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Response of Forage Oats to Sowing Dates and Cutting Management on Grain Production

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ABSTRACT

A field trial was conducted at Forage Research Farm, Gujarat Agricultural University, Anand to study the response of forage oats to sowing dates and cutting managements on grain production during *rabi* 1986-87, 1987-88 and 1988-89. The sowing of oats on 30th October followed by 15th November produced the maximum grain yield than sowing of oats on 15th October and 30th November. The pooled results indicated that genotypes AKS-4 and AKS-8 gave good performance than Kent though the differences were non-significant. Grain production without cutting management proved superior than cutting management for forage and thereafter left for grain production. The interaction effects of sowing date X genotype and sowing date x cutting management were significant. Any genotypes of oats (AKS-4, AKS-8 or Kent) should be sown on 15th November without taking any forage cut before harvesting the grains to obtain maximum benefit per unit cost, if the sowing needs to be done early from this date (15th November), oats variety Kent should be sown on 30th October without taking any cut for obtaining the higher yield and net returns.

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INTRODUCTION

Oats (*Avena sativa* L.) is one of the most important *rabi* forage cereal crops in India and used for both feed and fodder. This crop became more popular because of its excellent growing habit, quick regrowth and better nutritive value. It is therefore, essential to increase its grain production through agronomic management so that more area can be covered in the State. Keeping these points in view, a field trial was conducted to study the response of oats under different sowing dates and cutting management in terms of grain yield.

MATERIALS AND METHODS

The study was undertaken during winter season of 1986, 1987 and 1988 at Forage Research Farm of Gujarat Agricultural University, Anand. The treatments comprised of four sowing dates (15th and 30th October, 15th and 30th November) as main plot and combinations of three genotypes of oats (AKS-4, AKS-8 and Kent) and two cutting managements (No cut and one cut at 60 days after sowing for forage and thereafter crop leaving for grain production) were alloted to sub-plots in the split-plot design with three replications. The crop was sown in rows at 25 cm apart @ 60 kg/ha. The crop was fertilized with 120 kg nitrogen and 30 kg/ha of phosphoric acid. Half of the nitrogen and full dose of P_2O_5 was applied as basal and remaining quantity of nitrogen was given in two equal splits applied at 30 and 60 days after sowing.

