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Effect of Irrigation in Relation to Nitrogen on the Fodder Production of Oats

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ABSTRACT

A field experiment comprising three irrigation regimes (25, 50 and 75% ASM) and four nitrogen levels (0, 40, 80 and 120 kg N/ha) was conducted on sandy loam soil of Gujarat Agricultural University Research Farm, Anand (India) during *rabi* 1975-76 and 1976-77. The results indicated that the application of 120 kg N/ha was at par with 80 kg N/ha produced significantly higher green forage and crude protein yields than no application of nitrogen and 40 kg N/ha. An application of 80 kg N/ha produced significanlty higher dry matter yield than no application of nitrogen and 40 kg N/ha but was at par with 120 kg N/ha. The application of 80 kg N/ha showed the maximum net Incremental Cost Benefit Ratio (ICBR) as compared to that of 40 or 120 kg N/ha. Therefore, application of 80 kg N/ha could be recommended for obtaining higher forage yields and net returns. The most frequent irrigations at 75% ASM produced maximum higher green forage yield than irrigation at 25 and 50% ASM. However, maximum dry matter and crude protein yields was obtained when irrigation was applied at 50% ASM on pooled basis. Looking to the net ICBR, irrigation at 50% ASM gave higher net ICBR, (1:2.0) as compared to that of 75% ASM (-1:0.03). So irrigation given at 50% ASM appeared to be advantageous. The interaction effects between irrigation and nitrogen on fodder yield of oats were absent.

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INTRODUCTION

The scheduling of irrigation has a great significance in forage production and in particular oats (*Avena sativa* L.). The oats demands water requirement for luxuriant vegetative growth on one hand and limited water holding capacity of soils in which the crop is commonly grown on the other. Moreover, forage crops usually receive little or no attention while allocating water resources because of pressing irrigation need for food and cash crop. This led to work out the irrigation and nitrogen requirement of forage oats under single cut management. Therefore, an attempt is made to work on there aspects in this study.

MATERIALS AND METHODS

A field experiment with three irrigation regimes (25, 50 and 75 per cent Available Soil Moisture) and four nitrogen levels (0, 40, 80 and 120 kg N/ha) was conducted during *Rabi*, 1975-76 and 1976-77 at the Forage Research Farm, Gujarat Agricultural University, Anand (India). The experiment was conducted in randomized block design with three replications. The soil of the experimental field was sandy loam, neutral in pH and having 112.5 kg P_2O_5 and 226.5 kg K_2O/ha. Total N contents was 644 and 672 kg/ha during 1975 and 1976, respectively. The moisture at field capacity was 18.2 %, wilting point 5.4% and bulk density 1.589 g/cc. Oats variety kent was

