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RESPONSE OF MULTI CUT OAT ENTRIES TO DIFFERENT NITROGEN LEVELS

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SUMMARY

An experiment was carried out during *rabi* season, 2019-20 at Forage Research Farm Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar (Haryana) to access the performance of promising entries of multi cut oat to different levels of nitrogen. The experiment was conducted in split plot design with 16 treatments combinations *viz*., four promising entries (Two entries *i.e*., OL-1874 and JO-05-304 along with two National checks *i.e*., UPO-212 and RO-19 of multi cut fodder oat in main plot and four nitrogen levels (35, 70, 105 and 140 kg N/ha) in sub plot with three replications. Results revealed that growth parameters, green fodder and dry matter yield were recorded highest with entry UPO-212. However, highest crude protein content was recorded with entry OL-1874 (9.18%) which was significantly higher than all other entries. Maximum net returns and B: C were fetched with entry UPO-212 followed by RO-19 and OL-1874. Growth parameters, green fodder and dry matter yield were recorded highest with 140 kg N/ha which were statistically at par with 105 kg N/ha. Furthermore, crude protein content (9.41%) and crude protein yield (14.08 q/ha) were also recorded highest with 140 kg N/ha which were statistically at par with 105 kg N/ha. Maximum net returns (19263 Rs/ha) and B: C (1.41) were recorded with 140 kg N/ha followed by 105 kg N/ha.

Key words: Multi cut, Oat, Entries, Green fodder, Crude protein, Nitrogen levels

India faces a net deficit of 35.6% green fodder, 11.0% dry crop residues and 44.0% feeds (IGFRI Vision-2050). The availability of nourishing fodder is a prerequisite for the development of any dairy sector (Surje *et al*., 2015). In 2022, India had approximately an inventory of 308 million cattle. India had the highest cattle population that year, followed by Brazil, China, and the United States, while the global cattle population was over one billion (Anonymous, 2023). Livestock is a key source of income, supporting two thirds of the rural community and employing 8.8% of the workforce. Despite the enormous number of bovines, milk productivity in India is much below average of the world. Malnutrition, under nutrition or combination of both in animals, along with poor genetic potential is also a major concern for poor productivity. Limited access to high-quality feed is the dairy industries most pervasive and ongoing challenge, particularly during the very long dry season (Nagora *et al*., 2022).

Oat (*Avena sativa* L.) is an important cereal and forage crop grown during the *rabi* season, with nutritive value comparable to berseem (Patel *et al.,* 2021). The green fodder of oat (*Avena sativa* L.) is a highly succulent, palatable and nutritious with 10-11.5% crude protein, 55-64% neutral detergent fibre (NDF), 30-32% acid detergent fibre (ADF), 22-23% cellulose, and 17-20% hemicelluloses and 60-65% digestibility when harvesting at 50% flowering stage (Sterna *et al*., 2016). Taking one cut for fodder and grain production from re-growth, improves the economics of multi-cut fodder oats cultivation (Devi *et al*., 2014). Extended dry seasons, degraded soils, a lack of or insufficient adoption of optimum management practices like irrigation and fertilization, as well as a lack of seed for improved cultivars etc. are a variety of factors to the scarcity of high-quality feed. Due to competition from more lucrative crops like wheat, it is not possible to expand the area planted with fodder crops. The only solution is to develop multi-cut cultivars that provide higher tonnage per unit area and per unit time (Poonia *et al*., 2018). The growth and yield potential of any crop is dependent on its genotype to a large extent. Thus, it is important to identify promising cultivars.

The ever-rising demand for fodder and feed for sustaining livestock production can be fulfilled through increasing productivity of fodder. Among these, optimum fertilization especially that of nitrogen is one of the most critical factors deciding the fodder yield. Nitrogen is used extensively by all crops, but particularly by non-legumes nitrogen is required in large quantity. Through its effects on cell elongation, cell division, and inter-nodal expansion, nitrogen plays a critical function in the growth of fodder. It also plays a significant role in the early establishment of the crop. By facilitating the production of enzymes and chlorophyll, nitrogen helps to increase leaf area and weight. By enhancing growth factors such plant height, number of tillers, leaf area index, number of leaves, leaf: stem, and accumulation of dry matter, nitrogen increases the output of fodder (Kumar *et al.*, 2017). Apart from its various functions, nitrogen is a key component of both the protein and chlorophyll found in green plants (Patel *et al.*, 2021). According to some sources, the best single indicator of forage digestibility is the nitrogen concentration of the fodder. Because the crop consumes nitrogen in such huge amounts, it has essential role to play in fodder production. High photosynthetic activity, vigorous growth, and a dark green colour of the fodder are associated with an adequate nitrogen supply and is also known to help in carbohydrate utilization and enhancing fodder succulence. However, a larger amount of nitrogen can cause lodging of crop and may produce nitrate toxicity in animals (Devi *et al.*, 2019). Hence, the present investigation was carried out to examine the performance of different promising entries of multi-cut oat with different nitrogen levels.

