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Research Article

Evaluation of Quality Protein Maize Genotypes for Grain Yield in Mid Hill Districts of Nepal

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Article Information

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ABSTRACT

The present study pertaining to the identification of high yielding quality protein maize genotypes was conducted under coordinated varietal trials (CVT) at Khumaltar (Lalitpur) and Kabre (Dolakha) from 2011 to 2012 summer season and under coordinated farmers' field trials (CFFT) at Lumle (Kaski), Kimugaun (Dailekh) and Kabre (Dolakha) in 2011 summer season and at Dailekh and Kabre in 2012 summer season. The results of these trials showed that the genotypes namely Obatanpa followed by S99TLWQ-B and S01SIYQ produced the highest grain yield under coordinated varietal trials and genotypes namely S99TLYQ-B followed by S01SIWQ-3 and Poshilo Makai-1 produced the highest grain yield under coordinated farmers' field trials across testing sites and years. It is suggested that the superior genotypes derived from CFFT could be released and then recommended to farmers of mid hills of Nepal.

INTRODUCTION

In Nepal maize is the second most important staple crops after rice both in terms of area and production. Its area, production and productivity in Nepal is 928761 ha 2283222 mt and 2.458 kg/ha (MOAD, 2014), respectively. It contributes 3.15% to national GDP and 9.5% to agricultural GDP (MOAD, 2013). In our country all varieties of maize released so far are normal type except Poshilo Makai-1. Cereal protein contains on an average about 2% lysine which is less than one-half of the concentration recommended for human nutrition by Food and Agriculture Organization (FAO) of the United Nations (Prasanna *et al.,* 2001). For humans, lysine is the most limiting amino acid followed by tryptophan in maize protein (Kies *et al*, 1965). At least four studies on children and four on adults have found that eating QPM had significantly higher nitrogen retention than those who ate normal maize (Bressani 1991), indicating QPM protein is more bioavailable. The biological value of QPM protein is about 80% that of milk which is about 90% and that of normal maize is only about 45% (FAO, 1992). Maize has become the world's chief animal feed. It provides more feed than any other grain. It is outstanding being high in energy, low in fibre and easily digested by most livestock species. Normal maize has poor nutritional value for monogastric animals such as humans and pigs because of reduced content of essential amino acids such as lysine and tryptophan.

The majority of hill farm families in Nepal are suffering from protein malnutrition as their major staple food is maize and cannot afford animal protein. The research on the development of quality protein maize varieties is not sufficient in Nepal. Therefore, these trials were conducted to identify superior quality protein maize genotypes in terms of grain production for hills of Nepal.

MATERIALS AND METHODS

The coordinated varietal trials (CVT) were conducted in Khumaltar (Lalitpur) and Kabre (Dolakha) from 2011 to 2012 in summer season and coordinated farmer's field trials (CFFT) in Lumle (Kaski), Kimugaun (Dailekh) and Kabre (Dolakha) in 2011 in summer season and Kimugaun (Dailekh) and Kabre (Dolakha) in 2012 summer season. All trials were laid out in randomized block design with three replications in both CVT and CFFT. The plot size of CVT was 4 rows of 3 meter length (9 m^2) and for CFFT it was 6 rows of 3 meter length (13.5 m^2).

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The distance between row-to-row and plant-to-plant was 75 cm and 25 cm respectively. The Farmer's variety (local check) used in trials was Rampur Composite.

All plots were fertilized with 120:60:40 N:P_2O_5:K_2O kg/ha in the form of urea, di-amonium phosphate (DAP), and murate of potash (MoP). Of this 50 % of nitrogen, full 100% of phosphorous and potassium fertilizers were applied as basal and remaining 50 % of nitrogen was split first at knee high stage (top dressing) and second at tasseling stage (side dressing). Thinning was done at 25th day after sowing (DAS) to maintain a single plant per hill. Furadon (3 % C.G.) 2-3 granules per plant of maize were applied against the stem borer to the uppermost whorls of leaves at the grand growth stage (40 DAS). Two manual weedings were done throughout the maize growing period, first at knee-high (25 DAS) and second at tasseling stage (55 DAS). Irrigations was done two times during the growing period of maize hybrids, first at grand growth stage (40 DAS) and second at tasseling stage (60 DAS). Grain yield was adujusted on 80% shelling recovery and 15% moisture level.

