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Response of oat (*Avena sativa*) to cutting management, method of sowing and nitrogen

S.K. SHARMA AND S.R. BHUNIA

Agricultural Research Station, Rajasthan Agriculture University, Sriganganagar 335 001

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ABSTRACT

A field experiment was conducted during winter (*rabi*) seasons of 1997–98 and 1998–99 at Agricultural Research Station, Sriganganagar, to study the effect of cutting management, method of sowing and nitrogen doses on forage and grain yield of oat (*Avena sativa* L.). No-cut treatment gave higher grain (26.05 and 28.40 q/ha) and straw (82.83 and 86.55 q/ha) yields than cutting at 65 or 85 days after sowing. However, higher fodder yield (158.08 and 168.80 q/ha) was recorded when cutting was taken at 85 days. Net returns (Rs 15,619) and benefit : cost ratio (2.50) were higher with 1 cutting at 65 days and then the crop was left for grain production. Line-sown crop recorded higher forage (142.23 and 153.05 q/ha) and grain (19.40 and 20.56 q/ha) yield as well as net returns (Rs 17,329) and benefit : cost ratio (2.85) during both years than that of broadcast crop. Increasing level of nitrogen recorded higher yield, yield attributes as well as net returns and benefit:cost ratio. The highest yield of forage (158.97, 169.90 q/ha in 2 years), grain (23.55 and 23.73 q/ha in 2 years), net return (Rs 20,129), and benefit : cost ratio (3.24) were recorded with 80 kg N/ha.

Key words : Oat, Grain yield, Straw yield, Cutting, Sowing method, N

Oat (*Avena sativa* L.) is an important winter forage and cereal crop in north-western regions of the country owing to congenial climate for this crop in these region. Because of its excellent growth habit, quick regrowth after cutting and highly nutritive value for both milch as well as draft livestock, it's popularity as fodder crop is increasing. Grains are equally important for preparation of animal feed and baby foods (Thakral *et al.*, 1993). Generally, the crop is grown separately for seed production and fodder purpose. Cutting management, sowing methods and nitrogen management affect both forage and grain yields (Prasad and Mukherji, 1998). Hence present investigation was carried out to study the response of cutting and nitrogen on forage and grain yield of oat.

MATERIALS AND METHODS

The field experiment was conducted with 'Kent' oat at Agricultural Research Station, Sriganganagar, on sandy-loam soil, having 0.18% organic matter, 30 kg/ha phosphorus and 320 kg/ha potassium during winter (*rabi*) seasons of 1997–98 and 1998–99. The experiment was conducted in split-plot design with 3 replications. The treatments comprised 3 cutting management, viz. C_0, no cutting, grown for seed; C_1, 1 cutting 65 days after sowing; and C_3, 1 cutting 85 days after sowing) in main plot, 2 methods of sowing, viz. S_1 (broad-casting) and S_2 (line sowing, 25 cm apart) in sub plot and 3 nitrogen levels, viz. N_1 (40 kg N/ha), N_2 (60 kg N/ha) and N_3 (80 kg N/ha). The crop was sown in mild-November in both the years. At sowing recommended dose of P and half dose of N were drilled and the remaining N was applied in 2 equal splits, i.e. at tillering and boot leaf stages in no-cut treatment and in cut treatments, the remaining N was applied after the cutting of forage. The crop was harvested in the second week of May in no-cut treatment and third week of May in cutting treatments.

RESULTS AND DISCUSSION

Cutting management

Plant height and shoots/m row length at forage cutting stage recorded significantly higher when the crop was raised for grain after cutting for forage 85 days after sowing than the cut for forage taken at 65 days and then raised for grain production (Table 1). However, at harvest stage, significantly higher plant height was recorded in no-cut treatment and shoots/m row length as well as leaf : stem ratio when cutting was taken at 65 days. Grains/panicle and 1,000-grain weight were significantly higher when the crop grown for grain production without any cutting. Singh *et al.* (1993) also opined higher 1,000-seed weight and grains/panicle when oat was grown for grain.

The cutting-management practices influenced the green fodder, straw and grain yields significantly when the crop was harvested for forage at 65 days and then left for seed gave significantly higher seed and straw yields than cut for forage at 85 days. It was owing to higher yield attributes, viz. plant height, shoots/m length, leaf : stem ratio, grains/panicle and 1,000-grain weight. However, green-fodder yields were significantly higher and the grain production was lowest when the crop was cut 85 days after sowing and then left for grain production. Higher forage yield may be due to more duration provided to the crop in 85 days of cutting for forage and then left for seed. When the crop was raised for grain production only, it gave more grain. The overall performance of cutting-management practices seems more clear, when net return was computed. Treatment comprising forage cut 65 days after sowing, resulted in the highest net return over rest of the cutting management. Cutting 65 days after sowing gave 30.65 and 21.62% higher net return over no cut and 1 cut 85 days after sowing respectively. Similarly, benefit:cost ratio was the highest when the crop was cut 65 days after sowing and then left for grain production. These findings are in conformity with those of Singh *et al.* (1985).