MATERIALS AND METHODS

This experiment was carried out during *rabi*, 2019-20 at the Forage Section Research Farm of CCS HAU, Hisar (Haryana), India. The research farm is positioned at 29°10' N latitude, 75°46' E longitude, and has an average elevation of 215.2 m above mean sea level. The research site had a semi-arid, sub-tropical climate, characterized by hot and dry summers, and harsh cold winters. The area receives an average annual rainfall of approximately 450 mm, with 75% of the total precipitation occurring during the South-West monsoon from July to September. Fig. 1 illustrates the weekly weather conditions, including temperature (°C), relative humidity (%) and rainfall (mm) throughout the crop period. The soil in the experimental field was a sandy loam with a reaction pH of 7.9, a low available nitrogen content (165.9 kg/ha), a medium available phosphorus content (12.4 kg/ha) and

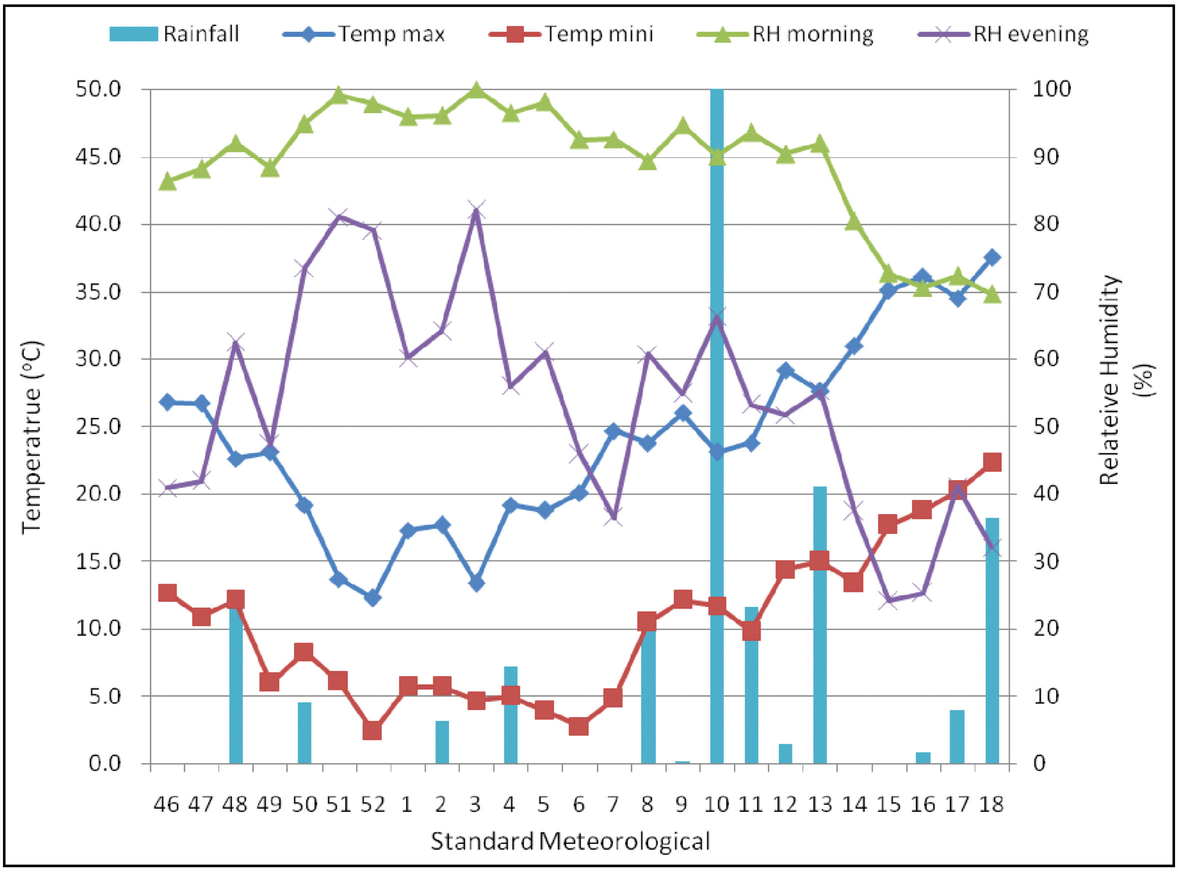

Fig. 1. Weekly weather parameters during *rabi* 2019-20 at the experimental site.

