



Research Article

Effect of Seed Priming on Maize in the Western Hills of Nepal

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Abstract

With a view to identify the effect of seed priming technology on maize in the western hills of Nepal, five different varieties of maize including farmers' local were tested during summer seasons of 2004 at three sites of Gorkha, Palpa and Myagdi districts using mother-baby scheme with primed and non-primed treatments. Results of mother trials combined over locations revealed that primed treatments silked three days earlier and matured six days prior to non-primed counterparts. Significant increase in grain yield, average of 11.6% and maximum of 27.8% was recorded. Farmers' response in baby trials combined over locations showed that plant stand after germination in primed treatment was found better as reported by 80% of the respondents.

Keywords: maize; seed; priming; yield

Introduction

Maize is the most important crop in the hills and ranks second in terms of area (891583 ha) and production (2231517 Mt.) with productivity of 2503 kg ha⁻¹. It occupies 42.82% area of the total food crops (rice, maize, wheat, millet, barley and buckwheat) in the hills and 26.97% in the country, and contributes 45.42% and 25.90% of the total cereal production in the hills and country, respectively. Similarly, contribution of maize to total edible production (5355232 tons) is 26.82 and to the total requirement (5426631 tons.) is 26.47 percent. Mountain and hilly regions are food deficit and only Terai has surplus edible production. Total edible balance is 71399 tons in negative direction in the country. Out of 75 districts 35 districts have insufficient edible balance (MoAD, 2017).

The strategy for maize research (LARC, 1997) highlighted the importance of agronomic management practices along with improved varieties to increase the production and productivity of maize in hills. A two-day workshop on seed priming held in Nepal on May 16-17, 2001 also highlighted the importance of seed priming and yield advantage of this technology on different crops up to 200% (Krishi, 2058 BS). Seed priming as a low cost, low risk intervention that increases and stabilizes yields has a large impact on the livelihoods of small scale, marginal and resource-poor farmers and families. On-farm maize seed priming is a technology where seed is soaked in water for a period that is less than "safe limit" that is 16-18 hours. Then are simply surface dried by spreading the seed in the shade for 15-30 minutes, and sown the same day.

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Yield and other advantages of primed seeds over non-primed are recorded in different crops in different countries. There has been much research during the last several years to test, develop and promote on-farm seed priming in a range of crops, countries and agro-environments. The beneficial effects of seed priming on crop establishment, development and yield have been documented (Parera and Cantliffe, 1994; Chivas *et al.*, 1998; Kulkarni and Eshanna, 1998; Harris *et al.*, 1999, 2001a, 2001b, 2002; Anonymous, 2002; Jasi *et al.*, 2000; Krishi, 2058). Currently, seed priming research is ongoing in Bangladesh, Cameroon, Cote d'Ivoire, Gambia, Ghana, India, Kenya, Nigeria, Pakistan, Sierra Leone, Thailand and Zimbabwe.

Materials and Methods

Site Selection

Gorkha, Myagdi and Palpa districts lie in middle hills. The latitude and longitude of Gorkha, Myagdi and Palpa districts are 28°0'0" N, 28°60'29" N, 27°52'0" N and 84°38'0" E, 83°33'62" E, 83°29'0" E, respectively. Sub-tropical climate prevails in these districts where experiments were conducted. Maize is the major crop for livelihood of the people in these districts.

Experimental Setup

Four varieties of maize namely, Manakamana 1, Manakamana 3, Rampur Composite and Manakamana 5 with primed and non-primed treatments were evaluated at three sites in farmers' field of Gorkha (Katteldanda, Shikhar and Bibinchok), Palpa (Khaseuli, Deurali and Nayarnamatalesh) and Myagdi (Ratnechaur-1, Jyamrukkot and Ratnechaur-1) districts (Table 1). The "Mother-Baby" trials methodology was used for experimentation. In baby trial, a single variety (2 kg seed of each variety) was given to four farmers in each VDC and asked to prime (16-18 hours) half of seed (1 kg) in water, then surface dry and sow using normal practices adjacent to a plot using non-primed seed. Baby trial was managed and led by farmers themselves. In addition to this, a complete set of trial i.e. mother trial (MT) consisting of four improved varieties and one local check was tested in centrally located farmers' field in each VDC using prime and non-prime treatments. Seventeen farmers were involved in testing the technology at each of the three sites in one district and thus, total 153 farmers participated the program. The scheme of a mother-baby trial using four varieties of maize using prime and non-prime treatments is given below in Fig. 1.

