GAU Res. J. 1990. 16 (1) : 42–46

Effect of Nitrogen, Phosphorus and Zinc Sulphate on Production Traits of Oat Forage

R. H. Patel and P. P. Vihol

Fodder Farm, Livestock Research Station,
Sardar Krushinagar

In India the scarcity of green fodder is one of the most important limiting factors for achieving "white revolution". Oat being a graminaceous fodder crop responds well to N fertilization (Sinha, 1968 and Saxena *et al.* 1971). The response to nitrogen is further increased if supplemented with phosphorus (Datta and Bains, 1961). Amongst micronutrients zinc aids in the formation of auxins and in the biosynthesis of indole acetic acid and also acts as metal activator of enzimes, thereby affecting the plant growth. In some cases, even no response of nitrogen or phosphate was seen unless the micronutrient deficiencies are corrected (Joshi and Joshi, 1957). However, the information about the requirement of nitrogen, phosphorus and zinc for oat forage crop in semi-arid region of North Gujarat, is scanty. In view of this an experiment was conducted to find out the optimum dose of nitrogen, phosphorus and zinc for maximising the green/dry yield of oat forage.

The experiment was conducted at Fodder Farm, Livestock Research Station, Gujarat Agricultural University, Sardar Krushinagar during *Rabi* season of 1982-83 on a loamy sandy soil with pH 7.7 The soil of the experimental plot had 0.293 per cent organic carbon, 14.17 kg available P_2O_5/ha, 376.30 kg available K_2O/ha and zinc content was 0.46 ppm. The treatment combinations consisted of four levels of N (N_{10}, N_{80}, N_{120} and N_{160}) kg N/ha, three levels of P (P_0, P_{30} and P_{60} kg P_2O_5/ha) and two levels of zinc sulphate (Zn_0 and Zn_{20} kg $ZnSO_4$/ha) and were tried in 4 x 3 x 2 factorial randomised block design with three replications. Half dose of nitrogen in the form of urea and full dose of P_2O_5 in form of DAP and zinc sulphate was applied before sowing and remaining half dose of nitrogen was applied after one month of sowing. Zinc sulphate was applied separately (not mixed with phosphate fertilizer). Kent variety of oat was sown in lines 25 cm apart on 12th November, 1982 at the seed rate of 80 kg/ha. The crop was harvested at about 50 per cent flowering stage. Data on the number of tillers per plant, height of the main shoot, leaf stem-ratio and yield of green and dry forage were recorded.

Effect of Nitrogen

Data presented in Table-1 showed that application of nitrogen in oat significantly enhanced the green as well as dry forage yield, with every successive increase in level

of nitrogen. The highest green forage yield was recorded under the treatment of 160 kg N/ha which was 10.25, 32.01 and 61.71 per cent, higher than those of 120, 80 and 40 kg N/ha, respectively. Similarly, the highest yield (101.97 q/ha) of dry forage was recorded under the treatment 160 kg N/ha. This increase of yield was associated with increasing plant height and number of tillers. Probably, nitrogen application might have increased the protoplasmic contents, cell division and cell enlargement, thereby resulting into enhanced growth rate at vegetative phase of crop plants. Similar argument was also put forward by Gill *et al.* (1976) and Reddy and Tomar (1985).

It was observed that the leaf-stem ratio showed increasing trend with the increased rates of nitrogen. Nitrogen at 160 kg/ha and 40 kg N/ha. Hovewer, it was at par with 120 kg N/ha.

Effect of Phosphorus

Increase in levels of phosphate successively increased the green and dry forage yield. The highest forage yield was obtained with the application of 60 kg P_2O_5/ha. This increase in yield was also associated with increasing number of tillers/plant and plant height. Similar results were also reported by Gill *et al.* (1976). The application of phosphorus might have assisted the merismatic activities of plant growth either by increasing the uptake of nitrogen for vegetative growth or by extensive proliferation of roots, thereby, accelerating the absorption of nutrients for plant growth.

Effect of Zinc

Amongst micronutrients zinc has a vital role of plant growth has development. In many soils of India, micronutrients are becoming limiting factors in increasing crop production. However, the present results on most of the characters could not support it. Similarly, Mehta *et al.* (1973) and Ganguli and Relwani (1976) also could not observe any significant response to zinc. Probably zinc might be freely available in the soils of these experiments.

Interactions among treatments

The most of the interactions were non-significant in almost all parameters except NP in number of tillers and NPZ in plant height. The treatment combination N_{120} P_{60} produced significantly more number of tillers per plant than rest of combinations (Table 2). Similarly, the maximum plant height

TABLE 2

Number of tillers in oat forage affected by interaction between nitrogen and phosphorus levels.

Phosphorus kg/ha (P)	*Nitrogen (N) kg/ha*			
	40	*80*	*120*	*160*
P_0	1.34^{g}	1.54^{efg}	1.83^{d}	2.18^{c}
P_{30}	1.76^{de}	1.51^{fg}	2.59^{ab}	2.27^{c}
P_{60}	1.83^{d}	1.62^{def}	2.74^{a}	2.35^{bc}
S. Em. ±	0.08			
C. D. at 5%	0.24			

Means having same superscript did not differ significantly ($P \leq 0.05$) from one another.

