

Response of oat (*Avena sativa*) to nitrogen and phosphorus levels

J.R. PATEL AND S. RAJAGOPAL

College of Veterinary Science, Anjora (Durg), Chhattisgarh 491 001

Received : June 2000

ABSTRACT

A field experiment was conducted during the winter seasons of 1996–97 and 1997–98 to study the response of forage oat (*Avena sativa* L.) to levels of nitrogen and phosphorus. The yield attributes as well as green and dry-forage yields increased significantly up to 50 kg N and 40 kg P₂O₅/ha. However, crude protein yield and nutrient uptake showed linear response up to 75 and 60 kg/ha N and P₂O₅ respectively.

Key words : Oat, Nitrogen, Phosphorus, Green and dry fodder, Crude protein, Nutrient uptake

Oat is a major cereal fodder crop grown in our country. To overcome the shortage of green fodder during winter season, it can be cultivated successfully in rice fallows (Pal and Jawai, 1985). The production potential of oat depends on nitrogen and phosphorus application to a great extent (Pradhan and Mohapatra, 1995; Roy and Pradhan, 1992). Since little information is available on fertilizer management on oat in Chhattisgarh agroclimatic conditions, this experiment was planned to find out the optimum dose of N and P fertilizer for forage oat.

MATERIALS AND METHODS

The experiment was carried out during the winter seasons of 1996–97 and 1997–98

at the Farm, College of Veterinary Science, Anjora (Durg) Chhattisgarh. The clay loam soil had 288, 19 and 430 kg/ha N, P₂O₅ and K₂O, respectively, with pH 6.8. The organic carbon was 0.62%. Treatments were laid out in split-plot design with 3 replications, keeping 4 levels of each of N (0, 25, 50 and 75 kg/ha) in main plots and P₂O₅ (0, 20, 40 and 60 kg/ha) in subplots. 'Kent' oat was sown on 27 and 30 November 1996 and 1997 respectively in rows, 25 cm apart. Half N and full P were applied basal. The remaining N was top-dressed in equal splits 30 days after sowing and after the first cut of forage. In addition to chemical fertilizers, a common dose of well-decomposed farmyard manure @ 8 tonnes/ha was also applied. The crop was

harvested twice. The yield attributes were noted before harvesting of the oat crop. The forage and crude protein yields as well as nutrient uptake were recorded at both the cuts. The content of nitrogen and phosphorus were determined by micro-Kjeldahl (as described by Piper, 1966) and Metavenadate (Olsen *et al.*, 1954) methods respectively. Uptake of nutrients on dry-matter basis was computed by multiplying the respective nutrient concentration by their dry-matter yield obtained.

RESULTS AND DISCUSSION

Nitrogen

Nitrogen application had significant effect on yield attributes, green-fodder, dry-matter and crude protein yields as well as uptake of N and P (Table 1). The green-fodder yield increased with increasing level of N up to 75 kg/ha. However, there was no significant difference between 50 and 75 kg N/ha. Dry-matter yield also increased proportionately to green-fodder yield with the increasing levels of N. The significant increase in yield up to 50 kg N/ha was also reported by Thakuria (1992). The increase in total green-fodder yield was achieved due to positive effect of N on plant height and number of shoots as well as leaves/m row length. Similar reasons for higher yield were also reported by Joshi *et al.* (1996).

Nitrogen fertilization significantly influenced the protein yield. Progressive increase in yield was observed due to N up to 75 kg/ha. The highest value of crude protein yield recorded was 7.4 and 10.6 q/ha in 1996–97 and 1997–98 crop season respectively. These findings are in conformity with the results of Singh and

Singh (1995). Similarly, the highest uptake of both N (118.8 and 169.5 kg/ha) and P (12.6 and 18.0 kg/ha) nutrients were recorded when oat was fertilized with 75 kg N/ha. Increase in N and P removal with N application was due to more availability of nutrients and higher herbage production with higher levels of N compared with its previous levels. Singh and Singh (1995) also reported beneficial effect of N on nutrients uptake in oat forage.

Phosphorus

Phosphorus application also influenced the green and dry-forage yields of oat (Table 1). The response to P was significant up to 40 kg P_2O_5 /ha over 0 and 20 kg P_2O_5 /ha. The higher level of P (60 kg P_2O_5) resulted in statistically similar green-forage and dry-matter yield to 40 kg P_2O_5 /ha. The higher green-fodder yield with an increase in applied P was owing to the better performance of different yield parameters (Table 1). The results confirm the findings of Ghosh (1985). The crude protein yield significantly affected due to the application of P. The maximum value (5.5 and 7.7 q/ha) was recorded with 60 kg P_2O_5 /ha. The increase in this indice could be ascribed to additive effect of increase in crude protein content and dry-forage yield. Further, the incremental doses of P increased N and P uptake up to the highest phosphorus levels (60 kg P_2O_5 /ha). The maximum value of N uptake was 88.4 and 122.9 kg/ha during 1996–97 and 1997–98 respectively. Similarly, the respective value of P uptake was 14.7 and 20.5 kg/ha. Similar results were also reported by Gill *et al.* (1976). The higher value of nutrients removal at 60 kg

