



Effect of Nitrogen Levels on Forage Yield and Quality of Multi Cuts Oat Cultivars

H. K. Patel^{1*}, P. H. Rathod¹ and D. R. Padheriya¹

¹Main Forage Research Station, ANAND Agricultural University, ANAND-388110 (GUJARAT), India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted at Main Forage Research Station, Anand Agricultural University, Anand during rabi-2019-20 to study the effect of nitrogen levels on yield and quality of multi cut oat cultivars with aim to find out nitrogen levels on green fodder yield and quality of oat. There were total four varieties (**V**₁: OL 1874, **V**₂: JO-05-304, **V**₃: UPO 212 and **V**₄: RO 19) and four levels of nitrogen (**N**₁: 35 kg N/ha, **N**₂: 70 kg N/ha, **N**₃: 105 kg N/ha and **N**₄: 140 kg N/ha) was tested. Experiment was laid out in split plot design with three replications. Experiments results revealed that significantly the highest green fodder yield was reported in RO 19 (**V**₄) treatment, while average plant height and average number of tiller per meter row length were reported in **V**₁: OL 1874 and **V**₂: JO 05-304 treatment, respectively. Average plant height, Green fodder yield, average dry matter, average crude protein, total crude protein yield and dry matter yield were found highest by application of 140 kg N/ha. Average tiller per meter row length was higher in **N**₄ (140 kg N/ha) and average dry matter was higher in **N**₁ (35 kg N/ha). Response of nitrogen non-significant in case of average ADF and NDF content.

Keywords: Oat; nitrogen and green fodder yield; crude protein yield; dry; matter yield.

1. INTRODUCTION

India possesses a large bovine population which includes 200 million cattle and 92 million buffalo. This accounts for 19.5 per cent of the global cattle population. Despite this large bovine population, the scenario of milk production and productivity is far below the world average. The supply of nutritious fodder is a pre-requisite for the success of any dairy industry (Surje et al., 2015). At present, the country faces a net deficit of 63% green fodder, 24% dry crop residues and 64% feeds [1]. The productivity of our livestock often remains low due to inadequate and nutritionally unbalanced supply of feed and fodder. Half of the total losses in livestock productivity are attributed to the inadequacy in supply of feed and fodder.

Oat (*Avena sativa* L.) is the important cereal (Gramineae) and forage crop grown during the rabi season, with nutritive value comparable to berseem. It also has a high energy content, a high protein content (13-15%), vitamin B, phosphorus, and iron [2]. The majority of the oats provided around the world are used as a primary source of feed for livestock. Just 17 percent of grain is used as human food. The ever-rising demand for fodder and feed for sustaining placental mammal production is met through increasing productivity of fodder [3].

All the crops in general and non-legumes in particular use nitrogen in large quantity. Apart from the other roles played by nitrogen, it is a major constituent of protein and chlorophyll of green plant. Nitrogen content of fodder has been said to be the best single index for forage digestibility. However, higher dose of nitrogen because lodging of crop and may also result in nitrate poisoning to animals. Nitrogen, because of its consumption by the crop in large quantity, plays a vital role in fodder production. The adequate nitrogen supply is associated with high photosynthetic activity, vigorous growth, and a dark green colour of fodder and is known to aid in carbohydrate utilisation and increasing fodder succulence [4].

2. MATERIALS AND METHODS

A field experiment was conducted at Main Forage Research station, Anand Agricultural University during *rabi* 2019-2020 to study the effect of nitrogen levels on yield and quality of promising entries oat. The soil of experimental field was loamy sand in texture, having organic

carbon (0.51%), low in nitrogen (222.0 kg/ha), phosphorus (26.0 kg/ha) and sulphur (18.69 kg/ha). Treatment comprising of four varieties (V₁:OL 1874, V₂: JO-05-304, V₃: UPO 212 and V₄: RO 19) and four levels of nitrogen (N₁: 35 kg N/ha, N₂: 70 kg N/ha, N₃: 105 kg N/ha and N₄: 140 kg N/ha). The experiment was laid out in split plot design with three replications. Nitrogen was given as per treatments through need coated urea, among total nitrogen requirement, 50% of nitrogen and full dose of phosphorus was applied as basal application and 25% of nitrogen was applied at 40 DAS and remaining 25% nitrogen was applied after first cut. As per the soil analysis all deficient nutrients were applied at time of sowing according to recommendation. Various growth and yield attributing characters and green fodder yield observations were recorded during growing period from net plot area. Plant was harvested at 50% flowering stage. The crude protein yield was calculated by a factor of 6.25. The dry matter yield was recorded.

