10018/CEL10023	AMB18MLND-13/AMB18MLND-17
50	CEL10012/CEL10014	AMB18MLND-14/AMB18MLND-15
51	CEL10012/CEL10023	AMB18MLND-14/AMB18MLND-16
52	CEL10012/CEL10023	AMB18MLND-14/AMB18MLND-17
53	CEL10014/CEL10023	AMB18MLND-15/AMB18MLND-16
54	CEL10014/CEL10023	AMB18MLND-15/AMB18MLND-17
55	CEL10014/CEL10023	AMB18MLND-16/AMB18MLND-17
56	CEL08014/CEL08025	AMB17TWP1-16/AMB17TWP2-16
57	CEL08025/CML561	AMB17TWP1-9/AMB17TWP2-9
58	WENCHI	AHMBP
59	JIBAT	AHMBP
60	KOLBA	AHMBP

AHMBP = Ambo Highland Maize Breeding Program

Statistical analysis and procedures

Data Collected and analysis of Variance: Data were recorded on thirteen different traits included: Days to 50% taselling, Days to 50% silking, Days to 50% maturity, Grain yield, Ear height, Plant height, Number of ears per plant, Ear aspect, Plant aspect, were recorded. Analysis of variance for all parameters studied was computed using the PROC MIXED procedure and test for significance differences among the genotypes was performed using SAS software [10].

Results and Discussions

The mean performances of single crosses included in the study were computed for traits, which showed significant mean squares difference. comparison was made among the 57 crosses and the three checks to find crosses superior to the already released hybrids in grain yield and yield components.

Days to 50% anthesis

Days to 50% anthesis ranged from 92 (CEL08025/CML561)) to 103 days (CEL08030/CEL13002) with the overall mean of 97 days (Table 1). Single crosses, CEL10018/CEL10023, CEL08025/CEL10023, CEL08050/CEL08025, CEL08025/CEL13002 showed significant fewer days than the single crosses and the two hybrid checks also single crosses CEL08014/CEL08025and CEL08025/CML561demonstrated significant fewer days than the three hybrid check (Wenchi, jibat and Kolba). On the other hand, 6 crosses revealed statistically the same days to 50% anthesis with checks Jibat and Kolba.

Days to 50% silking

Days to 50% silking showed a similar pattern to days to anthesis and varied from 93 to 106 for CEL08025/CML561 and CEL08030/CEL13002, respectively. Only one single CEL08025/CML561 had significant fewer days to 50% silking than the checks Wenchi and one hybrid CEL08025/CEL13002 had fewer days than the two checks (Jibat and Kolba)

Days to Maturity

Days to Maturity ranged from 188 days (9 crosses including check jibat) to 198 days (CEL08050/CEL10023) with a mean value of 188.3 days. The high yielding crosses CEL08008/CEL10023 (193 days) and CEL08008/CEL10014, CEL08050/CEL10014 (192 and 189 days respectively) were slightly late to mature (Table 2). Eight crosses were the same maturity date as Jibat (188.0 days) and these single crosses were the earliest maturing genotype. seventeen crosses were earlier than the check Wonchi), none of the highest yielding crosses was earlier in maturity than the three checks.

Common Rust

Mean performance of maize common rust disease scored demonstrated that there were crosses, which had less disease scored than cheeks. It indicated that some testcrosses had better gene resistance to maize common rust. From the results, 40 testcrosses showed significant better performances than the commercial hybrid checks (Wenchi, Jibat and Kolba). Similarly, 12 crosses CEL08050/CEL08050, CEL08050/CEL08030, EL08050/CEL08008,CEL08050/CEL10018,CEL08050/CEL10014,CEL08050/CEL10023, EL08050/CEL08025, CEL08050/CEL08030,CEL08030/CEL10023,CEL08008/CEL10018,CEL10012/CEL10014, CEL08025/CML561 performed better than the check Jibat. This finding is in agreement with previous work by [11] who reported the genetic variation of germplasm in their reaction to maize common rust disease.

Plant Height

Plant height among the studied test crosses ranged from 201.8 (CEL10014/CEL10023) to 258.7 cm (CEL08050/CEL10012), respectively with over all mean of 237.3 cm. Five crosses CEL10014/CEL10023,CEL10014/CEL10023,CEL08050/CEL08050,CEL08025/CEL10012,CEL10012/CEL10023) were significantly shorter than Jibat (222.7cm) and 14 crosses were shorter than Wenchi (233.1cm) and 33 crosses were shorter than Kolba (251.4cm). Hybrids with shorter plant height indicate less stem and root lodging.