Table 1. Effect of nitrogen and phosphorus levels on yield attributes, green forage, dry-matter and crude protein yield as well as nutrient uptake in oat

Treatment	Plant height (cm)		Shoots/m row length		Leaves/m row length		Green-forage yield (q/ha)		Dry-matter yield (q/ha)		Crude protein yield (q/ha)		Mean nutrient content (%) (1996-97 to 1997-98)		Nutrient uptake (kg/ha)			
	A	B	A	B	A	B	A	B	A	B	A	B	N		P			
													N	P	A	B	A	B
<i>N (kg/ha)</i>																		
0	102	101	60	66	155	168	208.3	286.3	49.2	67.4	3.3	4.5	1.08	0.144	53.0	72.6	7.1	9.8
25	112	114	71	80	186	176	388.9	540.7	64.4	89.1	4.9	6.8	1.23	0.148	79.1	109.4	9.5	13.2
50	118	120	78	86	190	206	433.0	616.6	75.5	106.9	6.8	9.6	1.44	0.149	108.8	153.7	11.2	15.9
75	123	128	82	90	201	221	442.6	633.4	81.3	116.0	7.4	10.6	1.46	0.155	118.8	169.5	12.6	18.0
CD (P=0.05)	5.1	7.3	4.1	4.6	12.5	15.2	13.8	17.0	9.2	10.6	0.6	0.8	0.04	0.001	9.1	10.5	1.2	1.6
<i>P₂O₅ (kg/ha)</i>																		
0	99	101	55	59	142	147	307.4	430.2	47.5	65.8	2.9	4.1	0.99	0.189	47.1	65.3	9.0	12.5
20	103	107	60	65	156	163	353.2	489.0	55.0	86.0	3.9	5.4	1.14	0.196	62.5	86.3	10.8	14.9
40	108	109	65	70	169	176	402.4	563.1	61.1	85.4	4.9	6.8	1.28	0.211	78.2	109.3	12.9	18.0
60	111	113	67	74	180	187	409.7	573.0	63.5	88.3	5.5	7.7	1.39	0.232	88.4	122.9	14.7	20.5
CD (P=0.05)	3.5	4.3	3.8	3.4	11.1	12.2	13.1	11.2	4.5	4.5	0.5	0.6	0.11	0.003	6.4	7.7	0.8	1.0

A, 1996-97; B, 1997-98; N, nitrogen; P, phosphorus

P_2O_5 /ha could be attained because of high tonnage and high N as well as P absorption by the oat forage.

REFERENCES

- Ghosh, D.C. 1985. Influence of nitrogen, phosphorus and cutting on growth and yield of oat. *Indian Journal of Agronomy* 30(2) : 172-176.
- Gill, P.S., Singh, K. and Tripathi, H.P. 1976. Response of oat varieties to nitrogen and phosphorus application. *Forage Research* 2(2) : 159-164.
- Joshi, Y.P., Singh, V. and Verma, S.C. 1996. Effect of nitrogen levels on the growth and yield of forage oat varieties. *Forage Research* 22 (1) : 67-69.
- Olsen, S.R., Cole, C.W., Wathode, F.S. and Peun, L.A. 1954. Estimation of available phosphorus in soil by extraction with CO_3 . *Circular 939* : 1-9, United States Department of Agriculture, Washington DC., USA.
- Pal, R.N. and Jawai, H. 1995. Cultivation of fodder oats in mid hills of Sikkims. *Indian Farming* 35 (2) : 27-40.
- Piper, C.S. 1966. *Soil and Plant Analysis* edn 1. Hans Publications, Bombay.
- Pradhan, L. and Mohapatra, B.K. 1995. Growth analysis and yield of fodder oat relation to cutting management, row spacing and levels of nitrogen. *Annals of Agricultural Research* 16 (3) : 273-277.
- Roy, S.K. and Pradhan, C. 1992. Forage and grain yield of oat as influenced by phosphorus levels and cutting management in soils of West Bengal. *Indian Journal of Agronomy* 37 (4) : 823-825.
- Singh, R. and Singh, A. 1995. Nutrient uptake and biomass production by oat varieties as influenced by moisture regimes and nitrogen application. *Annals of Agricultural Research* 16 (3) : 394-395.
- Thakuria, K. 1992. Effect of nitrogen and Azotobacter on fodder yield and quality of oat. *Indian Journal of Agronomy* 37 (3) : 571-572.