The soils of experimental field was sandy loam in texture having PH 8.1, EC 0.21

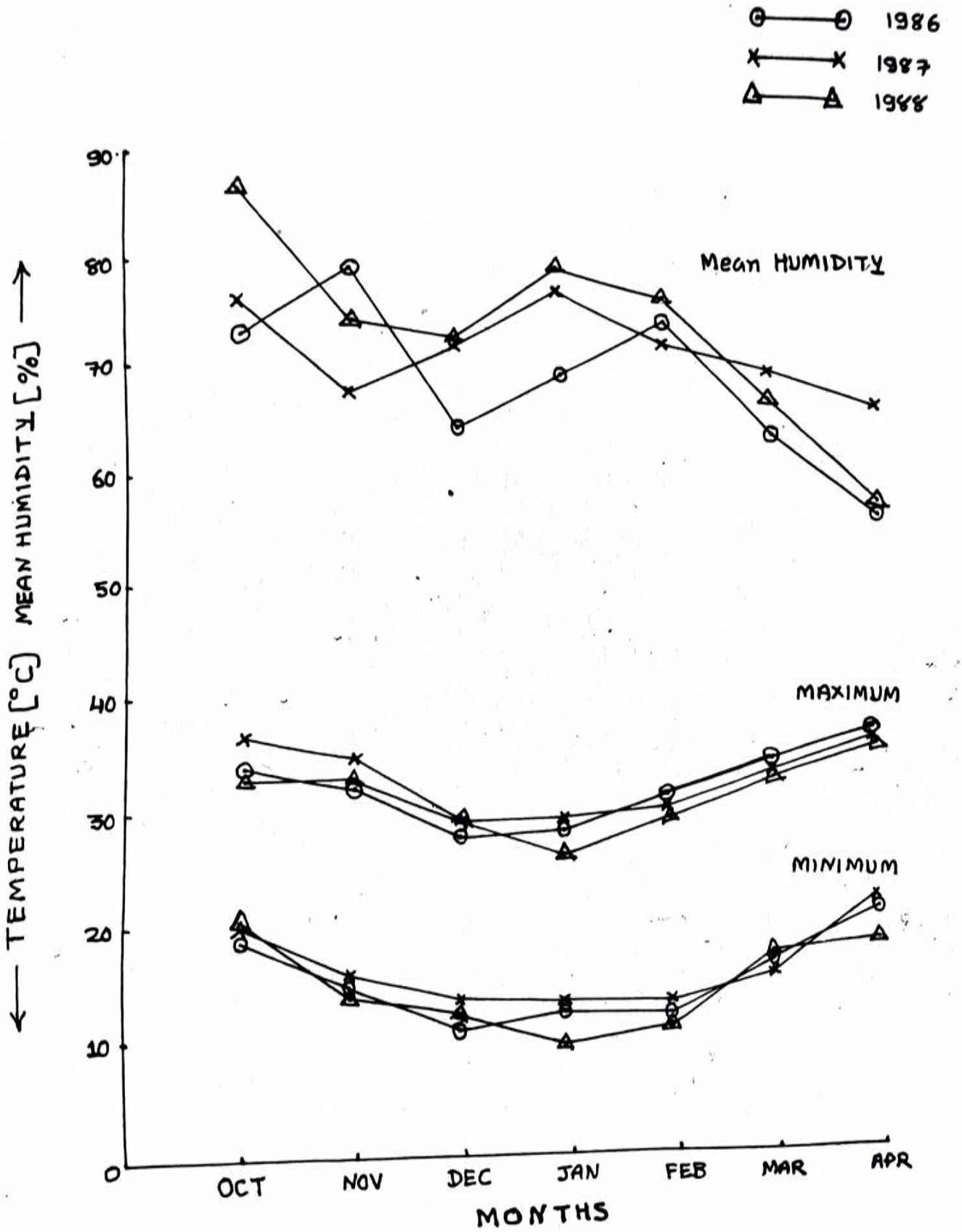

Fig. 1. Mean maximum, minimum temperatures and mean humidity during experimentation.

mmhos/cm at 25°C, available N 219 kg/ha, available P_2O_5 66 kg/ha and available K_2O 227 kg/ha. There were no rains during the period of investigation. The weather data (Fig.1) indicated that temperature declined from October to January and increased there after till April. The lowest average minimum temperature (9.4°C) was recorded during the month of January of 1988 and also the cold period was more during this year as compared to that of the years 1986 and 1987.

The green forage of oats crop was harvested at 60 DAS in case of one cut system. The yield of green forage and dry matter was recorded. As per treatment, crop was allowed to regenerate for taking grain yield. At maturity, grain yield and straw yield were recorded alongwith data on yield attributes. The straw yield was converted in to dry matter yield and it was summed up in yield of one cutting management treatments and accordingly analysis was carried out to know its performance over no cutting management.

RESULTS AND DISCUSSION

Effect of sowing dates

The data on the effect of sowing dates on grain and dry matter yield are presented in Table 1. The differences in grain yield due to different sowing dates were significant during all the three years of study. However, these differences did not remain consistent as indicated by the presence of year x sowing date interaction (Table 4). Treatment combination of Y_3D_3 produced significantly higher grain yield than other treatment combinations barring Y_3D_2, Y_3D_1 and Y_3D_4 also produced significantly higher yields than other treatment combinations. It was due to favourable climatic conditions for oats grain crops during the year 1988 particularly oats sown on 30th October and 15th November as shown in Fig.1. The overall differences in the pooled analysis were non-significant. However, examining the effect of dates during individual year, it was observed that during the first year, the highest grain yield was obtained when the crop was sown on 30th October. However, it was at par with 15th October. In the second year (1987), it was at par with 30th October and 15th November whereas in the third year, sowing on 15th November gave the highest yield although it was at par with 30th October. Thus, considering overall performances of different sowing dates, it can be safely recommended to sow the crop on 30th October followed by 15th November for obtaining high grain yield. The lower grain as well as dry matter yield from 30th November were due to early flowering and lesser growth of plants i.e. plant height, no. of tillers per m. at maturity and no. of grains per panicle (Table 5). Randhawa and Gill (1971) and Singh *et al.* (1985) also reported that delayed planting had adverse effect on grain production of oats. The highest grain as well as dry matter yield (calculated from straw) from 15th October, 30th October and 15th November were due to their superiority over 30th November in respect of all yield attributes such as plant height, no. of tillers per m. at maturity, no. of grains per panicle and 1000 grain weight (Table 5).