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Table 2. Mean performance of single crosses for yield and yield contributed traits of selected highland white maize hybrids

Single cross Hybrid	GY	DTA	DTS	PH	EH	EPP	RU	NP	EA	PA	DTM
CEL08050/CEL08050	4.2	98	102	212.4	117.1	1.5	2.0	15	3.2	3.5	192
CEL08050/CEL08025	7.2	93	97	237.6	136.1	2	1.6	12	2.7	2.0	193
CEL08050/CEL08030	5.8	100	103	229.5	125.9	1.5	2.0	14	3.1	3.0	189
CEL08050/CEL13002	6.0	96	97	244.0	145.9	1.5	1.7	13	3.6	3.5	189
CEL08050/CEL08008	7.4	95	97	245.5	141.2	2	2.0	13	3.4	2.0	189
CEL08050/CEL10018	6.4	95	99	246.1	142.4	2	2.0	14	3.0	2.0	188
CEL08050/CEL10012	5.9	96	99	249.0	152.9	1	1.7	18	3.5	3.0	189
CEL08050/CEL10014	6.7	96	99	233.0	136.2	2	2.0	14	3.0	2.0	192
CEL08050/CEL10023	6.7	96	98	242.6	133.6	2	1.8	16	3.4	2.5	198
CEL08050/CEL10023	7.2	96	98	229.9	130.9	2.5	2.0	12	2.9	2.3	188
CEL08050/CEL08025	7.6	96	98	228.4	132.4	2	2.0	16	2.7	2.3	188
CEL08050/CEL08030	6.1	101	103	234.0	130.5	1.5	2.0	15	3.3	2.5	196
CEL08050/CEL13002	6.6	99	99	239.2	143.4	2	1.8	16	3.7	3.0	188
CEL08050/CEL08008	7.1	98	101	236.1	135.9	2	1.8	16	3.3	1.9	189
CEL08050/CEL10018	7.5	98	102	247.6	140.4	2	1.6	17	3.1	2.2	189
CEL08050/CEL10012	7.0	98	99	258.7	146.7	2	1.7	17	3.3	2.8	195
CEL08050/CEL10014	7.8	98	101	237.3	135.3	2	1.6	14	3.0	1.5	189
CEL08050/CEL10023	7.4	97	100	246.0	139.8	1.5	1.8	15	3.4	2.5	195
CEL08050/CEL10023	7.5	99	101	247.5	138.0	2	1.9	16	3.2	2.5	189
CEL08025/CEL08030	6.3	98	101	236.4	142.3	1.5	1.6	11	2.9	1.9	188
CEL08025/CEL13002	7.2	93	95	237.3	135.7	1.5	1.7	17	3.0	2.3	188
CEL08025/CEL08008	6.7	95	97	243.3	147.5	1	1.7	16	2.3	2.0	189
CEL08025/CEL10018	6.0	94	97	245.0	139.8	1	1.5	16	3.0	2.5	194
CEL08025/CEL10012	7.1	94	96	216.1	121.2	1	1.5	17	2.4	2.2	193
CEL08025/CEL10014	6.0	94	96	223.6	123.6	1	1.6	15	2.7	2.0	189
CEL08025/CEL10023	6.4	98	100	227.0	130.5	1	1.7	16	2.8	2.7	195
CEL08025/CEL10023	7.3	93	96	242.5	142.9	1	1.8	17	2.6	2.3	193
CEL08030/CEL13002	6.6	103	106	240.8	140.7	1	1.5	13	2.7	2.2	196
CEL08030/CEL08008	7.6	101	104	236.6	136.2	1.5	2.1	16	3.0	1.8	192
CEL08030/CEL10018	6.5	101	102	253.2	144.3	1	1.5	15	2.9	2.5	192
CEL08030/CEL10012	6.7	102	103	250.9	144.1	1	1.8	14	3.3	2.5	188
CEL08030/CEL10014	5.6	102	106	251.1	141.0	1	1.8	13	2.5	2.5	196
CEL08030/CEL10023	6.6	100	99	243.6	145.7	1	2.0	14	3.4	2.3	188
CEL08030/CEL10023	7.4	102	105	247.0	144.4	2	1.6	17	2.9	2.0	196
CEL13002/CEL08008	6.5	101	101	245.6	150.0	2	1.8	15	3.2	2.0	196
CEL13002/CEL10018	7.6	94	97	242.9	140.2	1	1.5	15	2.7	2.3	193
CEL13002/CEL10012	7.5	98	99	251.8	148.6	1	1.6	14	3.1	2.6	192
CEL13002/CEL10014	6.1	97	99	257.6	145.3	1	1.4	16	2.9	2.9	189
CEL13002/CEL10023	7.2	97	99	234.7	137.0	1	1.6	14	2.3	2.0	188
CEL13002/CEL10023	7.8	94	96	244.3	144.2	1	1.6	17	2.7	2.0	196
CEL08008/CEL10018	6.6	98	101	231.2	125.9	1.5	2.0	18	2.8	2.1	192
CEL08008/CEL10012	7.7	98	100	247.3	144.8	1.5	1.5	15	2.5	1.9	189
CEL08008/CEL10014	7.8	100	102	255.6	148.9	2	1.7	16	2.6	2.0	192
CEL08008/CEL10023	7.2	94	96	229.2	137.4	2	1.7	15	2.5	1.8	189
CEL08008/CEL10023	7.9	94	97	238.8	139.7	2	1.8	16	2.6	2.3	193
CEL10018/CEL10012	6.5	95	98	239.3	139.1	1	1.9	17	2.8	2.7	189
CEL10018/CEL10014	5.4	99	103	234.9	144.3	1	1.7	16	2.7	2.2	188
CEL10018/CEL10023	7.4	93	96	228.0	126.6	1.5	1.8	14	2.8	2.0	189
CEL10018/CEL10023	6.2	98	101	223.9	122.2	1	2.1	17	3.1	2.6	193
CEL10012/CEL10014	5.5	100	102	223.8	128.1	1	2.0	13	2.8	2.7	192
CEL10012/CEL10023	5.8	98	101	232.3	144.2	1	1.9	15	2.7	2.8	192
CEL10012/CEL10023	5.9	101	103	221.7	132.8	1.5	1.8	14	3.0	2.8	196
CEL10014/CEL10023	5.9	95	98	230.3	130.2	1	1.5	13	2.9	2.5	196
CEL10014/CEL10023	5.4	99	101	207.9	112.0	1	1.8	16	3.2	3.0	190
CEL10014/CEL10023	5.8	101	104	201.8	129.8	1	1.5	16	3.1	3.0	192
CEL08014/CEL08025	6.7	93	97	223.1	129.3	1.5	1.8	10	2.2	2.2	192
CEL08025/CML561	6.8	92	93	243.5	139.7	1	2.0	17	2.4	1.9	196