Data were analyzed using the statistical package MSTAT-C and the significant differences between treatments were determined using least significant difference (LSD) test at probability level of 0.01 or 0.05 where the effects of the treatments were significant at 1% or 5% level of probability, respectively.

RESULTS AND DISCUSSION

The findings of CVT in 2011 summer showed that at Kabre and Khumaltar, all the genotypes were statistically significant for grain yield. At Khumaltar, the genotype Obatanpa produced the highest grain yield (5255 kg/ha), followed by Farmers' Variety (local check) (4436 kg/ha) and S99TLWQ-B (4240 kg/ha). At Kabre, the genotype S99TLYQ-HG-AB produced the highest grain yield (8639 kg/ha), followed by Obatanpa (8480 kg/ha) and Poshilo Makai-1 (8432 kg/ha). The combined analysis across Khumaltar and Kabre in 2011 summer showed that Obatanpa produced the highest grain yield of 6868 kg/ha followed by Farmers' variety (6345 kg/ha), S99TLYQ-HG-AB (6100 kg/ha) and S00TLYQ-B (6008 kg/ha). The highest yielding QPM genotypes showed higher grain yield than the local checks.

The results of CVT in 2012 showed that at Kabre and Khumaltar all the genotypes were statistically significant for grain yield. At Khumaltar, the genotype Obatanpa produced the highest grain yield (7397 kg/ha), followed by S01SIYQ (7015 kg/ha) and S00TLWQ-B (6382 kg/ha). At Kabre the genotype S99TLYQ-HG-AB produced the highest grain yield (7279 kg/ha), followed by S01SIYQ (7016 kg/ha) and S01SIWQ-2 (6557 kg/ha). The combined analysis across Khumaltar and Kabre in 2012 summer showed that S01SIYQ produced the highest grain yield of 7016 kg/ha followed by S99TLWQ-B (6747 kg/ha) and Obatanpa (6701 kg/ha) respectively. The QPM varieties could be more productive than normal maize is in agreement with a previous report (Yasin et al., 2007). Pixley and Bjarnason (2002) reported that QPM OPVs were more stable than hybrids for grain yield with the latter producing 13% higher grain yield.

The findings of CFFT in 2011 summer showed that at Kabre, Lumle and Dailekh all the tested genotypes were significant for grain yield. At Kabre the genotype S99TLYQ-HG-B produced the highest grain yield (4932 kg/ha), followed by Farmers' variety (4227 kg/ha) and S99TLYQ-A (4170 kg/ha) respectively. At Lumle, the genotype S99TLYQ-B produced the highest grain yield

Table 1: Grain yield of QPM maize genotypes evaluated under CVT at Khumaltar and Kabre during 2011 and 2012 summer

S.N.	Genotypes	2011	2011	Combined	2012	2012	Combined	Grand mean
		Khumaltar	Kabre		Khumaltar	Kabre		
1	Obatanpa	5255	8480	6868	7397	6005	6701	6784
2	S99TLYQ-HG-AB	3562	8639	6100	5114	6641	5878	5989
3	S01SIWQ-2	2747	6912	4830	5217	6557	5887	5358
4	S00TLYQ-B	3729	8287	6008	5332	5903	5617	5813
5	S01SIYQ	2688	7932	5310	7015	7016	7016	6163
6	Rampur S03 FQ-02	2428	7610	5019	5846	5340	5593	5306
7	S99TLWQ-B	4240	7391	5816	6214	7279	6747	6281
8	S00TLWQ-B	3368	7627	5498	6382	6054	6218	5858
9	Poshilo Makai-1	3445	8432	5938	5165	5180	5172	5556
10	Farmer's Variety	4436	8254	6345	6336	6450	6393	6369
	Grand mean	3590	7956	5773	6002	6242	6122	
	CV,%	26	11.2	9.6	13.9	11.5	13.3	
	$LSD_{0.05}$	1603	1526	1249.9	1432.4	1232.1	1349.3	
	F-test	*	*	*	*	*	*	

