Evaluation of Open Pollinated Normal Maize Varieties in the Eastern Mid Hill of Nepal

Surya N. Sah[1]* and Diwakar Sharma[2]

[1] Agriculture Research Statation-NARC, Pakhribas, Nepal
[2] National Maize Research Program-NARC, Rampur, Nepal

ABSTRACT

Full season maize genotypes were evaluated in on station coordinated varietal experiments during summer season at Agriculture Research Station (ARS), Pakhribas in three consecutive years 2003, 2004 and 2005. The experiments were laid out in randomized complete block design (RCBD) with three replications. The objective of this study was to identify high yield potential normal maize genotypes suitable for the existing cropping patterns in the eastern mid hill. Genotypes were evaluated in coordinated varietal trials (CVT) in 2003, 2004 and 2005 and in intermediate yield trial (IYT) in 2004. Five common genotypes including local and standard check were evaluated in the CVT 2003 and in the CVT 2004, another five common genotypes tested in the CVT 2004 and in the CVT 2005 and six common genotypes of the IYT 2004 and CVT 2005 were analyzed over year. Genotype P501-SARCO-F1/P502-SARCO-F1 produced significantly higher grain yield followed by DRACOSYN- F1/DRBCOSYN-F1 in the 1st two years and found about one week earlier than Mankamana-3. Across 00502 and Across 9942/Across 9944 were found superior with respect to grain yield and phenotypic characters like husk cover, plant aspect and ear aspect both in CVT 2005 and IYT 2004 across the years and the genotype Across 9942/Across 9944 was found tolerant to turcicum leaf blight (TLB) in 2005.

Key words: Eastern Nepal, evaluation, genotypes, maize

INTRODUCTION

Maize (*Zea mays* L.) (2n = 2x = 20) is the main cereal crop of hilly areas and the second most important crop in Nepal. It serves as main diet of more than 55% of the people who live in the hilly regions (Baniya et al 2003). It is grown for food, feed and fodder in Nepal. It is mostly grown as a rainfed crop in the hills. The total cultivated area under maize in the country is 864885 ha, of which the eastern hill covers 178239 ha. The average productivity (1.66 t/ha) of the eastern hill is less than the national average productivity 2.0 t/ha (CBS 2005). National Maize Research Program, Rampur has released 17 open pollinated maize varieties for general cultivation for different agro ecological zones. Among these, 7 varieties have been recommended for the Mid Hill. More than 86% hill farmers prefer to grow white maize (ARSD 2001/02). Out of those varieties Mankamana-1, Mankamana-3 as well as newly released Shitala and Deuti, all white colored varieties are getting popularity among mid hill farmers of the eastern Nepal. However, the varieties, which are good for today, might not remain the same for long because of the reoccurrences of new biotypes of pathogen on account to the changing environment. Farmers need varieties having not only white colored but also flint type grains for good storing capability, strong stem, stay green characteristics, system accountability and stress tolerant. Therefore, there is a continuous need of studies to identify demand driven suitable cultivars in Eastern Mid Hill of Nepal.

MATERIALS AND METHODS

A co-coordinated varietal trial was conducted at ARS, Pakhribas for three consecutive years 2003, 2004 and 2005. Including the standard and the local checks, nine entries in CVT 2003; CVT 2004; 16 entries in IYT 2004 and 11 entries in CVT 2005 were tested in RCBD with three replications. The unit plot size was of four rows of three meter length in CVT and two rows of three meter length

in IYT with the spacing of 25- × 75-cm. The planting dates were 15 April 2003, 3 May 2004, 28 April 2004 in IYT, 28 April 2005. Fertilizers were applied at the rate of 120:60:30 NPK kg/ha. Half dose of N and full dose of P and K were supplied as a basal dose at planting and the rest half nitrogen was given as a side top dressing during the knee high stage of plant. Compost @ 15 ton/ha was also applied uniformly through broadcasting immediately before land preparation each year. Malathion 5% dust was applied @ 20 kg/ha to protect the seed and germinating plants from soil insects. One set of five genotypes in the CVT 2003 and in the CVT 2004, 2nd set of five genotypes in the CVT 2004 and in the CVT 2005, 3rd set of six genotypes in IYT 2004 and in CVT 2005 including local and standard varieties were common tested entries across the years. The analysis of variances was performed for individual and over year for the traits recorded in trials using Genstat (1996). Ear aspect, plant aspect and husk cover were scored in 1 to 5 scale where 1 stands for excellent, 2 for, good, 3 for fair, 4 for poor and 5 for very poor. Similarly, Turcicum leaf blight (TLB) was also scored in 1-5 scales. Least significance difference (LSD) was used for comparison of means.