In the mother trials, plot size was 3m long 6 rows/variety. Seed rate was 20 kg/ha with spacing of 75 cm x 25 cm. Fertilizers were applied @ 80:40:30 NPK kg ha⁻¹, respectively. Farm yard manure was applied @10 t/ha. Observations were taken from four central rows on days to flowering, plant and ear height, grain yield and plant stand

at harvest from MTs. Data from mother trials were analyzed using MSTATC.

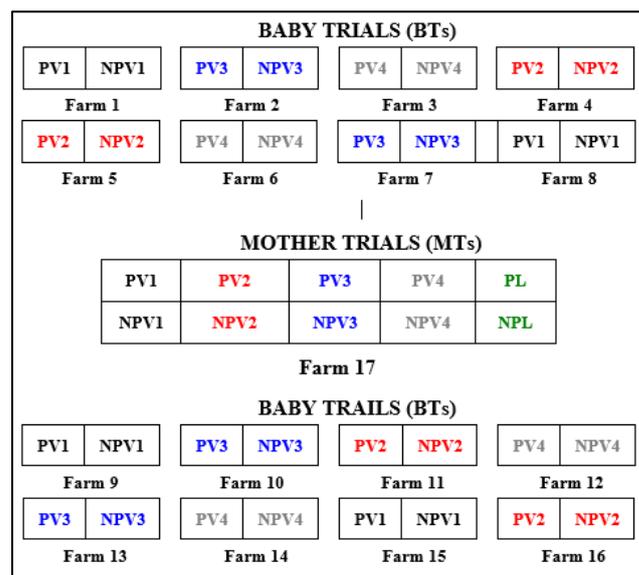


Fig. 1: The scheme of a mother-baby trial using four varieties of maize using prime and non-prime treatments [V1-V4 = New varieties, P = Primed, NP = Non-primed, L = Local variety]

Table 1: Pedigree, origin and source of germplasm

SN	Genotypes	Pedigree	Origin	Source
1	Rampur Composite	Suwan 1	Thailand	NMRP Rampur
2	Manakamana 3	BA-93	CIMMYT	NMRP Rampur
3	Manakamana 1	-	Nepal	ARS Pakhribas
4	Manakamana 5	Hill Pool White	Nepal	RARS Lumle
5	Farmers' Local	-	Nepal	Farmers in Gorkha, Myagdi and Palpa districts

Observations and Data Analysis

Farmers compared the performance of each improved variety with primed and non-primed treatments in baby trials and performance of local in mother trials from planting to post-harvest management. Individual farmer reported his/her own perceptions through a household level questionnaire (HLQ) through matrix ranking. Data in HLQ were recorded as scores where the primed treatment was compared to non-primed counterpart as better, same or worse. The following points were considered in HLQ: ease to planting, time to germination, plant stand after germination, plant height, lodging problem, weed problem, disease and insect pests problem, drought resistance, thickness of maize stover, days to maturity, ear size, grain yield, stover yield and plan for next year planting.

Results and Discussion

Mother Trial

Varietal differences were found highly significant for tasseling, silking, plant and ear height, and grain yield and significant for number of ears/plot. Location by variety interactions were highly significant for tasseling, silking, plant height, ear height and grain yield. Highly significant priming effects were recorded for tasseling, silking, number of ears/plot and significant for number of plants/plot and grain yield. Location by priming interactions were highly significant for grain yield, significant for days to tasseling and non-significant for rest of the traits. Variety by priming interactions were found significant only for grain yield. Location by variety by priming effects were observed non-significant for all the recorded traits. Observations recorded from the mother trials combined over locations have been summarised in Table 2.

