Effect of Nitrogen and Phosphate Levels on Forage Yield and Quality of Maize Varieties and Teosinte

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ABSTRACT

The present investigation was carried out during *kharif* (1971-73) at Anand to find out a variety of maize or teosinte suitable for this region and its manurial requirements for optimum forage yield. Nitrogen was applied at 0, 40, 80 and 120 kg/ha and phosphate at 0, 30 and 60 kg/ha. Among the four varieties of maize and one of teosinte, the maximum green forage, dry matter and crude protein yields were 465, 101 and 7.9 q/ha, respectively for teosinte variety T-1. Next was Ganga Safed-2. The varieties Ganga-5, Farm Sameri and Ganga-5 (F-2) showed poor performance as compared to the above two varieties. The application of nitrogen from 0 to 120 kg/ha, progressively increased the yield of green forage, dry matter and crude protein from 341 to 463 q/ha, 60.9 to 83.5 q/ha and 5.2 to 7.4 q/ha, respectively. Phosphorus application did not show such marked effect. *(Received on Octo. 9, 1974).*

INTRODUCTION

AMONG the high yielding cereal forage crops, maize (*Zea mays* L.) occupies an important position. Tripathi, Tomer and Moolani (1972) and Budoi and Budoi (1973) have studied the effect of nitrogen manuring on maize forage. The increase in yield of maize forage by the application of fertilizers has been reported by Raj, Rao, Lingegouda and Krishnamurthy (1971), Ovsyannikova (1974) and Tkachenko (1974). No effect on yield and quality of maize forage was observed by Gill, Pandey, Maurya, Singh and Abhichandani (1972) and Robinson and Murphy (1972) due to the application of phosphate. Gupta and Das (1961) and Kulshrestha, Upadhyaya and Saxena (1972) have studied the nutritive value of maize forage. Walli and Relwani (1962) have reported increase in the yield of teosinte (*Euchlaena mexicana*) by increasing the doses of nitrogen application.

The present experiment was therefore, undertaken to study the comparative performance of four maize varieties and one of teosinte under the influence of different levels of nitrogen and phosphate manuring.

METHODS

This experiment was conducted in *kharif* seasons of 1971, 1972 and 1973 at the Forage Research Project, Gujarat Agricultural University, Anand. Four varieties of maize viz., 'Ganga Safed–2', 'Ganga-5', 'Farm Sameri' and 'Ganga-5 (F-2)' and one of

teosinte 'T-1' were sown by drilling in rows 25 cm apart at 50 kg/ha seed rate. Split-plot design with three replications was followed. A common basal dose of 25 kg K_2O/ha was applied at the time of preparation of land. Nitrogen was applied at four levels of 0, 40, 80 and 120 kg/ha and phosphate at three levels of 0, 30 and 60 kg/ha. The main plot treatments were of varieties × phosphate levels and sub-plot treatments were of nitrogen levels.

Each variety was harvested at silking stage and plot–wise green forage yield was recorded, from which dry matter yield was determined. Crude protein content of forage samples of each treatment was determined as per the AOAC (1960) method. At the harvesting stage plot–wise plant height was measured and from the weights of leaf and stem, leaf-stem ratio was calculated.

RESULTS AND DISCUSSION

The data on green forage and dry matter yields are given in Table 1 and the results of crude protein and plant characters are presented in Tables 2 and 3, respectively.

TABLE—1

Green forage and dry matter yields of maize varieties and teosinte.