Table 1. Effect of cutting management, method of sowing and nitrogen level on yield attributes of oat

Treatment	Plant height (cm)				Shoots/m row length				Leaf : stem ratio (at forage cutting)		Grains/ panicle		1,000-grain weight (g)	
	At forage cutting		At harvest		At forage cutting		At harvest							
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
Cutting management														
C_0 (no cut)			132.82	136.54			98.89	112.15			72.43	73.55	42.14	44.58
C_1 (1 cut at 65 DAS)	15.83	16.38	122.54	128.58	122.55	126.43	130.54	160.83	8.64	9.35	68.32	68.85	40.35	41.22
C_2 (1 cut at 85 DAS)	35.43	37.39	105.43	109.34	178.34	180.58	120.43	148.54	7.12	7.95	54.85	57.95	36.45	36.83
CD (P=0.05)	3.34	2.93	4.32	5.65	8.64	7.56	2.43	2.86	0.28	0.24	5.51	5.55	0.34	0.21
Method of sowing														
S_1 (broadcasting)	24.82	26.83	117.39	146.55	142.84	144.54	110.82	128.43	7.85	8.61	62.35	64.29	38.34	40.65
S_2 (line sowing)	26.44	26.94	123.14	152.73	158.05	162.47	122.42	152.58	7.93	8.69	68.05	69.28	40.95	41.10
CD (P=0.05)	NS	NS	3.58	4.53	9.55	8.34	1.84	2.43	NS	NS	4.11	3.15	0.25	0.46
Nitrogen														
N_1 (40 kg N/ha)	15.07	24.41	110.97	114.85	111.56	115.43	100.94	112.54	6.21	7.11	62.43	64.35	37.83	38.54
N_2 (60 kg N/ha)	16.41	25.42	120.82	126.24	160.33	161.68	121.54	148.32	7.54	8.62	66.35	67.85	40.35	41.43
N_3 (80 kg N/ha)	18.78	30.83	129.03	133.37	179.45	183.41	127.38	160.66	9.89	10.22	66.82	68.15	40.76	42.66
CD (P=0.05)	NS	3.21	5.42	6.78	10.43	7.33	3.51	3.62	0.35	0.41	3.15	2.45	0.32	0.56

Y_1, 1997–98; Y_2, 1998–99; NS, not significant

Table 2. Effect of cutting management, method of sowing and nitrogen level on yield and economics of oat

Treatment	Green fodder yield (q/ha)		Straw yield (q/ha)		Grain yield (q/ha)		Gross return (Rs/ha)	Net return (Rs/ha)	Benefit : cost ratio
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2			
Cutting management									
C_0 (no cut)			82.83	86.55	26.05	28.40	17,667	11,955	2.09
C_1 (1 cut at 65 DAS)	117.58	124.50	77.18	80.43	20.22	21.31	21,875	15,619	2.50
C_2 (1 cut at 85 DAS)	158.08	168.80	66.34	68.25	9.38	10.16	19,098	12,842	2.05
CD (P=0.05)	13.82	10.07	4.13	5.44	3.57	0.53			
Method of sowing									
S_1 (broadcasting)	133.43	140.25	71.55	72.35	17.70	19.35	21,378	15,304	2.52
S_2 (line sowing)	142.23	153.05	79.35	84.47	19.40	20.56	23,403	17,329	2.85
CD (P=0.05)	6.24	9.30	6.83	7.58	0.90	0.98			
Nitrogen									
N_1 (40 kg N/ha)	115.96	122.66	62.84	66.35	12.66	14.33	17,727	11,799	1.99
N_2 (60 kg N/ha)	138.56	147.58	77.35	80.41	19.44	21.80	23,082	17,008	2.80
N_3 (80 kg N/ha)	158.97	169.90	86.16	88.47	23.55	23.73	26,348	20,129	3.24
CD (P=0.05)	6.01	10.33	5.84	7.32	1.63	0.61			

Y_1, 1997–98; Y_2, 1998–99
DAS, Days after sowing

Method of sowing

Significantly higher plant height at harvest, shoots/m row length at cutting stages and harvest, grains/panicle and 1,000-grain weight were recorded in line-sown crop over broadcasting. It might be owing to better management of line-sown crop than broadcast crop. However, leaf:stem ratio and plant height at forage cutting stages were statistically at par. Line-sowing method recorded significantly higher green fodder and grain than that of broadcast sowing method. Similarly, higher net return and benefit:cost ratio were recorded with line sowing than broad-casting.

Nitrogen

Yield attributes and yield increased significantly with increasing levels of N from 40 to 80 kg/ha, owing to higher plant height, shoots/m length, wider leaf:stem ratio, more grains/panicle and 1,000-grain weight (Tables 1 and 2). Similar results were obtained by Singh *et al.* (1989) and Gill and Malik (1983). Increase in forage yield with increased nitrogen levels can be attributed to tall plants, more number of shoots and wider leaf : stem ratio. When nitrogen level was increased from 40 to 60 kg/ha green forage, straw and grain yields increased by 18.16, 21.34 and 52.80% respectively. An increase in level of N from 60 to 80 kg/ha green forage, straw and grain yields increased 14.93, 9.44 and 14.65% respectively. Thus higher dose of N gave significantly higher production. However with increasing levels of nitrogen the crop responded to nitrogen. Net returns and benefit:cost ratios increased with increasing doses of N from 40 to 80 kg/ha. The crop recorded net returns of Rs 20,129 and benefit : cost ratio of 3.24 with 80 kg N/ha. These results are in conformity to those of Singh *et al.* (1993).

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