2.1 Dry Matter Content (%) and Dry Matter Yield (q/ha)

A fresh sample of 500 g green fodder oat harvest from each net plot, was subsequently chopped into small pieces and air dried for three to four days. This air-dried samples were then dried in the oven at 100 °C till attainment of constant weight. The dry matter content (%) was calculated by using given formula.

$$\text{Dry matter content (\%)} = \frac{\text{Oven dried fodder weight (g)}}{\text{Fresh fodder weight (g)}} \times 100$$

The dry matter yield was calculated by multiplying dry matter content (%) with green fodder yield using following formula and expressed in q/ha.

$$\text{Dry matter content (q/ha)} = \frac{\text{Dry matter content (\%)} \times \text{Green fodder yield (q/ha)}}{100}$$

2.2 Crude Protein Content (%) and Crude Protein Yield (q/ha)

The total nitrogen content (%) was estimated as per the Kjeldahl method (Jackson, 1973). Subsequently, crude protein content (%) was calculated by multiplying the percentage of total nitrogen content with a factor of 6.25. The crude protein yield was estimated by multiplying crude protein (%) with dry matter yield and expressed in q/ha.

$$\text{Crude protein yield (q/ha)} = \frac{\text{Dry matter content (\%)} \times \text{Crude protein content (\%)}}{100}$$

3. RESULTS AND DISCUSSION

3.1 Effect of Varieties

Perusal of data presented in Table 1 reported that variety V₁ (OL 1874) reported significantly average higher plant (110.45 cm) than rest of varieties except V₂ (JO 05-304). Variety V₂ (JO-05-304) and V₄ (RO 19) reported significantly higher average number of tillers per meter row length (60.88) and total green fodder yield (527.78 q/ha) than rest of treatments, respectively. Oat varieties do not respond on average crude protein content, average dry matter content, total crude and dry matter yield, average ADF and average NDF content but higher crude protein (17.08%) and dry matter content (21.90%) was reported higher in variety V₂ (JO 05-304) and V₁ (OL 1874), respectively while, high total crude protein yield (17.97 q/ha) and dry matter yield (109.32 q/ha) was observed in V₄ (RO 19) variety.

3.2 Effects of Nitrogen

3.2.1 Effect on plant height and number of tillers

Application of 140 kg N per ha (N₄) reported significantly maximum average plant height (114.87 cm) and higher average number of tillers per meter row length (61.46). The higher plant height on higher levels of nitrogen is mainly attributed to more availability and uptake of nitrogen, synthesis of food materials by crop which resulted in more vegetative growth and increase in protoplasmic constituent and acceleration in the process of cell elongation cell division, expansion, and differentiation and there by resulting in luxuriant growth [5], while number of tillers per meter row length may be higher due to increased vegetative growth and capacity to produce a greater number of tillers under higher nitrogen levels.

3.2.2 Effect on green fodder yield

Total green fodder yield (557.67 q/ha) was reported significantly the maximum by application of 140 kg N/ha (N₄). Green fodder yield was 34.28 %, 24.49 % and 10.75 % higher over N₁ (35 kg N/ha), N₂ (70 kg N/ha) and N₃ (105 kg N/ha). The green forage yield increased linearly with the application of nitrogen at 140 kg/ha. Higher green fodder yield with increasing levels

of nitrogen might be attributed to the significant enhancement in performance of yield is well linked with Considerably higher growth parameter performance (plant height, dry matter accumulation, crop growth rate or relative growth rate) as a result of higher metabolite availability. Such enhancements in various growth characteristics, ultimately resulted in higher fodder [6].