RESULTS AND DISCUSSION

Grain yield

The genotypes which were common in the CVT 2003 and in the CVT 2004 differed significantly over year in grain yield. In both years P501-SRCO-F1/P502-SRCO-F1 produced significantly higher grain yield (5443 kg/ha) than Manakamana-3 (3805 kg/ha), farmers' variety (3703 kg/ha) and ZM 421 (3661 kg/ha). DRACOSYN-F1/DRBCOSYN-F1 produced higher grain yield than local variety and ZM 421 and performed similar to P501-SRCO-F1/P502-SRCOF1 and Manakamana-3 (Table 1). P501-SRCO-F1/P502-SRCO-F1 and DRACOSYN-F1/DRBCOSYN-F1 genotypes were also identified better by Sah et al (2004), Sharma et al (2004), Adhikari et al (2004) and Sherchan (2004). Both the genotypes produced significantly higher grain yield than Manakamana-3 and local check as stated in ARSP (2004). They also produced significantly higher grain yield than Manakamana-2 (2243 kg/ha), however, they were found at par with Manakanama-3 and local check (3458 kg/ha) and grain yield performance of ZM 421 was found similar to P501-SRCO-F1/P502-SRCO-F1 and DRACOSYN-F_1/DRBCOSYN-F1 at Pakhribas (ARSP 2005). The result of combined analysis of five common genotypes of CVT conducted in 2004 and 2005 showed that Manakamana-3 (4973 kg/ha), Iquitos 9325 (4321 kg/ha), SZSYNKITH/SZSYNECU573 (4062 kg/ha) and ZM 421 (4006 kg/ha) produced significantly higher grain yield than local check (2849 kg/ha) and they were not different each other (Table 2). Iquitos 9325 and SZSYNKITH/SZSYNECU573 performed poorer than Manakamna-3, P501-SRCO-F1/P502-SRCO-F1 and DRACOSYN-F1/DRBCOSYN-F1 whereas Iquitos 9325 and ZM 421 performed same as Manakamana-3 (ARSP 2005).

TABLE 1. OBSERVED TRAITS OF COMMON MAIZE GENOTYPES IN CVTS CONDUCTED IN 2003 AND 2004

Genotype	Grain yield, kg/ha			Ear height, cm	Plant height, cm	Silking days (50%)	Plant aspect	Shoot lodging plant/ha, n	Harvest plant/ha, n
	2003	2004	Mean						
P501--SRCO-F1/P502- SRCO-F1	6422	4464	5443	124	243	92	2.65	5741	46667
DRACOSYN-F1/DRB-COSYN-F1	5522	3923	4723	113	228	91	2.65	7778	46296
ZM 421	3956	3365	3661	119	221	93	3.25	3333	43148
Manakamana-3	3526	4083	3804	151	266	93	3.05	9444	44074
Farmers' variety	3947	3458	3703	165	278	88	3.3	7593	44074
Mean	4675	3859	4267	135	247	91		6778	44852
F-test Entry	**	*	*	**	*	**		**	**
Year			**	*	**	*		ns	ns
Year x Entry			ns	*	**	**		ns	ns
LSD Entry	1301	1324	1005	16	20	4		7552	6388
Year			636	10	13	2			
Year x Entry				23	29	5			
CV, %	14.5	21	19	10	7	3		91	11

,, Significant at 0.05 and 0.01 probability level respectively. ns, Non significant.*

Over year variance analysis of six genotypes common in IYT 2004 and CVT 2005 showed significant ($P < 0.05$) differences among entries. Across 9942/Across 9942 (5976 kg/ha) and Across 00502 (5509 kg/ha) were evaluated alike Manakamana-3 in grain yield but their yields were found significantly higher than Coxtla 59627 (4876 kg/ha), Across 9942 (4537 kg/ha) and local variety

(3384 kg/ha) (Table 3). Mankamana-3 (5599 kg/ha) also gave significantly higher grain yield than Across 9942 and local check. Across 9942/Across 9942 and Across 00502 were recorded high yielding genotypes alike Manakamana 3 in a study conducted at Pakhribas (ARSP 2006). Across 9942/Across 9942 was also recognized the highest grain yielder genotype across locations as reported in NMRP (2006).