Treatments	Green forage, q/ha				Dry matter, q/ha			
	1971	1972	1973	Mean	1971	1972	1973	Mean
Varieties:								
Ganga Safed-2	409	372	561	447	64.2	71.3	74.6	70.0
Ganga-5	441	355	478	425	71.0	81.1	59.3	70.5
Farm Sameri	351	294	493	379	51.6	58.5	63.0	57.7
Ganga-5 (F-2)	244	340	364	316	36.4	75.4	70.2	60.7
Teosinte	584	415	395	465	126.3	97.7	79.0	101.0
C.D. at 5%	40.8	33.6	49.2	—	6.5	7.6	7.0	—
N levels:								
0 kg/ha	334	286	404	341	57.1	64.3	61.4	60.9
40 ,,	385	354	434	391	64.7	77.2	65.7	69.2
80 ,,	435	375	479	430	72.4	78.0	72.6	74.3
120 ,,	469	406	515	463	85.4	87.8	77.2	83.5
C.D. at 5%	15.6	14.6	30.2	—	3.1	3.5	4.5	—
P_2O_5 levels:								
0 kg/ha	414	373	444	410	71.0	77.5	66.9	71.8
30 ,,	408	350	469	409	71.4	79.1	71.6	74.0
60 ,,	395	342	461	399	67.4	73.9	69.2	70.2
C.D. at 5%	—	—	—	—	—	—	—	—
C.D. at 5% for interactions:								
V x N	—	—	—		2.2	7.8	—	
V x P	—	—	—		—	13.2	—	
N x P	—	—	—		5.4	—	—	
V x P x N	—	—	—		10.4	13.5	—	

N.B.: C.D. values are given only for significant effects.

TABLE—2

Crude protein content and yield of maize varieties and teosinte.

Treatments	*Crude protein per cent*				*Crude protein yield q/ha*			
	1971	*1972*	*1973*	*Mean*	*1971*	*1972*	*1973*	*Mean*
Varieties:								
Ganga Safed-2	8.9	9.3	10.0	9.4	5.70	6.63	7.43	6.59
Ganga-5	8.5	7.7	9.4	8.5	5.99	6.27	5.60	5.95
Farm Sameri	9.6	9.3	10.3	9.7	4.98	5.46	6.52	5.65
Ganga-5 (F-2)	10.8	7.8	8.8	9.1	3.91	5.90	6.25	5.35
Teosinte	7.3	8.0	8.4	7.9	9.24	7.83	6.67	7.91
N levels:								
0 kg/ha	9.1	8.2	9.1	8.8	4.84	5.17	5.54	5.18
40 „	9.2	8.1	9.3	8.9	5.56	6.15	6.12	5.94
80 „	8.9	8.7	9.8	9.1	6.11	6.71	7.04	6.62
120 „	9.0	8.8	9.4	9.1	7.34	7.65	7.27	7.42
P_2O_5 levels:								
0 kg/ha	9.4	8.7	9.3	9.1	6.34	6.64	6.23	6.40
30 „	8.8	8.2	9.3	8.8	5.87	6.46	6.61	6.31
60 „	8.9	8.4	9.6	9.0	5.69	6.16	6.63	6.16

TABLE—3

Plant height and leaf-stem ratio of maize varieties and teosinte.

Treatments	*Plant height cm*				*Leaf–stem ratio*			
	1971	*1972*	*1973*	*Mean*	*1971*	*1972*	*1973*	*Mean*
Varieties:								
Ganga Safed-2	210	215	212	212	1.00	1.15	1.15	1.10
Ganga-5	209	211	211	210	0.90	1.00	1.12	1.01
Farm Sameri	190	185	213	196	0.95	0.95	1.05	0.98
Ganga-5 (F-2)	208	211	215	211	0.88	0.90	0.85	0.88
Teosinte	202	174	184	187	0.89	0.90	0.79	0.86
N levels:								
0 kg/ha	197	190	196	194	0.95	0.94	1.02	0.97
40 „	207	199	205	204	0.96	0.94	1.00	0.97
80 „	213	201	213	209	0.86	1.03	0.97	0.95
120 „	214	206	214	211	0.94	1.00	0.97	0.97
P_2O_5 levels:								
0 kg/ha	211	199	204	205	0.92	1.01	1.02	0.98
30 „	206	198	208	204	0.92	0.95	0.98	0.95
60 „	206	195	208	203	0.94	0.98	0.98	0.97