In Gorkha, varietal differences were recorded highly significant for days to tasseling and silking, and plant

height, significant for ear height and grain yield and non-significant for number of plants and ears/plot. Highly significant priming effects were recorded for days to tasseling and silking, number of ears/plot and grain yield. Variety by priming interactions were found non-significant for all the traits. Results have been presented in Table 3. In Palpa, varietal differences were recorded highly significant for days to tasseling and silking, and plant and ear height, significant for grain yield and non-significant for number of plants and ears/plot. Highly significant priming effects were recorded for days to tasseling and silking and number of ears/plot. Variety by priming interactions were found non-significant for all the traits. Detail results are summarized in Table 4. In Myagdi, varietal differences were highly significant for all the traits except number of plants/plot. Highly significant priming effects were recorded for all the traits except plant and ear height. Variety by priming interactions were found non-significant for all the traits. Results have been given in Table 5.

Table 2: Performance of maize genotypes with and without priming treatments combined over locations, Mother trials, 2004

S N	Genotypes	Tasseling			Silking			Plant height, cm			Ear height, cm			Plant/plot (9m ²)			Ear/plot(9m ²)			Grain yield (kg/ha)		
		P	N	O	P	N	O	P	N	O	P	N	O	P	N	O	P	N	O	P	NP	%O NP
1	Rampur Composite	5 9	6 2	-3	6 3	6 5	-2	26 6	26 7	-1	12 8	12 8	0	4 5	4 3	2	4 8	4 3	5	51 42	47 84	7.5
2	Manaka mana 3	6 9	7 1	-2	7 3	7 6	-3	29 8	29 4	4	15 0	14 5	5	4 5	4 5	0	4 9	4 5	4	60 28	53 44	12.8
3	Manaka mana 1	6 1	6 3	-2	6 5	6 8	-3	27 4	27 2	2	13 5	13 1	4	4 7	4 5	2	4 8	4 2	6	52 15	40 79	27.8
4	Manaka mana 5	6 6	6 9	-3	7 0	7 3	-3	30 1	29 5	6	15 2	14 4	8	4 7	4 7	0	4 7	4 3	4	50 60	50 46	0.3
5	Farmers' Local	6 8	7 0	-2	7 2	7 4	-2	30 4	31 0	-6	16 7	16 8	-1	4 7	4 3	4	4 4	4 0	4	44 11	39 23	12.4
Grand mean		6 4	6 7	-3	6 9	7 1	-2	28 9	28 8	1	14 6	14 3	3	4 6	4 4	2	4 7	4 2	5	51 71	46 35	11.6
F-Variety		**			**			**			**			ns			*			**		
Location x Variety		**			**			**			**			ns			ns			**		
F-Priming		**			**			ns			ns			*			**			*		
Location x Priming		*			ns			ns			ns			ns			ns			**		
Variety x Priming		ns			ns			ns			ns			ns			ns			*		
Location x Variety x Priming		ns			ns			ns			ns			ns			ns			ns		
CV (%)		4.08			4.1			2.24			10.37			7.84			8.38			15.33		
LSD (0.05)		2.68			2.86			23.71			15			-			3.75			750.8		

P: Primed
*: Significant

NP: Non-primed
**: Highly Significant

ONP: Value over non-primed counterpart
%ONP: Percent over non-primed counterpart

Table 3: Performance of maize genotypes with and without priming treatment in Mother trials, 2004 (Gorkha)

S N	Genotyp es	Tasseling			Silking			Plant height, cm			Ear height, cm			Plant/plot (9m ²)			Ear/plot (9m ²)			Grain yield (kg/ha)		
		P	N P	O NP	P	N P	O NP	P	N P	O NP	P	N P	O NP	P	N P	O NP	P	N P	O NP	P	NP	%O NP
1	Rampur Composi te	5 7	5 9	2	6 1	6 3	2	26 3	26 6	3	13 1	13 6	5	4 3	4 0	3	4 9	4 0	9	55 44	49 05	13.0
2	Manaka mana 3	7 0	7 2	2	7 4	7 7	3	27 6	27 3	-3	14 4	14 5	1	4 2	4 3	-1	5 2	4 6	6	66 14	54 22	22.0
3	Manaka mana 1	6 0	6 2	2	6 5	6 7	2	24 8	25 8	10	12 9	13 0	1	4 0	3 9	1	4 9	4 2	7	60 26	38 43	56.8
4	Manaka mana 5	6 4	6 7	3	6 8	7 1	3	27 4	27 5	1	15 1	13 6	-15	4 0	4 0	0	4 7	4 1	6	54 52	51 24	6.4
5	Farmers' Local	6 8	7 0	2	7 2	7 5	3	29 7	30 7	10	14 7	15 1	4	4 0	3 8	2	4 4	4 3	1	48 59	45 85	6.0
Grand mean		6 4	6 6	2	6 8	7 1	3	27 2	27 6	4	14 1	14 0	1	4 1	4 0	1	4 8	4 2	6	56 99	47 76	19.3
F-Variety		**			**			**			*			ns			ns			*		
F-Priming		**			**			ns			ns			ns			**			**		
Variety x Priming		ns			ns			ns			ns			ns			ns			ns		
CV (%)		2.09			2.18			5.24			7.98			25.2			11.78			11.5		
LSD(0.05)		-			-			-			-			-			-			-		

