

Effect of nitrogen and farmyard manure application on maize (*Zea mays*) varieties

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ABSTRACT

A field experiment was conducted during the rainy (*kharif*) seasons of 1996 and 1997 at Salooni, Himanchal Pradesh, to study the response of 3 maize (*Zea mays* L.) varieties to nitrogen and farmyard manure (FYM) application under rainfed condition. Among the varieties, 'Salooni Local' recorded the highest plant height, cob length, grains/cob and 100-grain weight, resulting in higher grain and stover yields. Application of 90 kg N and 15 tonnes FYM/ha resulted in the maximum plant height, cob length, grains/cob, grain weight, harvest index and thereby higher yields. Maximum agronomic efficiency was recorded with application of 45 kg N and 15 tonnes FYM/ha.

Key words : Maize, N, FYM, Rainfed

Maize is very important cereal crop of Himachal Pradesh. Fertilizer management is one of the most important agronomic factor that affects the yield of cereal crop. Farmyard manure (FYM) improves the soil properties and finally crop yield (Bhatiya and Shukla, 1982). But in view of its inadequacy and low availability of nutrients, productivity of maize per unit area is very poor. Supplementing N through inorganic sources, thus play a vital role in increasing the yield of this crop. Therefore, present investigation was undertaken to study effect of N and FYM on different varieties of maize.

MATERIALS AND METHODS

The field experiment was conducted during the rainy (*kharif*) seasons of 1996 and 1997 at Research Sub-Station of Himachal Pradesh Krishi Vishva-vidyalaya, Salooni. The soil was clay loam in texture, medium in organic carbon (0.93%) and available potassium (210.6 kg/ha) and low in available nitrogen (260.5 kg/ha) and phosphorus (9.4 kg/ha), having pH 6.0. Eighteen treatments, comprising 3 varieties ('Early Composite', 'Parvati' and 'Salooni Local'), 3 levels of nitrogen (0, 45 and 90 kg N/ha) and 2 levels of farmyard manure (0 and 15 tonnes farmyard manure/ha)

were evaluated in randomized block design with 3 replications. One-third of nitrogen along with full P (45.0 kg P_2O_5 /ha) and K (30 kg K_2O /ha) applied at sowing time as basal and remaining two-thirds nitrogen was top-dressed in 2 equal splits, one at knee-high stage and another at pre-tasselling stage. The crop was sown on 18 and 15 May 1996 and 1997 respectively. The total rainfall received during the crop season of 1996 and 1997 was 762.5 mm and 1,063.7 mm respectively. The agronomic efficiency of FYM or nitrogen was calculated as:

$$\text{Agronomic efficiency} = Y_n - Y_c / A$$

where Y_n , grain yield (kg/ha) of nitrogen applied field; Y_c , grain yield (kg/ha) in field without nitrogen; and A, amount of nitrogen applied.

RESULTS AND DISCUSSION

Variety

Maize varieties influenced almost all the growth parameters, yield attributes and yield significantly except harvest index. Maximum grain and stover yields were recorded with 'Salooni Local' compared with 'Early Composite' and 'Parvati' (Table 2) except in the second year, where the difference in grain yield between 'Salooni Local' and 'Parvati' was not significant, followed by 'Early Composite' in 1996 and 'Parvati' in 1997. More yield in 'Salooni Local' was mainly owing to higher expression of growth and yield attributes in this variety (Table 1), which in turn, reflected in higher grain and stover yields. On an average, 'Salooni Local' recorded 13.32 and 21.69% more grain

Table 1. Effect of variety, nitrogen and farmyard manure on growth and yield components of maize

Treatment	Plant height (cm)		Cob length (cm)		Grains/ cob		100-grain weight (g)	
	1996	1997	1996	1997	1996	1997	1996	1997
<i>Variety</i>								
'Early Composite'	170.2	186.4	13.6	12.3	340.1	243.7	24.1	24.2
'Parvati'	190.6	193.5	12.5	14.4	320.7	341.1	24.6	24.5
'Salooni Local'	235.6	256.1	16.1	15.0	379.0	360.6	27.4	26.9
CD (P = 0.05)	10.2	12.2	0.8	0.9	21.4	22.5	1.0	1.1
<i>N (kg/ha)</i>								
0	150.3	160.2	10.4	11.5	151.2	187.5	21.6	23.1
45	191.5	200.6	14.9	14.6	350.3	362.6	26.4	25.6
90	254.6	275.2	16.9	15.6	460.5	395.3	27.1	26.9
CD (P = 0.05)	10.2	12.2	0.8	0.9	21.4	22.5	1.0	1.1
<i>FYM (tonnes/ha)</i>								
0	180.7	119.0	12.6	12.4	322.8	298.1	23.9	23.1
15	216.9	225.0	14.1	13.9	370.4	322.1	26.2	26.3
CD (P = 0.05)	7.8	8.1	0.7	0.7	16.5	18.2	0.8	0.8