From the results presented in Table 1, it is seen that the green forage and dry matter yields of maize varieties differed significantly in all the three years. The yield of green forage ranged from 244 to 584 q/ha, 294 to 415 q/ha and 364 to 561 q/ha in the year 1971, 1972 and 1973, respectively. The yields of green forage obtained by Budoi and Budoi (1973), Kulshrestha *et al* (1972) and Tkachenko (1974) ranged from 274 to 419 q/ha, 312 to 419 q/ha and 266 to 427 q/ha, respectively. These values are in the range reported here. Gill *et al* (1972) have reported only 97 to 187 q/ha green forage yield. The trend of green forage yield with respect to varieties was not consistent in all the three years. On an average, teosinte and Ganga Safed – 2 were found superior, Farm Sameri and Ganga-5 (F-2) inferior and Ganga-5 intermediate in green forage yield.

In dry matter production teosinte was found consistently superior in all the years and on an average it yielded 101 q/ha dry matter. In rest of the varieties, the dry matter production ranged from 57.7 to 70.5 q/ha. Budoi and Budoi (1973), Kulshrestha *et al* (1972) and Tripathi *et al* (1972) reported dry matter yield ranging from 63 to 91, 90 to 123 and 82 to 94 q/ha, respectively. These results are comparable to those reported in the present study. Ganga Safed-2 and Ganga-5 were found intermediate and Ganga-5 (F-2) and Farm Sameri inferior in this respect. The yields of dry matter per day were 1.37, 1.23, 1.16, 1.02 and 1.00 q/ha for teosinte, Ganga Safed-2, Ganga-5, Farm Sameri and Ganga-5 (F-2), respectively.

A linear increasing trend was observed for green forage and dry matter yields in all the three years for nitrogen doses varying from 0 to 120 kg/ha. Similar trend has also been reported by Budoi and Budoi (1973), Gill *et al* (1972), Robinson and Murphy (1972) and Tripathi *et al* (1972) in the case of maize and by Walli and Relwani (1962) in the case of teosinte. The average green forage and dry matter yields increased significantly from 341 to 463 q/ha and 60.9 to 83.5 q/ha, respectively by the application of nitrogen from 0 to 120 kg/ha. Phosphate application had no significant effect on yield. Robinson and Murphy (1972) also observed no effect on yield due to application of phosphate, while Gill *et al* (1972) reported slight increase in the yield due to application of 100 kg P_2O_5/ha over no application.

No significant differences in green forage yield were observed due to interactions in all the three years. The differences in dry matter yield were significant due to interactions V×N, N×P and V×P×N in the year 1971 and V×N, V×P and V×P×N in the year 1972. The fertilizer dose consisting of 120 kg N and 30 kg P_2O_5 per hectare was found optimum for maximum dry matter production.

In respect to crude protein content, Farm Sameri was top ranking having an average of 9.7 per cent. Crude protein yield of teosinte (7.91 q/ha), though the lowest in crude protein content (7.9%), was maximum. The second best variety found was Ganga Safed-2 which yielded 6.59 q/ha crude protein.

Somewhat increasing trend in crude protein content of forage was observed with the increasing doses of nitrogen. Similar trend was also observed by Gill *et al* (1972) and Tkachenko (1974). The crude protein yield increased considerably in all the years with the application of increased doses of nitrogen. On an average, with the application of 0, 40, 80 and 120 kg N/ha, crude protein yield increased from 5.18 to 5.94, 6.62 and 7.42 q/ha, respectively. Phosphate application has not shown much effect either on crude protein content or its yield.

The results of plant height indicated that the high yielding variety teosinte was the lowest and Farm Sameri was intermediate in height, while other varieties were tall in this respect. The application of nitrogen showed consistent increase in plant height in all the years with an average height varying from 194 to 211 cm. Phosphorus application had no such effect. In leaf-stem ratio, Ganga Safed-2 was found more leafy, while Farm Sameri and Ganga-5 (F-2) less leafy. Various doses of nitrogen or phosphate were without any effect on leafiness of maize varieties.

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