P: Primed

NP: Non-primed

ONP: Value over non-primed counterpart

*:Significant

**: Highly Significant

%ONP: Percent over non-primed counterpart

Table 4: Performance of maize genotypes with and without priming treatment (Palpa) in Mother trials, 2004

S N	Genotyp es	Tasseling			Silking			Plant height, cm			Ear height, cm			Plant/plot (9m ²)			Ear/plot (9m ²)			Grain yield (kg/ha)		
		P	N P	O NP	P	N P	O NP	P	N P	O NP	P	N P	O NP	P	N P	O NP	P	N P	O NP	P	NP	%O NP
1	Rampur Composi te	6 0	6 4	4	6 5	6 8	3	28 0	28 3	3	12 8	12 3	-5	4 4	4 4	0	4 5	4 3	2	54 91	53 78	2.1
2	Manaka mana 3	7 2	7 3	1	7 7	7 9	2	31 4	30 7	-7	15 2	13 8	-14	4 6	4 6	0	4 5	4 4	1	61 78	60 78	1.6
3	Manaka mana 1	6 2	6 5	3	6 6	7 0	4	27 2	25 9	-13	13 3	12 1	-12	4 6	4 5	1	4 5	4 0	5	49 72	42 75	16.3
4	Manaka mana 5	6 6	6 8	2	7 1	7 4	3	31 7	29 8	-19	15 7	14 6	-11	4 5	4 6	-1	4 4	4 2	2	42 78	51 23	-16.5
5	Farmers' Local	7 4	7 5	1	7 9	7 9	0	33 9	34 9	10	18 1	17 7	-4	4 6	4 0	6	4 4	4 0	4	50 35	45 73	10.1
Grand mean		6 7	6 9	2	7 2	7 4	2	30 5	29 9	-6	15 0	14 1	-9	4 6	4 4	2	4 5	4 2	3	51 91	50 85	2.1
F-Variety		**			**			**			**			ns			ns			*		
F-Priming		**			**			ns			ns			ns			**			ns		
Variety x Priming		ns			ns			ns			ns			ns			ns			ns		
CV (%)		1.29			2.41			4.96			12.85			6.99			6.12			16.05		
LSD(0.05)		-			-			-			-			-			-			-		

P: Primed

NP: Non-primed

ONP: Value over non-primed counterpart

*:Significant

**: Highly Significant

%ONP: Percent over non-primed counterpart

Table 5: Performance of maize genotypes with and without priming treatment in Mother trials (Myagdi), 2004