Table 2. Different data of common entries recorded in CVT normal maize 2004 and 2005

Genotype	Grain yield, kg/ha			Ear height, cm	Plant height, cm	Silking days	Root lodging plant/ha, n	Shoot lodging plant/ha, n	Ear aspect (1-5 scale)	Plant aspect (1-5 scale)	Husk cover (1-5 scale)
	2004	2005	Mean								
Iquitos 9325	3596	5047	4321	141	247	85	4255	11111	2.67	2.75	1.83
Szsynkith/Szsynecu 573	3101	5022	4062	149	265	85	4811	5889	2.92	2.9	2.83
ZM 421	3365	4647	4006	112	206	81	3333	4078	2.83	3.5	3.17
Manakamana-3	4083	5863	4973	144	251	86	6666	10367	2.42	2.5	1.33
Farmers' variety	3458	2239	2849	171	284	80	12967	16667	3.5	1.16	0.5
Mean	3642	4688	4042	140	251	84	6411	9633	2.87	3	1.93
F-test: Entry	*	**	**	**	**	**	**	**			
Year			**	*	**	ns	ns	**			
Year x Entry			*	ns	ns	ns	*	**			
LSD: Entry	1324	1232	1064	25	13	3.8	4666	5378			
Year			673	16	8	2.46	2888	3400			
Year x Entry			1505	36	19	505	6555	7600			
CV, %	21	15.5	21.7	15	4.3	3.8	60	46			

,, Significant at 0.05 and 0.01 probability level respectively. ns, Non significant.*

EAR AND PLANT HEIGHT

Five common entries of all three sets showed significant differences for plant and ear height. Farmers' variety possessed taller ear and plant height in each set. P501-SRCO-F1/P502-SRCO-F1 and DRACOSYN-F_1/DRBCOSYN-F1 were recorded shorter both in ear and plant height than Manakamana-3 (Table 1). Plant and ear heights of Iquitos 9325 were found at par with Manakamana-3. SZSYNKH/S2SYNECU573 was measured taller than Manakamana-3 in plant height and found same as Manakamana-3 in ear height. ZM 421 was the shortest among all both in ear and plant heights (Table 2). Across 00502 was found alike Manakamana-3 both in ear and plant heights. Across 9942/Across 9944 and Across 9942 were shorter than Manakamana-3 and Across 00502 in ear height and same as Manakamana-3 in plant height whereas Coxtla was found shorter than Manakamana-3 both in ear and plant heights (Table 3). P501-SRCO-F1/P502-SRCO-F1 and DRACOSYN-F_1/DRBCOSYN-F1 produced ears almost in the mid portion of the plant and ZM 421 produced ears above middle parts of plant. Across 9942, Coxtla 59627 and Across 00502 had the ears almost in mid portion whereas Across 9942/Across 9944, Iquitos 9325 and SZSYNKH/S2SYNECV573 had ears above mid portion of plants. Higher ear placed plants tend to lodge where as lower ear placement is more prone to damage by wild animals like Dumsi, monkey and Dheru particularly in the Eastern hilly areas surrounded by Jungles.