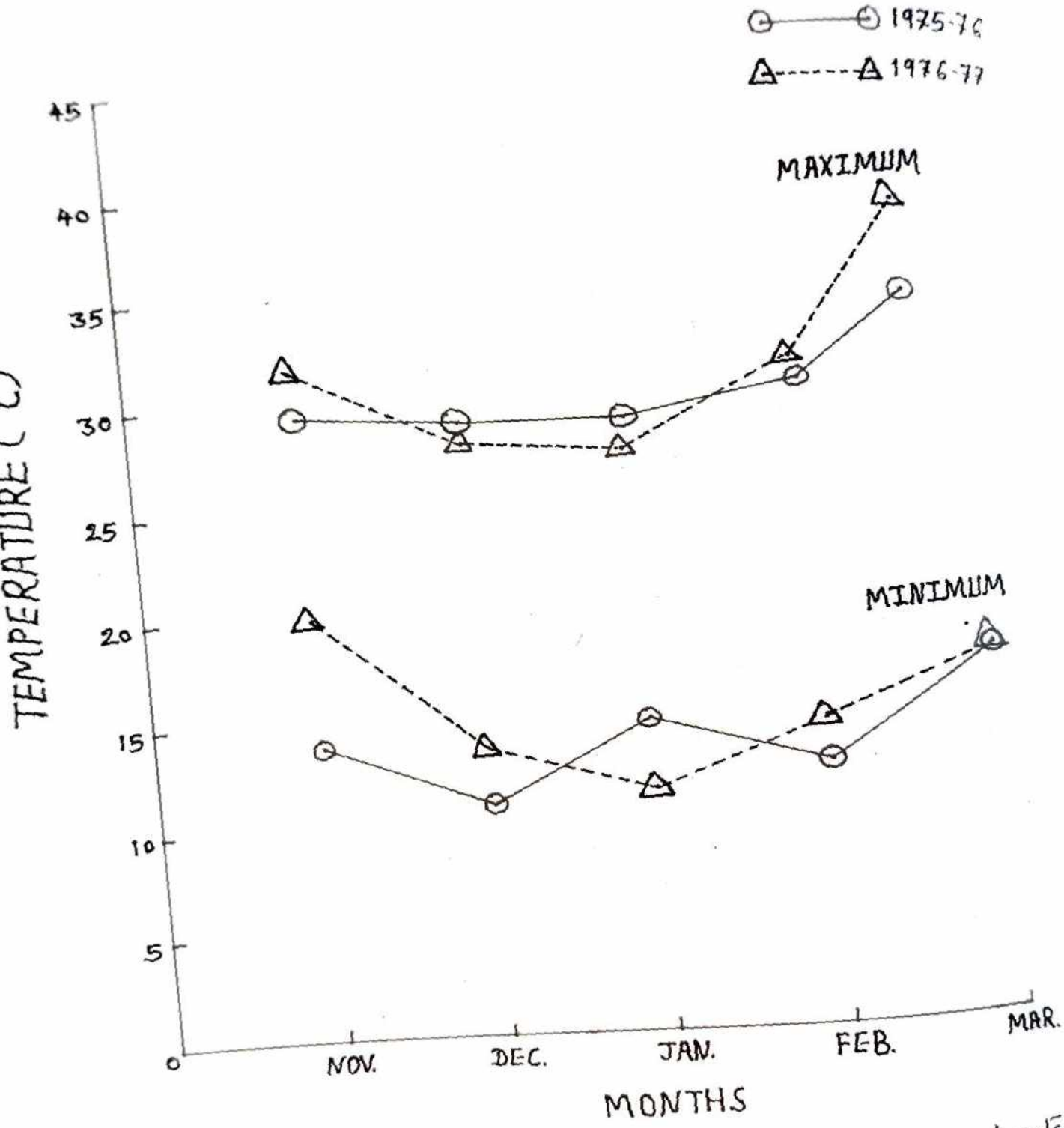

Fig. 1. Showing weather data during growth seasons of oats

sown on November 18 in 1975 and November 5 in 1976 in rows spaced at 25 cm apart by drilling using 100 kg seed/ha. The weather data during crop growth seasons of oats are given in Fig. 1.

A uniform application of 30 kg P_2O_5 and 25 kg K_2O/ha was applied at the time of sowing. Nitrogen was applied as per treatments. For knowing the moisture status, soil samples were taken from 0.30M layer at an interval of 4 days and measured quantity of irrigation water was applied to the treatments as per requirement. The number of irrigations at 25, 50 and 75% ASM were 2, 3 and 6 respectively during both the years. Fresh weight of green forage from each plot was recorded immediately after harvesting and 500 g sample from each treatment were collected randomly for dry matter estimation. Green samples were cut into small pieces and first air dried and then oven dried at 70 c. The dry matter weight was separately recorded for each treatments. Nitrogen content of the oven dried samples of fodder was determined by micro-kjeldahl's method. The crude protein percentage was worked out by multiplying nitrogen percentage by 6.25. There was no rain during the period of investigation in both the years.

RESULTS AND DISCUSSION

Effect of Irrigation

When differrent irrigation treatments were compared for green forage and dry matter yields, it was observed that during 1975-76 irrigation application did not show significant improvement in yields. However, in 1976-77, scheduling of irrigation at 50 and 75% ASM resulted into significantly higher green forage and dry matter yields (Table 1). Irrigation at 50 and 75% ASM also produced higher green forage and dry matter yields than 25 % ASM on an average of two years, although the results were found non-significant.

The most frequent irrigations at 75 % ASM produced higher green forage yield than irrigation at 25 and 50 % ASM during 1976 and on pooled basis. However maximum dry matter and crude protein yields produced when irrigation was applied at 50% ASM on pooled basis. This was identical with crude protein concentration. The irrigation at 50 % ASM gave higher net ICBR (1 : 2.0) as compared to 75 % ASM (-1 : 0.03) (Table 2). Therefore, the irrigation given at 50 % ASM appeared to be advantageous. Similar results are reported by Hukkeri *et al.* (1977), Kumar and Verma (1981) and Joon and Singh (1989). Hukkeri *et al.* (1977) reported that fresh fodder yield increased with increasing ASM from 332 and 301 q/ha at 25 % ASM to 422 and 466 q/ha at 75 % ASM with loam and sandy loam soils, respectively at IGFRI, Jhansi. They recommended the application of 90 kg N/ha and to give irrigation at 75 % ASM. Joon and Singh (1989) reported that increase in green and dry fodder yields were recorded with the increase in frequency of irrigation scheduled at 110 and 70 mm CPE during first cut (75 DAS) in both the year at HAU, Hissar.