S N	Genotypes	Tasseling			Silking			Plant height, cm			Ear height, cm			Plant/plot (9m ²)			Ear/plot (9m ²)			Grain yield (kg/ha)		
		P	N	O	P	N	O	P	N	O	P	N	O	P	N	O	P	N	O	P	NP	%O NP
1	Rampur Composite	5 9	6 2	3	6 2	6 5	3	25 4	25 3	-1	12 5	12 6	1	4 8	4 4	4	5 0	4 4	6	43 92	40 69	7.9
2	Manakamana 3	6 4	6 7	3	6 7	7 1	4	30 5	30 4	-1	15 1	15 2	1	4 8	4 5	3	5 0	4 4	6	52 92	45 32	16.8
3	Manakamana 1	6 1	6 4	3	6 5	6 8	3	30 2	30 0	-2	14 2	14 3	1	4 8	4 4	4	4 8	4 5	3	46 47	41 19	12.8
4	Manakamana 5	6 7	7 1	4	7 1	7 4	3	31 2	31 1	-1	14 9	15 0	1	4 8	4 5	3	5 0	4 6	4	54 49	48 90	11.4
5	Farmers' Local	6 2	6 5	3	6 5	6 8	3	27 5	27 3	-2	17 2	17 4	2	4 7	4 2	5	4 5	3 8	7	33 37	26 12	27.8
Grand mean		6 3	6 6	3	6 6	6 9	3	29 0	28 8	-2	14 8	14 9	1	4 8	4 4	4	4 9	4 3	6	46 24	40 45	14.3
F-Variety		**			**			**			**			ns			**			**		
F-Priming		**			**			ns			ns			**			**			**		
Variety x Priming		ns			ns			ns			ns			ns			ns			ns		
CV (%)		1.28			1.26			5.47			6.31			3.09			3.35			4.84		
LSD(0.05)		-			-			-			-			-			-			-		

P: Primed

NP: Non-primed

ONP: Value over non-primed counterpart

*: Significant

**: Highly Significant

%ONP: Percent over non-primed counterpart

Table 6: Farmers' preferences on on-farm maize seed priming combined over locations, 2004

Traits	Rampur Composite			Manakamana 3			Manakamana 1			Manakamana 5		
	1(%)	2(%)	3(%)	1(%)	2(%)	3(%)	1(%)	2(%)	3(%)	1(%)	2(%)	3(%)
Ease to planting	63.9	16.7	19.4	66.7	8.3	25.0	75.0	13.9	11.1	75.4	8.3	16.3
Time to Germinate	83.3	16.7	0.0	91.7	8.3	0.0	91.7	8.3	0.0	94.4	5.6	0.0
Plant stand after germination	86.1	13.9	0.0	94.4	5.6	0.0	86.1	13.9	0.0	97.2	2.8	0.0
Growth of the plant	61.1	38.9	0.0	72.2	27.8	0.0	72.2	27.8	0.0	83.5	16.5	0.0
Weed problem	5.6	91.7	2.8	5.6	86.1	8.3	11.1	86.1	2.8	8.3	88.9	2.8
Time to tasseling/silking	77.8	22.2	0.0	86.1	8.3	5.6	83.3	13.9	2.8	86.3	13.7	0.0
Stover thickness	27.8	72.2	0.0	41.7	55.6	2.7	33.3	63.9	2.8	42.9	57.1	0.0
Plant height	8.3	75.0	16.7	11.1	58.3	30.6	19.4	58.3	22.2	15.8	49.1	35.0
Disease problem	38.9	58.3	2.8	41.7	55.6	2.7	27.8	66.7	5.6	45.7	51.7	2.6
Insect/pest problem	38.9	55.6	5.6	47.2	50.0	2.8	30.6	69.4	0.0	42.9	51.7	5.3
Lodging	41.7	47.2	11.1	38.9	52.8	8.3	41.7	55.6	2.8	40.0	51.9	8.1
Drought tolerance	16.7	75.0	8.3	25.0	72.2	2.8	13.9	72.2	13.9	26.7	68.2	5.1
Maturity	61.1	30.6	8.3	69.4	11.1	19.5	61.1	27.8	11.1	78.2	19.0	2.8
Ear size	38.9	58.3	2.8	47.2	52.8	0.0	50.0	50.0	0.0	47.9	52.1	0.0
Grain production	38.9	55.6	5.6	58.3	41.7	0.0	61.1	38.9	0.0	56.4	43.6	0.0
Stover production	47.2	52.8	0.0	50.0	50.0	0.0	50.0	47.2	2.8	48.3	51.7	0.0
Plan for next year planting	75.1	-	24.9	88.9	-	11.1	86.1	-	13.9	81.0	-	19.0

Note: 1(%), 2(%), 3(%) – percent respondents reporting better, similar and worse result, respectively, of primed seed over non-primed counterpart for each trait.