Single cross Hybrid	GY	DTA	DTS	PH	EH	EPP	RU	NP	EA	PA	DTM
WENCHI	6.8	93	95	233.1	136.9	1	1.9	15	2.5	2.0	189
JIBAT	7.1	94	95	222.7	127.4	2	2.0	16	2.3	2.0	188
KOLBA	7.6	93	95	251.4	142.6	2	1.3	13	2.5	1.5	188
Grand Mean	6.7	97	99	237.3	137.2	1.5	1.8	15	2.9	2.3	191
Checks Mean	7.2	93.3	95.0	235.7	135.6	1.7	1.7	14.7	2.4	1.8	188.3
SED	1.61	3.38	2.17	91.52	85.23	0.12	0.02	3.04	0.07	0.09	7.60
Maximum	7.9	103	106	258.7	152.9	2.5	2.1	18	3.7	3.5	198
Minimum	4.2	92	93	201.8	112.0	1	1.0	10	2.2	1.5	188
LSD	2.57	3.77	3.17	20.56	19.74	0.69	0.32	3.84	0.58	0.64	5.82
CV%	18.93	1.89	1.48	4.03	6.73	23.53	8.56	11.61	9.19	12.93	1.44
F-Test	***	***	***	***	**	***	***	**	***	***	***

*, **, *** = Significant at 0.05, 0.01 and 0.001 levels of probability, respectively, DTA days to anthesis, DTM=days to maturity, DTS= days to silking, EH=ear height, EPP =number of ears per plant, ER=Ear aspect, GY= grain yield, PH=plant height, NP= number of plants, PA=Plant aspect, RU=common Rust