potassium content (241.7 kg/ha). The study was performed in a split-plot design consisted of 16 treatment combinations *viz*., four promising entries (Two test entries *i.e*., OL-1874 and JO-05-304 along with two National checks i.e., UPO-212 and RO-19 of multi cut fodder oat in main plot and four nitrogen levels (35, 70, 105, and 140 kg N/ha) in sub plot with three replications. Oat new genotypes were manually sown on November 15, 2019 in furrows that were spaced 25 cm apart, using a seed rate of 100 kg/ha. Standard package practices were consistently followed for oat cultivation across all treatments. The 1st cut was taken 68 days after sowing on January 22, 2020 and the subsequent 2nd cut at 50% flowering, and the green fodder from each plot was weighed in kg/plot and then converted to q/ha. A 500 g sample was collected from each plot during harvest, chopped, and placed in paper bags that were aerated by making small holes. The samples were sun-dried for 15 days and then dried in an electric hot air oven at a temperature of 60±5°C until they reached a constant weight. The green fodder yield was then converted into dry matter yield (q/ha). The crude protein content was estimated by multiplying the nitrogen content with 5.83 by the conventional micro-Kjeldahl method (AOAC, 1995) in dried and ground samples (2 mm sieve size) collected at 50% flowering stage. The crude protein yield was calculated by multiplying the crude protein content with the dry matter yield (q/ha). The local market's prevailing input and product prices were used to calculate economics. The trial data were analyzed by using OPSTAT software which is available on CCS Haryana Agricultural University official site (Sheoran *et al*., 1998).

RESULTS AND DISCUSSION

Effect of Genotypes: Data presented in Table 1 revealed that among the entries, no significant differences were observed for green fodder and dry fodder yield, however maximum values were recorded with entry UPO-212 *i.e*., 428.7q/ha and 140.7q/ha, respectively. Maximum crude protein content (9.18%) was estimated with OL-1874 which was significantly higher than all other entries, whereas crude protein yield was not influenced significantly by different entries. The plant height at harvest was recorded numerically highest in UPO-212 (116.5 cm). Similarly, per day productivity (q/ha/day) of green fodder (3.54) and dry fodder (1.16) were found numerically highest in UPO-212. The numbers of tillers per meter row length and leaf to stem ratio did not differ significantly among different entries, although were observed highest in UPO-212. Economic analysis presented in Table 2 revealed that maximum net returns (17648 Rs/ha) and B: C (1.38) were fetched with entry UPO-212 followed by RO-19 and OL-1874.

Effect of Nitrogen Levels: Data presented in Table 1 revealed that the maximum plant height at harvest (119.5 cm) was recorded with the application of 140 kg N/ha which was statistically at par with 105 kg N/ha. Among nitrogen levels, the maximum green fodder (443.6 q/ha) and dry matter (149.6 q/ha) yield were recorded with 140 kg N/ha which were significantly higher than lower levels but statistically at par with 105 kg N/ha. Maximum number of tillers (53.8) per meter row length were recorded with 140 kg N/ha which were at par with 105 kg N/ha but significantly superior over 35 kg N/ha and 70 kg N/ha. The application of 140 kg N/ha increased the green fodder yield and dry fodder yield by 68.3 q/ha and 31 q/ha, respectively over application of 35 kg N/ha. Per day productivity of green fodder (3.67 q/ha/day) and dry fodder (1.24 q/ha/day) were also maximum with the application of 140 kg N/ha which were statistically at par with 105 kg N/ha but significantly superior over 35 kg N/ha and 70 kg N/ha. Islam *et al*. (2020) reported that nitrogen application increased the growth and yield of oat significantly. The results revealed that growth parameters and straw yield were found superior with 105 kg ha/N application whereas yield parameters and grain yield were obtained better with 90 kg N/ha application. Godara *et al*. (2016) also reported that compared to lesser nitrogen dosages, the application of 120 kg nitrogen/ha resulted in considerably higher yield of both green and dry fodder.

