Acta Scientific AGRICULTURE (ISSN: 2581-365X)

Volume 6 Issue 2 February 2022

Research Article

Nitrogen Management and its Effect on Fodder Yield and Quality of Multicut Oat (*Avena sativa* L.) Genotypes in Tarai Region of Uttarakhand (India)

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Received: September 13, 2021

Published: January 13, 2022

Abstract

Field experiment was carried out at instructional Dairy Farm, G B Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) during winter season 2020-21 to study the effect of nitrogen management on forage productivity and quality of multicut oat varieties. The experiment comprised of four oat genotypes i.e. HF-707, RO-19, OL-1882 and UPO-212 in main plot and 3 nitrogen level i.e. 70,105 and 140 N kg/ha respectively in sub plots, was planted in split plot design and replicated thrice. The green and dry fodder yield was recorded significantly higher in UPO-212 with 4.5, 9.5 and 29.3% higher green fodder yield than OL-1882, RO-19 and HF-707 entries, respectively. The crude protein yield was 16.7, 17.8 and 45.8% greater in UPO-212 than OL-1882, RO-19 and HF-707, respectively. The green and dry fodder yield, crude protein and crude protein yield increased with increasing N levels and significantly highest values were recorded at application of 140 kg N/ha. Therefore, it is concluded that multi cut oat genotype UPO-212 may be grown with application of 140 kg N/ha for higher green and dry fodder production as well as crude protein production in *Tarai* region of Uttarakhand and other areas having similar agro-ecologies and soil types.

Keywords: Green Fodder Yield; L:S Ratio; Quality; Crude Protein

Background

Oat (*Avena sativa* L.) is the second most important fodder crops grown during winter season in wide range of agro-climatic conditions varying from temperate to tropical as well as irrigated to rainfed conditions of India. Normally it is grown in north, east and central India. It is a fast growing fodder crop with high regeneration capacity leading to early fodder availability in early winter months. It also produces higher green fodder yield per unit area and with minimum irrigation. The green fodder of oat is rich in fat, crude protein (9-10%), vitamin B, phosphorus and iron, while the kernels have 66% carbohydrates, 11% dietary fibre, 4% beta-glucan, 7% fat and 16-17% protein and rich in P, K, Mg and vitamin B complex. Oat is a double purpose crop, being grown for both forage and grains. Both milch and drought animals relish on its green fodder, while its grains are high quality feed for horse, pigs, poultry and equines. Green oat is also used as green chop, silage and hay. Besides the oat based food products like breads, biscuits, cookies, probiotic drinks, breakfast cereals, flakes and infant food are gaining increasing importance. Oat is also rich in antioxidants supporting good animal and human health.

The varieties with its genetic potentials and fertilizers particularly nitrogen are the most important factors that influence the forage productivity and nutritional quality [6]. Improved fodder quality with fertilizer application is due to their favorable effects on plant water relations, light absorption, crop density, plant height, leaf area and nutrient utilizations [1]. Oat has high regrowth ability and it could be enhanced by precision nitrogen management for higher forage productivity [9]. The application of nitrogen fertilizer improves the dry matter, biomass yield and quality of forage [3]. Nitrogen content in green fodder is the best singly index for forage digestibility. Nitrogen plays a vital role in fodder production as it is associated with high greenness, photosynthetic activity and vigorous plant growth and finally leads to more succulence and carbohydrate utilization, however higher dose of nitrogen may cause lodging and nitrogen poisoning in animals [8].

Recently number of new multicut oat varieties have been released for cultivation having variable yield potentials and require precision nitrogen management for realizing its genetic potentials in different agro-climatic region of India. The literature on nitrogen management and its dynamics in relation to multicut oat production is lacking. Therefore the purpose of present field study was planned to study the effect of nitrogen management on fodder yield and quality of multicut oat (Avena sativa L.) genotypes in *Tarai* region of Uttarakhand (India).

Materials and Methods

Field experiment was carried out at Instructional Dairy Farm, G B Pant University of agriculture and technology, Pantnagar (Uttarakhand) during winter season-2020-21 to study the effect of nitrogen management on forage yield and quality of multicut oat genotypes in Tarai region of Uttarakhand (India). The experimental site was sandy loam with neutral soil pH and available nitrogen, phosphorus and potassium were 278.5, 27.7 and 232.8 kg/ha, respectively. The experiment comprised of four oat genotypes i.e. HF-707, RO-19, OL-1882 and UPO-212 in main plot and 3 nitrogen levels i.e. 70,105 and 140 N kg/ha, respectively in sub plots, was planted in split plot design and replicated thrice. The crop was grown under recommended agronomy. Pendimethalin @ 3.3l/h as a pre emergence herbicide was sprayed uniformly after sowing to control the weeds. The experiment was planted on 10th November 2020. Half nitrogen and full phosphorus (60 kg/ha) and potassium (40kg/ha) was applied at sowing time and remaining half nitrogen was top dressed in equal splits after 1st and 2nd cut, respectively. The growth attributes, yield and crude protein were recorded after each cut and average values were reported. The plant samples were collected plot wise from 1m^2 area after each cut with the help of quadrate and green and dry fodder yields were weighed and presented in q/ha. Later the dry samples were grounded and analyzed for estimation of crude protein content and crude protein yield was estimated by multiplying crude protein content multiply by dry matter yield.