Baby Trials

Feedback from baby trials was recorded from each individual farmer for different pre and post-harvest traits of each variety (Table 6). Farmers' responses combined over locations showed that 64-75% respondents express their opinion on the favour of easy planting of primed seed. Plant stand after germination in primed treatment was found better as reported by 80% of the respondents. 78% of the respondents claimed earlier maturity in Manakamana 5 whereas more than 60% respondents claimed the same for rest of the varieties. Majority of the respondents reported non-significant differences in primed and non-primed treatments for weed, disease, insect and lodging problem, plant height and stover thickness. Regarding grain production, 38.9%, 58.3%, 61.1% and 56.4% of

participating farmers reported better performance of primed seed in Rampur composite, Manakamana 3, Manakamana 1 and Manakamana 5 respectively. 75.1 to 88.9 % farmers express their desire to use maize seed priming technology in the coming years. Farmers' preferences of maize genotypes with and without priming treatments of different districts (combined over sites) have been summarised and presented in table 6, 7 and 8. Based on farmers' view in HLQ, focus group discussions (FGD), field day and inter-district observation tour, farmers of Gorkha and Palpa preferred Manakamana 3, Manakamana 5 and Rampur composite whereas farmers of Myagdi preferred Manakamana 3 and Manakamana 5. Feedbacks from farmers from each district have been summarized in Table 7, 8 and 9.

Table 7: Farmers' feedback on seed priming of different maize varieties in HLQ (BT), Gorkha, 2004

Traits	Rampur Composite			Manakamana 3			Manakamana 1			Manakamana 5		
	1(%)	2(%)	3(%)	1(%)	2(%)	3(%)	1(%)	2(%)	3(%)	1(%)	2(%)	3(%)
Ease to planting	50.0	8.3	41.7	41.7	8.3	50.0	75.0	8.3	16.7	58.3	8.3	33.3
Time to Germinate	75.0	25.0	0.0	91.7	8.3	0.0	91.7	8.3	0.0	83.3	16.7	0.0
Plant stand after germination	83.3	16.7	0.0	91.7	8.3	0.0	100.0	0.0	0.0	91.7	8.3	0.0
Growth of the plant	66.7	33.3	0.0	91.7	8.3	0.0	91.7	8.3	0.0	83.3	16.7	0.0
Weed problem	16.7	75.0	8.3	16.7	75.0	8.3	25.0	75.0	0.0	25.0	66.7	8.3
Time to tasseling/silking	58.3	41.7	0.0	66.7	16.7	16.7	83.3	16.7	0.0	83.3	16.7	0.0
Stover thickness	66.7	33.3	0.0	75.0	16.7	8.3	75.0	25.0	0.0	75.0	25.0	0.0
Plant height	25.0	33.3	41.7	8.3	25.0	66.7	33.3	8.3	58.3	8.3	25.0	66.7
Disease problem	75.0	16.7	8.3	66.7	25.0	8.3	50.0	41.7	8.3	83.3	16.7	0.0
Insect/pest problem	75.0	16.7	8.3	83.3	16.7	0.0	50.0	50.0	0.0	75.0	16.7	8.3
Lodging	66.7	8.3	25.0	50.0	25.0	25.0	66.7	25.0	8.3	58.3	25.0	16.7
Drought tolerance	33.3	66.7	0.0	50.0	50.0	0.0	16.7	58.3	25.0	33.3	66.7	0.0
Maturity	41.7	41.7	16.6	58.3	8.3	33.3	58.3	16.7	25.0	75.0	16.7	8.3
Ear size	58.3	33.3	8.4	83.3	16.7	0.0	83.3	16.7	0.0	66.7	33.3	0.0
Grain production	66.7	25.0	8.3	91.7	8.3	0.0	91.7	8.3	0.0	83.3	16.7	0.0
Stover production	83.3	16.7	0.0	91.7	8.3	0.0	83.3	16.7	0.0	83.3	16.7	0.0
Plan for next year planting	67.0	-	33.0	75.0	-	25.0	75.0	-	25.0	58.3	-	41.7

Note: 1(%), 2(%), 3(%) – percent respondents reporting better, similar and worse result, respectively, of primed seed over non-primed counterpart for each trait.