Effect of Nitrogen

An application a t120 kg N/ha was at par with 80 kg N/ha produced significantly higher green forage yield than no application of nitrogen and 40 kg N/ha during the year 1975 and on average of two years (Table1). An application at 80 kg N/ha had also given the highest yield during the year 1976 but it was at par with 40 and 120 kg N/ha. A linear response upto 120 kg N/ha (Gill *et al.* 1979 and Taneja *et al.* 1981) and 160 kg N/ha (Joon and Singh, 1989) had also been reported for green forage yield of oats.

An applicaiton of 80 kg N/ha was at par with 120 kg N/ha produced significantly higher dry matter yield than no application of nitrogen during the year 1976 and on pooled basis. An application of 40 kg N/ha produced significatnly lower yield than 80 and 120 kg N/ha on an average of two years. Similar type of results were also been reported by Gill *et al.* (1979) and Taneja *et al.* (1981).

An application of 120 kg N/ha produced significantly higher crude protein yield than no

TABEL 1

Effect of irrigation in relation to nitrogen on the fodder production of oats.

Treatment	Yield in q/ha						Crude Protein			Crude Protein Concentration (%)		
	Green Fodder			Dry matter			Crude Protein					
	1975	1976	Pooled	1975	1976	Pooled	1975	1976	Pooled	1975	1976	Average
Irrigation												
25% ASM	477	455	466	89.6	86.5	88.1	7.38	8.00	7.63	8.0	9.2	8.6
50% ASM	484	562	523	92.3	105.5	98.9	7.38	10.00	8.63	7.9	9.4	8.7
75% ASM	488	591	540	89.3	103.2	96.2	6.88	9.13	8.00	7.7	8.7	8.2
S.Em.±	8	17	33	13.0	3.3	4.8	0.11	0.31	0.54			
S.D.(5%)	NS	51	NS	NS	9.6	NS	0.31	0.94	NS			
Nitrogen(kg/ha)												
0	417	487	452	79.1	88.4	83.7	5.00	6.50	5.75	6.2	7.3	6.8
40	469	518	493	86.6	96.0	91.3	6.50	8.50	7.50	7.6	8.8	8.2
80	515	577	546	97.0	107.0	102.0	6.50	10.50	9.13	8.0	9.8	8.9
120	533	561	547	98.8	102.2	100.5	8.50	10.63	10.13	9.6	10.5	10.0
S.Em.±	9	20	11	1.5	3.8	2.0	0.13	0.36	0.35			
C.D.(5%)	27	59	32	4.4	11.1	5.8	0.36	1.08	1.55			

TABLE 2

Relative profitability of irrigation in relation to nitrogen on the fodder production.

Treatment	Pooled green forage yield q/ha for 1975 & 1976	Total return Rs/ha	Additional return over control Rs/ha	Additional cost Rs/ha (irrgation + labour)	Gross ICBR	Net ICBR
Irrigation						
25% ASM	466	4660	—	—(2)	—	—
50% ASM	523	5230	570	190(3)	1:3.00	1:2.00
75% ASM	540	5400	740	760(6)	1:0.97	1:0.03
C.D.(5%)	NS					
Nitrogen(kg/ha)						
0	452	4520	—	—	—	—
40	493	4930	410	213	1:1.92	1:0.92
80	546	5460	940	426	1:2.21	1:1.21
120	547	5470	950	638	1:1.49	1:0.49
C.D.(5%)	32					

Cost calculated on the basis of Rs. 10/- per q of green forage, Rs. 5.32 per kg of nitrogen fertilizer from urea and Rs. 190/- for one irrigarion including labour in one hectare area.
Figures in parentheses indicate frequency of irrigation.
ICBR=Incremental Cost Benefit Ratio.

application of nitrogen and 40 kg N/ha barring 80 kg N/ha during the year 1976 as well as when data were pooled. The application at 120 kg N/ha had also produced significantly higher yield than all other nitrogen levels during 1975. Gill *et al.* (1979) and Verma and Singh (1987) reported that crude protein yield in oats increased with increasing levels of nitrogen. It was also observed that crude protein content increased with increasing levels of nitrogen and Bokde (1968) as well as Verma and Singh (1987) also recorded higher crude protein content under higher dose of nitrogen.

An application of 80 kg N/ha gave higher net ICBR (1:1.21) as compared to 40 kg N/ha (1:0.92) and 120 kg N/ha (1:0.49) Table 2. So the recommendation is 80 kg N/ha for obtaining higher forage yield and net realization in oats var. kent.

The results reveal that the effect of irrigation and nitrogen on forage production of oats was indepenedent and there was no interaction during both the years. An application of 80 kg N/ha and 50 % ASM irrigation treatments produced higher forage yields, nutrient yield and net returns.

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