An examination of data reveals that average crude protein content (18.35%) was significantly the maximum in N₄ (140 kg N/ha) treatment, while average dry matter content (22.65%) was higher in N₁ (35 kg N/ha). Increase in these quality parameters might be due to increased root density and availability of soil nitrogen resulting in higher uptake of nitrogen and higher concentration of pigments including chlorophyll which is house of photosynthetic activity for formation of different food ingredients and more energy of carbohydrates might have been converted into ether extract and mineral matter under better soil moisture conditions. Higher crude protein content might be due to the accumulation of protein bodies and their derivatives due to increased efficiency of water utilisation by forage crop and enhanced translocation and assimilation of absorbed nitrogen, which has resulted in higher crude protein [6]. Another results might be due to genetical make up of varieties or higher biomass production which leads to higher nitrogen uptake resulted in higher crude protein content [7].

Perusal of data presented in Table 1 indicated that higher application of nitrogen (N₄: 140 kg N/ha) reported significantly the highest total crude protein yield (20.57 q/ha) and total dry matter yield (112.50 q/ha) than rest of levels of nitrogen. This might be due to the fact that application of nitrogen leads to adequate availability of nutrients which cause more uptakes of nutrients and corresponding increase in crude protein content of fodder and ultimately increased crude protein yield and dry matter yield. Also, the nitrogen is the constituent of various metabolites including amino acids and protein, so increase in nitrogen content in plant with increase nitrogen rate increased synthesis of protein.

Response of nitrogen on acid detergent fiber (ADF) and Neutral detergent fiber was found non-significant, but minimum ADF content (37.33%) was found with application of 105 kg N/ha (N₃) and NDF (66.02%) was found in N₁ (35 kg N/ha).

Table 1. Effect of nitrogen levels on growth attributes and green fodder yield of multi cuts oat

Treatment	Average Plant height (cm)	Average No of tiller meter row	Total GFY (q/ha Two cuts)	Average CP%	Average DM%	Total CPY (q/ha)	Total DMY (q/ha)	Average ADF (%)	Average NDF %
Main Plot									
V ₁	110.45	59.92	475.69	16.85	21.90	17.46	103.60	37.86	66.73
V ₂	99.87	60.88	448.61	17.08	21.19	16.25	94.64	38.70	65.51
V ₃	106.27	56.12	472.22	16.92	21.13	17.03	100.01	37.54	66.40
V ₄	107.55	53.98	527.78	16.44	20.84	17.97	109.32	38.93	67.33
S.Em.	1.40	1.12	4.97	0.25	0.67	0.49	3.37	0.57	0.70
CD 0.05 %	4.83	3.89	17.20	NS	NS	NS	NS	NS	NS
CV%	4.56	6.75	3.58	5.22	10.86	9.82	11.47	5.20	3.63
Sub plot									
N ₁	97.90	53.94	415.28	15.18	22.65	14.30	94.07	38.62	66.02
N ₂	102.90	54.72	447.92	16.84	20.56	15.43	91.88	38.35	66.59
N ₃	108.47	60.78	503.47	16.91	21.66	18.40	109.12	37.33	66.48
N ₄	114.87	61.46	557.64	18.35	20.18	20.57	112.50	38.73	66.88
S.Em.	1.11	0.85	2.84	0.21	0.48	0.46	2.55	0.40	0.71
CD 0.05 %	3.25	2.49	8.30	0.61	1.41	1.34	7.43	NS	NS
CV%	3.63	5.11	2.05	4.31	7.88	9.25	8.66	3.66	3.68
Interaction	NS	NS	*	NS	NS	NS	NS	NS	NS

Table 2. Total green fodder yield

Main Plot	Total Green Fodder Yield (q/ha)			
	N ₁	N ₂	N ₃	N ₄
V ₁	438.89	444.44	488.89	530.56
V ₂	380.56	411.11	486.11	516.67
V ₃	400.00	444.44	494.44	550.00
V ₄	441.67	491.67	544.44	633.33
S.Em. ±	5.68			
CD at 5%	16.59			
CV%	12.05			

3.3 Interaction Effect of Nitrogen and Varieties

Date presented in Table 2 indicated that application of 140 kg N/ha to RO 19 variety reported significantly the highest green fodder yield (633.33 q/ha).

4. CONCLUSION

In view of the results obtained from the present examination, it is concluded that application of 140 kg N/ha to RO 19 variety recorded significantly higher green fodder yield and quality of oat.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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