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Effect of Nitrogen on Growth and Yield of Promising Forage Oat Cultivars

Key words : Green forage yield, Nitrogen levels and Oat varieties

Importance of fodder crops in agriculture needs no emphasis because of the fact that the continuous supply of nutritious fodder is a basic requirement for livestock production to meet the demand of milk, butter and other byproducts for human consumption. The total area under cultivated fodder in India is only 8.4 m ha (5.23% of gross cultivated area) which is static since last two decades. The fodder production in the country is not sufficient to meet the requirements of the growing livestock population and in addition, the forages offered to animal are mostly of poor quality. At present, the country faces a net deficit of 61.1 % green fodder and 21.9 % dry crop residues. In an effort to bridge the gap, many forage crops were bought under cultivation. Among them, oat is a cool season crop having quick growing habit, palatability, succulency and nutrient content and forms an excellent combination when fed along with other cold season legumes, like berseem and Lucerne etc.

Restriction of N supply at any development stage can reduce fodder and grain yield by up to 65% (Zhao et al., 2009). Both the deficiency and excess supply of this nutrient has adverse effect on growth and yield of crops. Hence, genetic differences in responsiveness to nitrogen fertilizer are to be identified. Therefore, in the present study six forage single cut oat varieties along with national check Kent were tested at different levels of nitrogen.

A experiment was carried out at Agricultural Research Institute, Rajendranagar, Hyderabad (The farm is geographically situated at an altitude of 542.6 m above mean sea level on 18' 50^{o} N latitude and 77.53^{o} E longitude) during the winter (*rabi*) season of 2002-03. The soil of experimental site was sandy loam in texture. The experiment was laid out in randomized block design (RBD) with three replications. The treatments comprising of six pre released oat varieties *viz.,* JHO 2001-3 , JHO 99-1, SKO-20, JHO 2001-1, OS-6, JHO 2001-2 and national check (KENT) evaluated at four levels of nitrogen *i.e.* 0, 40, 80 and 120 kg ha^{-1} that were applied in the form of urea. Half the dose of nitrogen in all treatments except control was applied at the time of sowing by side dressing with the help of a hand drill. While the remaining half dose of N was applied at 25 DAS. 40 kg P_2O_5 and 30 kg K_2O were applied uniformly to all treatments as basal in the form of single super phosphate and muriate of potash.

Oat cultivars were sown on a well prepared seed bed with 25 cm row to row spacing using seed rate of about 80-100 kg ha^{-1}. Necessary agronomic and plant protection measures were taken as per the recommended package of practices. The crop was harvested as green fodder at 50 per cent flowering. Plant height and number of leaves plant^{-1} were measured for ten plants in each treatment and averaged. The entire forage from the net plot area was cut close to the ground, fresh forage yield was measured and then green forage yield (GFY) in q ha^{-1} determined by multiplying with area. The observations during the investigation were subjected to analysis statistically using analysis of variance techniques (ANOVA) for randomized block design as prescribed by Panse and Sukhatme (1985). Standard error of mean and the critical difference were computed at 5% level of probability. Simple correlation coefficients (r) were calculated as per procedure of Panse and Sukhatme (1985). Significance was tested by referring to the correlation coefficient tables at (n-2) degrees of freedom.

The plant height of all entries ranged between 85.5 to 100.0 cm. plant height was highest with SKO-20 and it was on par with JHO 2001-3, JHO 99-1 and OS-6. All the varieties except JHO 2001-2 reached higher plant height than Kent national check. Number of leaves per plant ranged between19.2 to 21.6 and highest was reported in JHO 2001-3, however it was on par with JHO 2001-1 and Kent. Paroda (1975) reported that height and number of tillers plant^{-1} were positively correlated

with leafi ness and inturn green and dry fodder yield of forage crops. Hence, it was assumed that the varieties that have higher plant height and number of leaves plant^{-1} also has higher green and dry fodder yield. The variety OS-6 reached 50 % flowering very early (61.5 days) than all other varieties. The days to 50 % flowering reached by varieties JHO2001-1, Kent, JHO2001-3, JHO 99-1 and SKO-20 ranged between 70.2 and 67 days and were significantly at par. But the variety JHO2001-2 took 93.7 days to reach 50 % flowering and can be considered as late variety. Green and dry fodder yield of SKO-20 was higher than other varieties however it was statistically at par with Kent, JHO 2001-3, JHO 2001-1 and OS-6 varieties. This may be attributed to higher plant height and number leaves plant^{-1} in these varieties. The genetic characteristics of individual genotypes might have resulted in vigorous plant growth and ultimately higher green and dry fodder yield. These results are in accordance with those reported by Dhadheech *et al.* (2000). Lowest green and dry fodder yield was recorded with JHO 99-1 and was at par with JHO 2001-2 in green fodder yield and also with JHO 2001-1 and OS-6 in dry fodder yield.