TABLE 1

Effect of nitrogen, phosphorus and zinc sulphate on the ancillary characters of oat.

Treatment	*Green forage yield (q/ha)*	*Dry matter yield*	*Number of tillers/ plant*	*Height (cm/ plant)*	*Leaf-stem ratio*	*Economics Net profit (Rs./ha)*
Levels of Nitrogen						
N_{40}	403.20	70.00	1.64[a]	100.1	0.554[a]	1296[a]
N_{80}	493.90	79.06	1.55[a]	105.4	0.576[ab]	1977[b]
N_{120}	591.32	92.59	2.39[b]	111.5	0.621[bc]	2731[c]
N_{160}	652.00	101.97	2.27[b]	121.4	0.635[c]	3118[d]
S. Em. ±	12.46	3.16	0.05	1.4	0.020	107
C. D. at 5%	35.31	8.98	0.14	4.0	0.057	225
Levels of phosphorus						
P_0	463.12	77.83	1.72	99.8	0.592[a]	1731[a]
P_{30}	553.43	85.71	2.03[c]	110.3	0.579[a]	2461[f]
P_{60}	588.77	94.17	2.13[c]	118.7	0.619[a]	2618[f]
S. Em. ±	10.74	2.74	0.04	1.2	0.017	92
C. D. at 5%	30.51	7.77	0.12	3.5	N.S.	195
Levels of Zinc Sulphate						
Zn_0	535.94[a]	86.17[a]	1.95[a]	108.8[a]	0.600[a]	2340[a]
Zn_{20}	534.27[a]	85.64[a]	1.97[a]	110.4[a]	0.593[a]	2220[a]
S. Em. ±	8.80	2.24	0.03	1.0	0.014	75
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Means having same superscript did not differ significantly ($P \leq 0.05$) from one another.

TABLE 3

Plant height in oat as influenced by interaction between nitrogen, phosphorus and zinc sulphate levels.

Zinc sulphate kg/ha (Zn)	*Phosphorus kg/ha (P)*	*Nitrogen (N) (kg/ha)* 40	80	120	160
Zn_0	P_0	82.4	96.7^{abc}	100.5^{abcd}	112.9^{fghij}
	P_{30}	93.7^{a}	106.2^{cdefg}	113.6^{fghijk}	121.1^{ijklm}
	P_{60}	115.0^{ghijk}	110.8^{efgh}	125.3^{klm}	127.5^{m}
Zn_{30}	P_0	94.8^{a}	96.3^{ab}	99.9^{abcd}	114.9^{fghijk}
	P_{30}	111.7^{efghi}	105.1^{bcdef}	107.4^{defgh}	123.3^{klm}
	P_{60}	102.7^{abcde}	117.1^{hijkl}	122.5^{jklm}	128.8^{m}
	S. Em. ±	3.5			
	C. D. at 5%	9.8			

Means having same superscript did not differ significantly ($P \leq 0.05$) from one another.

(128.8 cm) was observed in case of N_{160} $P_{60}Zn_{20}$ treatment combination, while minimum plant height (82.4 cm) was registered in case of $N_{40}P_0Zn_0$ treatment combination (Table 3).

The average net economic profit varied significantly among the nitrogen and phosphorus levels (Table-1). Maximum net profit of Rs. 3118 and Rs. 2648 was realised for N_{160} kg/ha and P_{60} kg/ha treatment respectively. However phosphorus levels P_{20} and P_{40} resulted more or less same net profit.

(Received on 15th Nov. 1987)

REFERENCES

Datta, N. P. and S. S. Bains, 1961. Effect of soil application of fertilizer mixture (NPK) alone and in conjuction with soil and/or spray fertilization of micronutrients. *Indian J. Agron.* **4** : 258-263.

Ganguli, T. K.; J. P. Singh and L. L. Relwani, 1976. Note on the effect of nitrogen, phosphorus and zinc on yield and composition of fodder oat. *Indian J. Agric. Sci.* **46** (5): 238-240.

Gill, P. S.; K. Singh and H. P. Tripathi, 1976. Response of oat varieties to nitrogen and phosphorus application. *Forage Res.* **2** : 159-164.

Joshi, N. V. and S. C. Joshi, 1057. Copper as a fertilizer. *J. Indian Soc. Soil. Sci.* 5 : 21-30.

Mehta, B. V.; R. T. Dangarwala and B. S. Trivedi, 1973. Response of wheat to zinc application in North Gujarat. *Ferti. News.* **18** : 32-5.

Reddy, B. S. and P. S. Tomar, 1985. Nitrogen and phosphorus requiremen: of fodder oat under variable crop sequences. *Forage Res.* **11** (1): 55-62.

Saxena, M. C.; L. Joshi and S. D. Rai, 1971. Studies on the performance of two varieties of oats as affected by dates of planting and levels of nitrogen fertilization. *Indian J. Agron.* **16** : 288-293.

Sinha, M. N. 1968. Effect of rates and times of nitrogen application on growth, yield and quality of oat. *Indian J. Agric. Sci.* **38** : 730-735.