Table 2. Effect of variety, nitrogen and farmyard manure on grain and stover yields of maize

Treatment	Grain yield (q/ha)			Stover yield (q/ha)			Harvest index (%)		Agronomic efficiency (kg/kg)	
	1996	1997	Mean	1996	1997	Mean	1996	1997	1996	1997
<i>Variety</i>										
'Early Composite'	36.00	30.12	33.06	60.27	51.10	53.69	35.20	35.61	21.63	18.70
'Parvati'	33.10	37.90	35.50	54.75	59.65	56.90	35.41	35.77	20.92	19.76
'Salooni Local'	40.70	39.75	40.23	72.40	70.50	71.45	35.65	36.60	24.78	20.63
CD (P=0.05)	2.24	2.52		4.03	4.28		NS	NS		
<i>N (kg/ha)</i>										
0	19.50	25.74	22.62	31.20	41.18	36.19	33.33	34.63	2.67	5.96
45	39.70	40.37	40.04	67.49	67.53	67.51	35.82	35.81	37.46	32.50
90	50.70	41.67	46.18	88.73	71.94	80.34	37.11	37.54	27.20	20.01
CD (P = 0.05)	2.24	2.52		4.03	4.28		1.18	1.37		
<i>FYM (tonnes/ha)</i>										
0	34.40	31.27	32.84	53.25	50.90	52.08	35.12	35.26	19.53	15.37
15	38.60	40.58	39.59	71.69	69.54	70.62	36.31	36.72	23.35	24.07
CD (P = 0.05)	1.56	2.05		2.85	3.70		0.85	0.92		

and 25.5 and 33.80% more stover yield over than 'Parvati' and 'Early Composit'. The findings confirm the report of the HPKV (1991-92). Based on 2 years study, the agronomic efficiency was also higher in 'Salooni Local' 'Early Composite' and 'Parvati' (Table 2). Higher agronomic efficiency in 'Salooni Local' may be due to higher yield potential of this variety.

Nitrogen

Nitrogen application significantly increased the plant height, cob length and grains/cob and 100-grain weight (Table 1). Application of 90 kg N/ha recorded significantly higher harvest index, grain and stover yields than 0 and 45 kg N/ha during both the years, except in 1997, whereas 45 kg and 90 kg N/ha were at par with each other (Table 2). The higher yield with increasing levels of nitrogen mainly due to it, beneficial effect on growth and yield, attributing character, (Table 1). The mean increase due to application of 90 kg N/ha over 45 kg and the control was 6.14 and 22.56 q/ha for grains and 12.83 and 44.15 q/ha for stover. Our results confirm those of Minhas and Singh (1998). The agronomic efficiency was maximum with 45 kg N/ha and decreased with 90 kg N/ha.

Farmyard manure

Farmyard manure had a significant effect on the growth and yield components (Table 1), harvest index, grain and stover yields (Table 2). On an average, farmyard manure application recorded 20.55 and 35.65 % more grain and stover yields respectively over no farmyard manure application. The increase in yield may be owing to the

favourable effects of farmyard manure on growth and yield attributes in plant. (Minhas and Singh, 1998) also recorded higher yield with farmyard manure application in maize. The farmyard manure application recorded more agronomic efficiency than no farmyard manure. It might be due to the presence of nutrients in farmyard manure which increases the efficiency.

Interaction effect

Based on pooled analysis of grain yield of maize, the interaction effect between farmyard manure and nitrogen levels was found to be significant (Table 3). Grain yield was significantly highest with the application of 90 kg N/ha in combination with 15 tonnes farmyard manure/ha, followed by 90 kg N/ha alone. However, the yield obtained with 90 kg N/ha without farmyard manure application was statistically at par with that of 45 kg N/ha in combination with 15 tonnes farmyard manure/ha. Minhas and Singh (1998) also observed the similar effect of integration of chemical fertilizers with organic manures.

Table 3. Interaction effect of FYM and nitrogen levels on pooled grain yield of maize (q/ha)

FYM (tonnes/ha)	N (kg/ha)		
	0	45	90
0	17.2	37.6	44.0
15	28.0	42.5	48.3
CD (P = 0.05)		2.97	

Hence an application of 90 kg N/ha in combination with 15 tonnes farmyard manure/ha recorded the maximum yield, 45 kg N/ha in combination with 15 tonnes

farmyard manure/ ha proved equally good as 90 kg N/ha without farmyard manure.

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