Table 3. Observed traits of common entries in IYT 2004 and CVT 2005 normal maize

Entry name	Grain yield, kg/ha			Ear height, cm	Plant height, cm	Silking days	Ear aspect (1-5)	Plant aspect (1-5)	Husk cover (1-5)	Root lodging plant/ha, n
	IYT 2004	CVT 2005	Mean							
Across 9942	5582	3492	4537	114	227	76	2.83	2.5	1.8	2966
Coxtla 59627	5011	4741	4876	112	220	81	2.17	2	1.8	1300
Across 00502	5761	6053	5909	131	236	88	2.05	2	2	2777
Across 9942/Across 9944	6265	5688	5976	117	221	80	1.83	1.5	1.16	922
Manakamana-3	5336	5863	5599	133	244	83	2	1.8	1.16	4077
Farmers' variety	4528	2239	3384	162	262	80	3	3.16	1	9078
Mean	5115	4679	4897	128	235	82				3522
F-test: Entry	**	**	*	**	**	**				**
Year			ns	**	**	**				**
Year x Entry			ns	*	ns	*				*
LSD Entry	1666	1232	1615	13	20	2.2				4255
Year				8	11	1.3				2455
Year x Entry				18	27	3.2				6030
CV, %	22.5	15.5	27	8.5	7	2.3				101

,, Significant at 0.05 and 0.01 probability level respectively. ns, Non significant.*

Silking days

Tested genotypes differed significantly ($P < 0.01$) in 50% silking days in all three sets. DRACOSYN F1/DRBCOSYN-F1 (91 days) and P501-SRCO-F1/P502-SRCO-F1 (92 days) were not different

from Manakamana-3 (93 days) and farmers' variety (88 days). ZM 421 (93 days) was also evaluated statistically at par with Manakmana-3 and farmers' variety in silking days in combined analysis of CVT 2003 and CVT 2004 (Table 1) and found significantly earlier than Manakamana-3 in combined result of CVT 2004 and CVT 2005 (Table 2), however, its yield potentiality was recorded poorer than others. Across 00502 was recorded very late (88 days) and Across 9942 was the earliest (76 days) in silking than all other tested genotypes in combined analysis of IYT 2004 and CVT 2005 where as silking days of Across 9942/Across 9944 (80 days) was alike with local variety but earlier than Manakamana-3 (Table 3). Similarly, Iquitos 9325 (85 days), SZSYNKH/S2SYNECU573 (85 days) and Manakamana-3 (86 days) were evaluated same in silking days (Table 2).

Ear aspect, plant aspect and husk cover

DRACOSYN-F1/DRBCOSYN-F1 and P501-SRCO-F1/P502-SRCO-F1 were scored better with regard to ear and plant aspects. P501-SRCO-F1/ P502-SRCO-F1 were evaluated fair in husk cover whereas DRACOSYN F1/DRBCSYN-F1 was found poor in husk cover. Across 9942/Across 9944, Across 00502 and Manakamana-3 were evaluated better with regard to plant aspect, ear aspect and husk cover. Iquitos 9325 was better in husk cover and fair in ear and plant aspects. SZSYNKH/S2SYNECV573 was fair in ear aspect, plant aspects and husk cover scores.

DRACOSYN-F1/DRBCOSYN-F1 and P501-SRCO-F1 / P502-SRCO-F1 were of good yield potential (4464 kg/ha) and same as Manakamana-3 in maturity. Both genotypes were recorded shorter in ear height and plant height than Manakamana-3, however, their ear placement was almost in middle part of plant (Table 1). P501-SRCO-F1/P502-SRCO-F1 was found promising considering recorded traits and is promoted for further verification. Iquitos 9325 and SZSYNKH/S2SYNECU573 possessed yield potentiality and silking days same as Manakamna-3 but Iquitos 9325 and Manakamna-3 were evaluated better with regard to ear aspect, plant aspect and husk cover than SZSYNKH/S2SYNECU573. ZM 421 was found earlier in silking, shorter both in ear and plant height and fair in plant aspect, ear aspect and husk cover. Its earliness trait could be used to make early population. Across 9942/Across 9944 and Across 00502 were high grain yielder varieties but their grain yield was not significantly different from Manakamana-3. Across 9942/Across 9944 was found earlier in silking, shorter in both ear and plant height and better with regard to ear aspect, plant aspect and root lodging. Therefore, this variety is recommended to promote for further test on the farmers' field. Across 00502 was found high yielder and good with respect to ear aspect, plant aspect and husk cover, however it was late in silking days like Deuti. Coxtla is same as Across 00502 in many characters but earlier in silking. So this genotype should also be considered for on farm verification.

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