Data on economics of sowing dates (Table 1) revealed that sowing of oats on 30th October gave the maximum total return (Rs. 9256 /ha). But if the net ICBR is considered, sowing of oats on 15th November resulted into the maximum net ICBR (1:8.54) followed 30th October (1:5.69).

Effect of genotypes

Among different genotypes, AKS-4 gave significantly higher grain yield than var. Ke

TABLE 1

Grain and dry matter yields of oats as well as its economics as influenced by sowing dates and cutting managements.

Treatment	Grain yield (kg/ha) 1986	1987	1988	Pooled	Dry matter yield (q/ha) 1986	1987	1988	Pooled	Total returns Rs/ha	Net ICBR
Sowing dates (D)										
D_1 15th October	1079	1175	2081	1445	97.8	82.8	94.0	91.5	85.25	1:2.30
D_2 30th October	1403	998	2391	1597	93.8	90.9	101.0	95.2	9256	1:5.69
D_3 15th November	856	937	2530	1441	84.4	93.6	90.8	89.6	8452	1:8.54
D_4 30th November	606	674	1692	991	77.8	88.6	82.1	82.8	6448	—
S. Em. ±	132	78	125	122	7.6	9.1	3.1	4.1		
C. D. 0.05	458	269	432	NS	NS	NS	10.8	NS		
Genotypes (G)										
G_1 AKS-4	1182	1078	2252	1504	86.4	76.8	86.3	83.3	8509	—
G_2 AKS-8	866	1022	2410	1433	88.6	93.2	90.2	90.7	8453	—
G_3 Kent	910	737	1859	1169	90.3	97.1	99.4	95.6	7544	—
S.Em. ±	66	59	104	91	3.6	2.1	1.5	2.8		
C. D. 0.05	188	167	299	NS	NS	6.0	4.2	NS		
Cutting Management (C)										
C_1 One cut	1261	1132	2258	1550	90.3	82.3	95.7	89.4	—	—
C_2 One cut for forage and then grain production	711	760	2089	1187	86.6	95.7	88.2	95.7	—	—
S.Em. ±	54	48	85	78	2.9	1.2	1.2	4.6		
C. D. 0.05	154	137	NS	NS	NS	4.9	3.5	NS		

Selling price of grain and dry matter are Rs. 4/kg and Rs. 30/q. respectively and irrigation cost = Rs 210/Irri./ha.

during all the three years. However, it was at par with genotype AKS-8 during 1987 and 1988. Kent variety had significantly higher 1000-grain weight than other genotypes could not maintain its superiority over AKS-8 because it was inferior in productive tillers. Economics of (Table 1) also indicated that genotypes AKS-4 and AKS-8 were higher in total returns (Rs. 8509/- and Rs. 8453/- respectively) as compared to variety (Rs. 7544/-).

Effect of cutting management

It was observed that differences in grain yield due to cutting management were significant in two out of three years, where no cutting management gave significantly higher grain yield as compared to one cut treatment. However, in the third year, though no cutting gave higher yield, it was at par with one cutting. This was indicated by the presence of year x cutting management interaction (Table 4). Treatment combination of Y3C1 produced significantly higher grain yield (2258 kg/ha) than other treatment combinations except Y3C2 due to low temperature as well as more cold span during that year (Fig. 1).

Significant higher number of productive tillers and 1000-grain weight in case of no cu management might have resulted into highe grain yield. Maximum grains per panicle were also noted in no cut system. These findings are in confirmity with those reported by Deo and Rai (1975) and Gill *et al.* (1973). The dry matte production (dry matter from straw) was not dif fered significantly due to different cuttin management practices when the results were pooled. At Titpur, Faizabad, Jhansi, Hissar Anand, Urulikanchan and Jabalpur centres, the highest grain yield was obtained with no cu system as compared to that of one cut syster harvested at 50-50 DAS or 70 DAS and the grain production (Anonymous, 1988-89). Bokde (1968) observed that the grain, straw and dr matter yields were more in grain crop, whereas the total protein yield were more in the fodder cum-grain crop. On the basis of results, he sug gested that a farmers should grow a separate grain crop instead of grain-cum-fodder crop fo economic grain production in oats. Desai and Deore (1982) also reported that no cut manage ment significantly out yielded grain yield tha one cut and two cut system.