Response of oat varieties to nitrogen levels revealed that plant height, number of leaves plant^{-1}, days to 50% flowering, green and dry fodder significantly improved upto 120 kg N ha^{-1} over lower doses of nitrogen application but increment of increase varied. Level of increase was significant only upto 40 kg N ha^{-1} in case of plant height, number of leaves and 50 % flowering and upto 80 kg N ha^{-1} in case of green and dry fodder yield. Nitrogen is major nutrient that contributes to cell division and cell elongation which results in increase in plant height and the assimilating area that might be producing more assimilates with adequate plant nutrition. The application of nitrogen increased the plant height and green leaves per plant, which in turn had their impact on increasing dry matter accumulation per plant and ultimately forage yield. The results were in close agreement with the findings of Hasan *et al.* (2000) and Singh *et al.* (2000). The interaction between varieties and nitrogen levels was found non-significant in all the parameters.

Correlation among forage yield and yield components of oat varieties and nitrogen levels:

Correlation coefficients were calculated between nitrogen levels and growth and yield characters of oat varieties (Table 2) which revealed that plant height had positive and significant (P 0.05) correlation with green fodder yield (r =0.986*) and highly significant (P 0.01) correlation with Number of leaves plant^{-1} (r =0.998**) and dry fodder yield (r =0.994**). Number of leaves plant^{-1} also showed highly significant (P 0.01) correlation with green fodder yield (r =0.991**) and dry fodder yield (r =0.994**).

The tested variable in the experiment i.e. nitrogen showed positive correlation with all the parameters and was significant (P 0.05) with green fodder yield (r =0.964*) and dry fodder yield (r =0.941*). It explains the fact that the nitrogen is the single important nutrient that has significant influence on growth and yield of oat varieties.

It is recommended that pre released single cut oat varieties SKO-20 and JHO 2001-3 in addition to national check Kent can be recommended for cultivation in Andhra Pradesh and nitrogen level of 80 kg ha^{-1} can be recommended for maximizing green and dry fodder yield of oat varieties.

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Table 1. Performance of single cut forage oat varieties at different nitrogen levels.

Treatment	Plant height (cm)	Number of leaves plant^{-1}	Days to50 % flowering	Green fodder yield (q ha^{-1})	Dry fodder yield (q ha^{-1})
Varieties					
JHO 2001-3	96.7	21.6	69.7	397.53	110.25
JHO 99-1	95.9	19.4	69.2	354.44	99.00
SKO-20	100.0	19.9	67.0	421.49	116.39
KENT (check)	94.4	21.1	69.8	384.41	106.75
JHO 2001-1	94.3	20.6	70.2	371.66	98.97
OS-6	97.4	19.3	61.5	371.66	98.97
JHO 2001-2	85.5	19.2	93.7	364.78	100.0
C.D.(P=0.05)	5.9	1.5	3.2	48.53	13.51
N levels (kg ha^{-1})					
0	89.3	18.4	69.8	299.04	82.54
40	95.1	20.2	71.6	372.06	103.17
80	97.6	20.9	72.1	417.37	116.36
120	97.7	21.1	72.8	434.74	117.98
C.D.(P=0.05)	4.5	1.2	2.4	36.68	10.22
Varieties × N levels					
C.D.(P=0.05)	NS	NS	NS	NS	NS

Table 2. Coefficients of Correlation (r) among plant height, number of leaves plant^{-1}, green fodder yield and dry fodder yield of single cut oat varieties grown at four nitrogen levels.

	(1)	(2)	(3)	(4)	(5)
N level (1)	1	0.90805	0.92452	0.96419*	0.94168*
Plant height (2)		1	0.99842**	0.98633*	0.99408**
Number of leaves/plant (3)			1	0.99107**	0.99445**
Green fodder yield (4)				1	0.9968**
Dry fodder yield (5)					1

* = Significant (P 0.05) ** = Highly significant (P 0.01)

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