Table 8: Farmers' preferences on seed priming of different maize varieties, (BT), Palpa, 2004

Traits	Rampur Composite			Manakamana 3			Manakamana 1			Manakamana 5		
	1(%)	2 (%)	3(%)	1(%)	2(%)	3(%)	1(%)	2(%)	3(%)	1(%)	2(%)	3(%)
Ease to planting	50.0	33.3	16.7	58.3	16.7	25.0	50.0	33.3	16.7	84.6	0.0	15.4
Time to Germinate	75.0	25.0	0.0	83.3	16.7	0.0	83.3	16.7	0.0	100.0	0.0	0.0
Plant stand after germination	75.0	25.0	0.0	91.7	8.3	0.0	58.3	41.7	0.0	100.0	0.0	0.0
Growth of the plant	50.0	50.0	0.0	66.7	33.3	0.0	50.0	50.0	0.0	92.3	7.7	0.0
Weed problem	0.0	100.0	0.0	0.0	91.7	8.3	8.3	83.3	8.3	0.0	100.0	0.0
Time to tasseling/silking	75.0	25.0	0.0	91.7	8.3	0.0	75.0	16.7	8.3	92.3	7.7	0.0
Stover thickness	8.3	91.7	0.0	41.7	58.3	0.0	16.7	75.0	8.3	53.8	46.2	0.0
Plant height	0.0	91.7	8.3	16.7	58.3	25.0	25.0	66.7	8.3	30.8	30.8	38.5
Disease problem	33.3	66.7	0.0	50.0	50.0	0.0	33.3	58.3	8.3	53.8	38.5	7.7
Insect/pest problem	33.3	58.3	8.3	50.0	41.7	8.3	41.7	58.3	0.0	53.8	38.5	7.7
Lodging	50.0	41.7	8.3	58.3	41.7	0.0	58.3	41.7	0.0	61.5	30.8	7.7
Drought tolerance	8.3	66.7	25.0	16.7	75.0	8.3	16.7	66.7	16.7	38.5	46.2	15.4
Maturity	75.0	25.0	0.0	66.7	16.7	16.7	83.3	16.7	0.0	84.6	15.4	0.0
Ear size	50.0	50.0	0.0	50.0	50.0	0.0	58.3	41.7	0.0	76.9	23.1	0.0
Grain production	41.7	58.3	0.0	66.7	33.3	0.0	75.0	25.0	0.0	69.2	30.8	0.0
Stover production	50.0	50.0	0.0	50.0	50.0	0.0	41.7	50.0	8.3	61.5	38.5	0.0
Plan for next year planting	58.3	-	41.7	91.7	-	8.3	83.3	-	16.7	84.6	-	15.4

Note: 1(%), 2(%), 3(%) – percent respondents reporting better, similar and worse result, respectively, of primed seed over non-primed counterpart for each trait.

Table 9: Farmers' reactions on seed priming of different maize varieties,(BT), Myagdi, 2004

Traits	Rampur Composite			Manakamana 3			Manakamana 1			Manakamana 5		
	1(%)	2(%)	3(%)	1(%)	2(%)	3(%)	1 (%)	2(%)	3(%)	1(%)	2(%)	3(%)
Ease to planting	91.7	8.3	0.0	100.0	0.0	0.0	100.0	0.0	0.0	83.3	16.7	0.0
Time to Germinate	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0
Plant stand after germination	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0
Growth of the plant	66.7	33.3	0.0	58.3	41.7	0.0	75.0	25.0	0.0	75.0	25.0	0.0
Weed problem	0.0	100.0	0.0	0.0	91.7	8.3	0.0	100.0	0.0	0.0	100.0	0.0
Time to tasseling/silking	100.0	0.0	0.0	100.0	0.0	0.0	91.7	8.3	0.0	83.3	16.7	0.0
Stover thickness	8.3	91.7	0.0	8.3	91.7	0.0	8.3	91.7	0.0	0.0	100.0	0.0
Plant height	0.0	100.0	0.0	8.3	91.7	0.0	0.0	100.0	0.0	8.3	91.7	0.0
Disease problem	8.3	91.7	0.0	8.3	91.7	0.0	0.0	100.0	0.0	0.0	100.0	0.0
Insect/pest problem	8.3	91.7	0.0	8.3	91.7	0.0	0.0	100.0	0.0	0.0	100.0	0.0
Lodging	8.3	91.7	0.0	8.3	91.7	0.0	0.0	100.0	0.0	0.0	100.0	0.0
Drought tolerance	8.3	91.7	0.0	8.3	91.7	0.0	8.3	91.7	0.0	8.3	91.7	0.0
Maturity	66.7	25.0	8.3	83.3	8.3	8.3	41.7	50.0	8.3	75.0	25.0	0.0
Ear size	8.3	91.7	0.0	8.3	91.7	0.0	8.3	91.7	0.0	0.0	100.0	0.0
Grain production	8.3	83.3	8.3	16.7	83.3	0.0	16.7	83.3	0.0	16.7	83.3	0.0
Stover production	8.3	91.7	0.0	8.3	91.7	0.0	25.0	75.0	0.0	0.0	100.0	0.0
Plan for next year planting	100.0	-	0.0	100.0	-	0.0	100.0	-	0.0	100.0	-	0.0