Ear Height

Ear height varied from 112.0 (CEL10014/CEL10023)) to 152.9 cm (CEL08050/CEL10012). CEL10014/CEL10023 (112 cm), CEL08050/CEL08050 (117.1 cm), CEL08025/CEL10012 (121.2cm), CEL10018/CEL10023 (122.2 cm) and CEL08025/CEL10014 (123.6 cm) recorded significantly shorter ear heights from the check Jibat. The overall mean of ear height was 135.6 cm, whereas check Jibat, Wenchi and Kolba had 127.4, 136.9 and 142.6 cm, respectively. Testcrosses that have short plant height and ear length indicate less stem and root lodging.

Ears per plant

Mean value for number of ears per plant was 1.5 ranging from 1.00 27 crosses to 2.5 CEL08050/CEL10023 (Table 2). Among the checks Kolba had the highest number of ears plant^{-1} (2.0) and four crosses surpassed it. Two of the highest yielding crosses CEL08008/CEL10023 (2.0) and CEL08050/CEL10023 (2.5) are among genotypes with the highest number of ears plant^{-1}. Seven crosses had ears plant^{-1} intermediate between that of Kolba (2.0) and Jibat (2.0). The remaining 16 crosses had ears plant^{-1} lower than that of Wonchi (1.0).

Plant Aspect

Mean performance of plant aspect of genotypes included under study, only one crosses, CEL08050/CEL10014 exhibited good and significant plant aspect. It indicates that this cross had better uniformity of plant height and ear height, less disease occurrence and good grain filling.

Ear aspect

The mean values ranged from 2.2 for CEL08014/CEL08025 to 3.7 for CEL08050/CEL13002 with overall mean of 2.9 (Table 2). CEL08014/CEL08025 (2.2) had the best ear aspect. Only one cross CEL08014/CEL08025 had better ear aspect than Jibat (2.3) and two crosses (CEL08025/CML561, CEL08025/CEL10012) had better ear aspect than Kolba (2.5) in addition two crosses (CEL08008/CEL10023, CEL08008/CEL10012) had better ear aspect than the check Wonchi. The remaining 50 crosses had ear aspect lower than that of Wonchi (2.5) with ear aspect ranging between 2.6 (CEL08008/CEL10014) to 3.7 (CEL08050/CEL13002). The four high yielding crosses CEL08050/CEL10014, CEL13002/CEL10023, CEL08008/CEL10014, CEL08008/CEL10023 had inferior ear aspect.

Grain Yield

The mean grain yield of single cross tested in this study ranged from 4.2 (CEL08050/CEL08050) to 7.9 ton ha^{-1} (CEL08008/CEL10023,) with overall mean of 6.7 ton ha^{-1}. Among 60 single crosses evaluated, 7 single crosses manifested significant higher grain yield than the best commercial hybrid check Kolba. In general, CEL08008/CEL10023, CEL08050/CEL10014, CEL13002/CEL10023, CEL08008/CEL10014, revealed significantly higher grain yield as compared to all the three checks included in the study and are identified as the potential hybrids for production after further testing to confirm stability. The means of three checks were not significantly different. These indicate that there were genetic variations among genotypes for this trait in agreement with several authors report [12]; [13];[14].

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3. CONCLUSION

This study was conducted to identify superior single cross hybrids from the best check for most of yield and other traits. The experiment had (6 x 10) alpha lattice design and a three hybrid checks were evaluated for their yield and yield related traits performance at Kulumsa agricultural research field in 2019/1920 cropping season.

The results obtained in the present investigation were encouraging and tremendous increase in grain yield was obtained in most of the hybrids. Six promising CEL08008/CEL10023, EL08050/CEL10014, CEL08008/CEL10014, CEL13002/CEL10023 CEL08008/CEL10012, CEL08050/CEL08025 which had higher yield as compared to the checks were identified based on their mean performance which can improve the production and productivity of maize yield in the country.

Therefore, promising CEL08008/CEL10023, CEL08050/CEL10014, CEL08008/CEL10014, CEL13002/CEL10023 CEL08008/CEL10012, CEL08050/CEL08025 identified in this study should be used in maize research program as possible candidates for release after confirming the stability of their performance in multi-locations and one more season.

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