In this study, maximum crude protein yield (14.08 q/ha) and crude protein content (9.41%) were estimated with the application of 140 kg N/ha. Enhancement in protein content with increase in nitrogen levels were also reported in previous studies by Kumar *et al.* (2023), Saklani and Pal (2022) and Kumar *et al.* (2021). As nitrogen aids in the production of amino acids and proteins in plants, nitrogen application improved the protein level in oat (Sheoran *et al*., 2017). The crude protein yield with the application of 140 kg N/ha was significantly superior over all the other nitrogen doses while crude protein content maximum with the application of 140 kg N/ha which was statistically at par with 105 kg N/ha but significantly superior over 35 kg N/ha and 70 kg N/

TABLE 1
Growth, quality parameters and productivity of oat entries as influenced by nitrogen levels

Treatments	Plant height at harvest (cm)	No. of tillers/ m row length	Leaf stem ratio	Per day productivity (q/ha/day)		Green fodder yield (q/ha)	Dry fodder yield (q/ha)	Crude protein content (%)	Crude protein yield (q/ha)
				Green fodder	Dry fodder				
Entries									
OL-1874	111.4	47.0	0.36	3.36	1.10	406.5	133.4	9.18	12.28
UPO-212 (NC)	116.5	54.3	0.40	3.54	1.16	428.7	140.7	8.90	12.56
JO-05-304	107.7	44.4	0.35	3.29	1.08	398.8	130.1	8.87	11.62
RO-19 (NC)	112.2	48.2	0.37	3.38	1.11	408.4	134.4	8.82	11.93
SEm (±)	2.7	1.9	0.01	0.08	0.03	9.7	3.4	0.07	0.29
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	0.24	NS
Nitrogen levels (kg/ha)									
35	103.3	42.6	0.29	3.10	0.98	375.3	118.6	8.40	9.96
70	110.0	46.8	0.35	3.30	1.07	398.9	129.7	8.80	11.45
105	115.0	50.7	0.40	3.51	1.16	424.5	140.7	9.17	12.90
140	119.5	53.8	0.43	3.67	1.24	443.6	149.6	9.41	14.08
SEm (±)	1.6	1.2	0.01	0.06	0.03	7.1	3.5	0.12	0.35
CD (P=0.05)	4.8	3.4	0.03	0.17	0.09	20.7	10.3	0.36	1.01
Factor (B) at same level of A									
SEm (±)	5.5	3.9	0.03	0.16	0.06	19.3	6.9	0.14	0.59
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Factor (A) at same level of B									
SEm (±)	3.9	2.8	0.02	0.13	0.06	15.6	7.0	0.22	0.67
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

ha. The application of 140 kg N/ha gave highest leaf to stem ratio (0.43) that was statistically at par with 120 kg N/ha. Economic analysis presented in Table 2 revealed that among nitrogen levels, maximum net returns (19263 Rs/ha) and B: C (1.41) were recorded with 140 kg N/ha followed by 105 kg N/ha. Patel *et al.* (2022) at Sardar Kushinagar (Gujarat) reported significantly higher green fodder yield, crude protein, fibre content, crude protein yield and economic at returns with the application of 140 kg N/ha 65 days after cutting of forage oat. Pal and Jain (2022) observed that growth and fodder yield of multicut oat increased with increasing N dose upto 150 kg/ha.

TABLE 2
Economics of oat promising entries as affected by nitrogen levels

Treatment	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B: C
Entries				
OL-1874	46650	60980	14330	1.31
UPO-212 (NC)	46650	64298	17648	1.38
JO-05-304	46650	59813	13163	1.28
RO-19 (NC)	46650	61255	14605	1.31
Nitrogen levels (kg/ha)				
35	46020	56291	10271	1.22
70	46440	59830	13390	1.29
105	46860	63681	16821	1.36
140	47280	66543	19263	1.41

CONCLUSION

Entry UPO-212 performed best in respect of green fodder, dry matter yield and monetary returns, whereas OL-1874 for crude protein content. Application of 140 kg N/ha was best in case of green fodder yield, dry matter yield, crude protein content, crude protein yield and monetary returns which was on a par with 105 kg N/ha.

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