Note: 1(%), 2(%), 3(%) – percent respondents reporting better, similar and worse result, respectively, of primed seed over non-primed counterpart for each trait.

Discussions

Results of mother trials combined over locations revealed that primed treatments silked 3 days earlier and consequently matured 6 days earlier compared to non-primed counterparts. Likewise, increased number of plants and ears per plot in the primed treatment was observed. Significant increase in grain yield (average of 11.6% and maximum of 27.8% in Manakamana 1) was recorded. Priming effect for grain yield was found not only variety specific but also location specific. Highest grain yield was obtained from the variety Manakamana-3 both in primed (6028 kg ha⁻¹) and non-primed (5344 kg ha⁻¹) conditions. Similar results were obtained in Pakistan and Zimbabwe by Harris and his colleagues (2002) where seed priming on maize increased grain yield by 17-76% and 14% over non-primed, respectively. In Gorkha, Grain yield increment ranged from 6.0% for farmers' local to 56.8% for Manakamana 1. Highest grain yield was obtained from the variety Manakamana 3 both in primed (6614 kg ha⁻¹) and non-primed (5422 kg ha⁻¹) situations. In Palpa district, Variety Manakamana-1 showed better performance of seed priming (16.3% yield increment). Highest grain yield was obtained from the variety Manakamana 3 both in primed (6178 kg ha⁻¹) and non-primed (6078 kg ha⁻¹) seeds. In Myagdi district, Grain yield increment ranged from 7.9% for Rampur composite to 27.8% for Farmers' local. Highest grain yield was obtained from the variety Manakamana 5 both in primed (5449 kg ha⁻¹) and non-primed (4890 kg ha⁻¹) environments. Our research findings from both mother and baby trials conducted at nine sites in three districts of Nepal agreed and supported the findings of previous research results carried out in various countries that direct benefits of seed priming in maize are faster emergence, better and more uniform stands, less need to re-sow, more vigorous plants, earlier flowering, earlier harvest and higher and stable grain yield (Chivasa *et al.*, 1998; Harris *et al.*, 1999, 2001b, 2002; Rashid *et al.*, 2002). These results were confirmed for maize in Pakistan and Zimbabwe (Harris *et al.*, 1999, 2002). However, the previous findings that better drought tolerance and weed control in primed seeds was not supported by our research results.

Conclusion

Varieties namely Manakamana 3, Manakamana 5 and Rampur composite in Gorkha and Palpa whereas Manakamana-3 and Manakamana 5 in Myagdi districts were preferred by farmers. At the same level of management, significant effect of priming in maize grain yield (average of 11.6% and maximum of 27.8% in Manakamana 1) has been observed. Priming effect for grain yield was found not only variety specific but also location specific. Highest grain yield was obtained from the variety Manakamana 3 both in primed (6028 kg ha⁻¹) and non-primed (5344 kg ha⁻¹) conditions. However, variety and location specific results on maize seed priming were

recorded, and positive impacts of seed priming in grain yield and other quantitative traits have been verified. Therefore, this technology should be promoted and disseminated widely using different varieties at different locations.

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