Results and Discussion

Effect of genotypes

Genotypes HF-707 and RO-19 had almost similar plant height that was significantly higher than OL-1882 and UPO-212, being both were non-significant each other. The number of tillers was recorded significantly higher in both HF-707 and UPO-212 genotypes, while RO-19 had the lowest tillers. The L:S ratio did not influence by oat genotypes, however the highest value was recorded in RO-19 followed by OL-1882. The green and dry fodder yields were recorded significantly higher in UPO-212 followed by OL-1882, RO-19 and the lowest in HF-707. Similar trend was also observed in per day green and dry fodder productivity. Oat genotype UPO-212 had 4.5, 9.5 and 29.3% higher green fodder yield than OL-1882, RO-19 and HF-707 entries, respectively. The higher green fodder yields were mainly contributed by cumulative effect of more number of tillers and plant height. [9] reported significantly higher green and dry fodder yield in oat variety Palampur-1 followed by Kent and significantly lowest in JHO-882 mainly due to variation in genetic potentials of oat varieties. [7] also found significant yield variation among oat varieties in Pantnagar agro-climatic conditions. The CP content was found highest in UPO-212 followed by RO-19 and the lowest in HF-707. The CP yield was recorded significantly higher in UPO-212 followed by OL-1882, RO-19 and HF-707, respectively. The crude protein yield was 16.7, 17.8 and 45.8% greater than OL-1882, RO-19 and HF-707, respectively. The higher crude protein yield was attributed to more dry matter yield and crude protein content. [8] revealed that higher crude protein content and crude protein yield increased with increasing level of nitrogen application.

Effect of N levels

The growth attributes, fodder yield and crude protein yield increased with increasing level of nitrogen (Table 1). Tallest plants as well as number of tillers/m row length were recorded at application of 140 kg N/ha. Plant height was most responsive to nitrogen application and each successive increase in nitrogen dose significantly produced taller plants. These findings are in line with the results [2,4]. The L:S ratio increased with N levels and the highest values were observed at 140 kg N level. The green and dry fodder yield as well as it's per day productivity were also increased with increasing N levels and significantly highest values were recorded at 140 kg N/ha. The higher green and dry fodder yield at higher nitrogen levels was attributed to the better growth of plants as expressed in terms of plant height, number of tillers and higher L:S ratio. Higher green and dry fodder yields were reported at application of higher nitrogen [4,9]. The per day productivity of green and dry fodder yield was also recorded highest at higher dose of nitrogen i.e. 140 kg N/ha mainly due to higher green and dry fodder yield. The crude protein content and crude protein yield were also found significantly highest at 140 kg N levels followed by 105 kg N/ha. [5] reported that the crude protein content and its yield increased from 40 to 120 kg N/ha and these results were supported by [8,9]. The higher values were caused to higher crude protein content and dry matter production. The interaction effect was found non significant.

Treatment	Pl ht (cm)	No of tillers/m row length	L:S ratio	Green fodder yield (q/ha)	Dry fodder yield (q/ha)	Green fodder productivity (q/ha/day)	Dry fodder productivity (q/ha/day)	CP (%)	CP production (q/ha)
Genotypes									
HF-707	92	108	0.78	422.2	57.5	2.99	0.41	9.13	5.26
RO-19	92	90	0.91	498.9	64.7	3.54	0.46	10.02	6.51
OL-1888	86	107	0.86	522.5	69.7	3.71	0.49	9.33	6.57
UPO-212	85	108	0.84	546.1	75.9	3.87	0.54	10.09	7.67
SEm±	1.6	03	0.03	16.4	2.3	0.12	0.02	0.02	0.23
LCD (0.05)	05	10	NS	48.5	6.9	0.34	0.05	0.34	0.68
Nitrogen levels (kg/ha)									
70	82	90	0.80	440.1	60.0	3.12	0.43	8.96	5.38
105	89	104	0.84	497.8	66.6	3.53	0.47	9.73	6.50
140	94	114	0.90	554.5	74.3	3.93	0.53	10.24	7.62
SEm±	1.4	03	0.013	14.2	2.0	0.10	0.02	0.10	0.20
LCD (0.05)	04	09	0.4	42.0	6.0	0.30	0.04	0.30	0.59
Interaction	NS	NS	NS	NS	NS	NS	NS	S	NS
Factor (B) at same level of A									
SEm±	4.57	7.77	-	46.17	6.86	2.03	0.02	0.22	0.64
LSD (0.0.5)	NS	NS	-	NS	NS	5.99	0.04	0.62	NS
Factor (A) at same level of B									
SEm±	2.93	5.98	-	30.33	4.36	4.06	0.03	0.20	0.42
LSD (0.0.5)	NS	NS	-	NS	NS	NS	NS	0.65	NS

Table 1: Effect of nitrogen levels on growth, yield and quality of multi cut oat genotypes.

Conclusion

Based on above experimental results, among multi cut oat genotype, UPO-212 had the highest green and dry fodder yield and also crude protein production. Similarly the nitrogen dose @140 kg/ha produced highest green and dry fodder as well as crude protein. Therefore, it may be recommended that genotype UPO-212 may be grown with application of 140 kg N/ha for higher productivity and quality of multicut forage oat in Tarai region of Uttarakhand and be replicated in similar agro-climatic regions of India.

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