Table 2: Grain yield of QPM maize genotypes evaluated under CFFT at Kabre, Lumle and Dailekh in 2011 summer and Kabre and Dailekh in 2012 summer

S.N.	Genotypes	2011	2011	2011	Combined	2012	2012	Combined	Grand mean
		Kabre	Lumle	Dailekh		Kabre	Dailekh		
1	S99TLY-HG-B	4932	3694	4585	4772	6275	4597	5343	4885
2	S01SIWQ-3	4138	4165	5532	4833	6453	5552	5952	5232
3	S99TLYQ -B	4042	4511	6072	5069	6483	5224	5784	5312
4	S99TLYQ -A	4170	4120	5310	4910	5962	4977	5415	4981
5	Poshilo Makai-1	4153	4063	4936	4706	7161	4803	5851	5096
6	Farmer's Variety	4227	4445	5688	4865	5255	5212	5231	4989
	Grand mean	4277	4166	5354	4859	6265	5061	5596	5083
	CV,%	17.29	15.3	11.7	31	22.5	13.5	23.6	
	$LSD_{0.05}$	1115	838	1144.3	2497	2116.4	902.5	1811.6	
	F-test	*	*	*		*	*		
	Genotype (G)				*			*	
	Environment (E)				*			**	
	G x E				*			*	

(4511 kg/ha), followed by Farmers' Variety (4445 kg/ha) and S01SIWQ-3 (4165 kg/ha). At Dailekh, the genotype S99TLYQ-B produced the highest grain yield (6072 kg/ha), followed by Farmers' Variety (5688 kg/ha) and S01SIWQ-3 (5532 kg/ha).

The combined analysis across location (Dailekh, Lumle, and Kabre) revealed that S99TLYQ-B produced the highest grain yield (5069 kg/ha), followed by S99TLYQ-A (4910 kg/ha) and Farmers' Variety (4865 kg/ha). The interaction between genotype × location (G × L) was significant for grain yield. The results of CFFT in 2012 summer season at Kabre, and Dailekh showed that at Kabre, all the tested genotypes were significant for grain yield. At Kabre, the genotype Poshilo makai-1 produced the highest grain yield (7161 kg/ha), followed by S99TLYQ-B (6483 kg/ha) and S01SIWQ-3 (6453 kg/ha). At Dailekh, the genotype S01SIWQ-3 produced the highest grain yield (5552 kg/ha), followed by S99TLYQ-B (5224 kg/ha) and Farmers' Variety (5212 kg/ha). The combined analysis across location (Dailekh, and Kabre) revealed that S01SIWQ-3 produced the highest grain yield (5952 kg/ha), followed by Poshilo makai-1 (5851 kg/ha) and S99TLYQ-B (5784 kg/ha). The interaction between genotype × location (G × L) was significant for grain yield but for environment was found highly significant. The mean grain yield of maize genotypes differed across years and sites, which may be due to differing environmental conditions over times and sites. The sites themselves differed greatly in key attributes such as geographic location, temperature and rainfall that affect performance of maize genotypes. The possible reason for the observed differences in grain yield among the maize genotypes under the same station trials (locations) was due to their variation in their genetic makeup. These results are in line with those of Prasai *et al.* (2015), who observed considerable genotypic variability among various QPM genotypes in hill regions of Nepal.

CONCLUSION

Based on the results of these trials, It can be concluded that the genotypes namely S99TLYQ-B followed by S01SIWQ-3 and Poshilo Makai-1 were found superior in grain yield production across years and locations in mid hills of Nepal. Therefore they should be released and recommended to farmers of hill districts of Nepal for general cultivation.

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