TABLE 2

Effect of dates of sowing x genotypes on grain yield (kg/ha) and dry matter yield (q/ha) of oats and its economics (pooled of 1986-87 and 88).

	Genotypes			*Total Returns, Rs/ha*			*Net ICBR*		
D/G	G_1	G_2	G_3	G_1	G_2	G_3	G_1	G_2	G_3
D_1	1729 (88.6)	1357 (88.3)	1248 (97.7)	9574	8077	7923	1:5.38	1:3.07	1:2.76
D_2	1597 (88.1)	1621 (93.7)	1574 (103.8)	9031	9185	9410	1:7.28	1:7.65	1:8.18
D_3	1499 (78.8)	1691 (98.2)	1133 (91.9)	8360	9610	7289	1:12.37	1:18.30	1:7.27
D_4	1191 (77.1)	1062 (82.3)	720 (89.1)	7077	6717	5553	—	—	—
S. Em. ±	91								
C. D. 0.05	255								

TABLE 3

Effect of dates of sowing x cutting management on grain yield (kg/ha) and green forage as well as dry matter yields (q/ha) of oats and its economics.

D/C	Cutting management		Total Returns Rs/ha		Net ICBR	
	C_1	C2	C_1	C_2	C_1	C_2
D_1	1583(90.49)	1306 (70.73) 180 GFY	9046.70	8605.90	1:0.45	1:0.12
D_2	1669(92.46)	1526 (38.19) 370 GFY	9449.80	9457.80	1:4.52	1:1.17
D_3	1775(90.55)	1107 (47.29) 381 GFY	9816.50	8513.70	1:11.78	1:0.60
D_4	1174(84.16)	808 (41.15) 381 GFY	7220.80	7133.50	—	—
S.Em. ±	74					
C. D. 0.05	208					

Figures in parenthesis indicates dry matter yield from straw in q/ha.
Selling Price of grain = Rs. 4/kg
Selling Price of green fodder = Rs. 7/q
Selling Price of dry matter = Rs. 30/q
Harvesting cost for one cut = Rs. 440/ha
Irrigation cost = Rs. 210/Irri./ha.

TABLE 4

Interaction table of year x sowing dates and year x cutting management for grain yield of oats (kg/ha).

Y/D & Y/C	Sowing dates				Cutting management	
	D_1	D_2	D_3	D_4	C_1	C_2
1986(Y_1)	1079	1403	856	606	1261(90.3)	711(86.6)
1987(Y_2)	1175	998	937	674	1132(82.3)	760(95.7)
1988(Y_3)	2081	2391	2530	1962	2258(95.7)	2089(88.2)
S.Em. ±	114				79(2.5)	
C. D. 0.05	339				221(7.1)	

Figures in paranthesis indicates dry matter yield (q/ha).

It was also observed that the effect of cutting management remained significant for different sowing dates (Table 3). When the crop was sown of 15th November, no cutting treatment gave significantly higher yield than other treatment combinations barring sowings of oats on 15th Oct. and 30th Oct., without cut.

Data on economics of sowing dates and cutting management interaction (Table 3)

TABLE 5

Yield attributes of different genotypes of oats under varied sowing dates and cutting management.

Treatments	*Tillers/m at maturity*				*1000-grain weight (g)*				*Plant height (cm.) at maturity (grain)*				*Grains/panicle*				*Maturity days (Grain)*			
	1986	1987	1988	AV.	1986	1987	1988	AV.	1986	1987	1988	AV.	1986	1987	1988	AV.	1986	1987	1988	AV.
Sowing dates																				
October 15	63.0	77.8	45.8	62.2	37.56	32.00	32.28	33.95	131.7	115.0	143.5	130.1	44	45	45	45	153	165	151	156
October 30	59.1	65.0	59.2	61.1	36.78	33.89	32.86	34.51	123.6	116.7	139.8	126.7	45	46	46	46	145	152	143	147
November 15	37.5	63.4	49.0	50.0	35.17	34.72	32.94	34.28	117.7	103.3	152.8	124.6	41	41	42	41	143	137	132	137
November 30	47.8	61.7	50.0	53.2	36.73	31.06	31.78	33.19	110.9	98.5	148.4	119.3	35	35	36	35	132	126	119	126
S. Em. ±	3.48	4.21	2.0		1.14	0.81	0.31		4.1	1.6	1.1		3.4	3.4	3.2		0.12	0.08	0.08	
C.D. (5%)	12.03	NS	NS		NS	NS	NS		NS	5.6	3.9		NS	NS	NS		0.42	0.26	0.28	
Genotypes																				
AKS-4	52.3	69.7	56.8	59.6	34.96	32.67	30.73	32.79	121.2	104.9	144.1	123.4	41	39	40	40	142	140	136	139
AKS-8	52.9	63.4	51.1	55.8	33.63	31.29	32.29	32.40	121.5	110.3	147.4	126.4	44	44	45	44	142	143	136	140
Kent	50.4	67.7	45.1	54.4	40.79	34.79	34.38	36.65	120.2	107.3	147.0	124.8	38	40	39	39	146	145	136	142
S. Em. ±	1.82	2.48	2.3		0.99	0.79	0.27		2.2	2.3	1.3		2.9	2.6	2.5		0.12	0.11	0.11	
C.D. (5%)	NS	NS	6.6		2.82	2.25	0.76		NS	6.5	NS		NS	NS	NS		0.34	0.30	0.33	
Cutting management																				
No cut	59.6	79.8	50.1	63.2	35.50	33.92	33.33	34.25	133.8	118.6	152.9	135.1	52	53	53	53	128	132	126	129
One cut for forage and then for grain production	44.1	54.1	51.9	50.0	37.42	31.92	31.60	33.65	108.2	98.2	139.3	115.2	31	30	32	31	158	154	146	153
S. Em. ±	1.49	2.02	1.8		0.81	0.64	0.22		1.8	1.9	1.1		2.3	2.1	2.2		0.10	0.09	0.09	
C. D. (5%)	4.25	5.78	NS		NS	1.84	0.62		5.0	5.3	3.0		6.7	6.0	6.2		0.28	0.25	0.27	

revealed that sowing of oats on 15th November without cutting practices showed the maximum total returns (Rs. 9,816.50) and net ICBR (1:11.78) followed by sowing of oats on 30th October without cutting practice (total returns Rs. 9,449.80 and net ICBR 1:4.52).

Effect of sowing dates x genotypes (D x G) interaction

In the pooled analysis, it was observed that D_1G_1 treatment combination significantly indicated that the relative performance of different genotypes remained inconsistent when sown on different dates (Table 2). When the crop was sown on 15th October (D_1), genotype AKS-4 gave the significantly highest yield as compared to other genotypes wheras if the sowing was delayed upto 30th October (D_2) all the genotypes were at par. Further delaying in sowing beyond 15th November (D_3) genotypes AKS-8 gave the highest yield. Under this situation, it can be concluded that genotype AKS-4 should be sown on 15th October for getting the highest yield. If these delay in sowing upto 30th October, any genotype can be sown. Sowing beyond this date, reduced the overall yield of the crop.

Data on economics of sowing dates and genotypes of oats (Table 2) revealed that genotype AKS-8 sown on 15th November showed the maximum total returns (Rs. 9,610/ha). If we consider the net ICBR, genotype AKS-8 sown 15th November showed the maximum net ICBR (1:18.30) followed by genotype oats AKS-4 sown on 15th November (1:12.37) and oats var. Kent sown on 30th October (1:8.18) as well as it was sown on 15th November (1:7.27).

Thus from the present experiment, it can be suggested that for obtaining maximum benefit per unit cost, any genotypes of oats (AKS-8, AKS-4 or Kent) should be sown on 15th November without taking any forage cut before harvesting the grains. If the sowing need to be done early from this date (15th November), oats variety Kent should be sown on 30th October without taking any cut for obtaining the higher yield and net returns.

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