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RESPONSE OF PROMISING ENTRIES OF SINGLE CUT FODDER OAT TO DIFFERENT NITROGEN LEVELS

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SUMMARY

An experiment was conducted during *rabi* season, 2018-19 at Forage Research Farm Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar (Haryana) to study the effect of N levels on yield and quality of promising entries of oat. The experiment consisted of 40 treatment combinations *viz.*, 10 promising entries (Seven entries *i.e.* SKO-229, HFO-607, HFO-525, JO-05-7, OL-1869-1, OL-1861, OL-1862 + 2 national checks *i.e.* Kent and OS-6 + 1 zonal Check *i.e.* OL-125 (North West Zone) of single cut fodder oat and four nitrogen levels (30, 60, 90, and 120 kg N/ha). Results showed that growth parameters, green fodder and dry matter yield were recorded highest with entry JO-05-7. However, crude protein content was recorded highest with entry HFO 607 and OL-125 (9.42 %) which was statistically at par with JO-05-7. While, crude protein yield was recorded highest with entry JO-05-7 (16.6 q/ha) which was significantly higher than rest of entries. Maximum net returns and B: C ratio was fetched with entry JO-05-7 followed by OL-1861. Growth parameters, green fodder and dry matter yield were recorded highest with 120 kg N/ha which were statistically at par with 90 kg N/ha. Furthermore, crude protein content and crude protein yield were also recorded highest with 120 kg N/ha (9.08 % and 14.1 q/ha, respectively) which were statistically at par with 90 kg N/ha. Maximum net returns and B: C ratio was recorded with 120 kg N/ha followed by lower levels of nitrogen.

Key words : Single cut, Oat, Entries, Fodder, Nitrogen levels

India top in rank among ten milk producing countries in the world and produced 187.7 million tonnes of milk in 2018-19 (Basic Animal Husbandry Statistics, 2019) not owing to efficiency of milch animal but due to involvement of very large number of livestock population with low milking potential as compared to other many western countries in the world. Malnutrition, under nutrition or combination of both in animals, along with poor genetic potential is also a major factor for poor productivity. India faces a net deficit of 35.6 per cent green fodder, 11.0 per cent dry crop residues and 44.0 per cent feeds (IGFRI Vision-2050). The ever-rising demand for fodder and feed for sustaining livestock production can be met through increasing productivity of fodder. The adequate availability of quality fodder and feed with better nutritive composition is a decisive factor controlling the productivity and so on the overall performance of the livestock. Inadequate and poor nutritional quality of fodder and feed is the most important cause of low milk productivity. India is lacking in availability of quality green fodder, dry fodder and other concentrates. The scope of availability of quality fodder from different sources *viz.,* cultivable land, forest area, pastures and grazing lands will fix the growth and development of livestock in near future. Among different *rabi* annual, fodder oat is energy rich crop having good regeneration ability with high dry matter content (Kumar *et al*., 2010). In India, it is mainly grown in Haryana, Punjab, Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Rajasthan, Maharashtra, West Bengal and Gujarat where irrigation facilities are available (Joshi *et al.,* 2015). It is used for preparation of hay, silage and also as concentrate feed grain. It is the most important cereal fodder crop suitable for Haryana region having crude protein content 10 to 14 percent. Furthermore, its wider adaptability, quick growing nature, high yielding potential, palatable as well as nutritious value liked by variety of animal. Being succulent cereal, oat both as fodder and grain is a good source of protein, carbohydrate, fibre, minerals and slightly less fats and protein. Although the vegetative growth of any crop is largely dependent upon the genotype potential, nutrient management, ability of the soil to supply the nutrients to the crop and capacity of the plants to take and use the nutrients in unit time. The most important constraint in the fodder production and productivity is the non availability of improved genotypes of forage crops to the farmers. Oat, single as well as multi-cut in nature is also highly responsive to fertilizers specially nitrogen, having good source of macro (N, P, K, Ca, Mg and S) as well as micro (Fe, Mn, Cu, B, Co, Cl, Na etc.) nutrients. Among all the primary nutrients, nitrogen plays a pivotal role in quantitative as well as qualitative improvement in the productivity of the fodder crop. It is an important constituent of protein and chlorophyll. It imparts dark green colour to the plants, promotes vegetative growth and rapid early growth. It improves the quality by increasing the protein content of fodder crops and governs to a considerable degree, the utilization of potassium, phosphorus and other essential nutrient elements (Patel *et al.,* 2007). Almost all the soils of Haryana are deficient in nitrogen and if the required amount of nitrogen of any crop is not supplied in sufficient amount then the deficiency of nitrogen is reflected in the fodder. Since nitrogen is a constituent of amino acid and deficiency of nitrogen in grain and straw of the cereals as well in the fodder crops may cause severe disorders in animals and human beings (Midha *et al*., 2015). The poor yield of oat crop in our country is mainly ascribed to low fertility of soil, inadequate manuring and cultural practices. Our soils have exhausted in respect of major and minor elements hampering the yield of crops. The new varieties of the crop require higher amounts of nutrients for realizing their inherent yield potential. Proper and optimum application of fertilizers not only increases the yield but also favourably affects the quality of the produce. All the crops in general and non-legumes in particular use nitrogen in large quantity. Nitrogen content of the fodder has been said to be the best single index for forage digestibility. However, higher dose of nitrogen leads to 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 known to help in carbohydrate utilization and increasing succulence of the fodder. Therefore, it is essential to find out the optimum dose of nitrogen for fetching good yield of newly tested oat entries. Keeping the above stated aspect in the view, the present investigation was undertaken to study the performance of different promising genotypes of oat with different nitrogen levels.

MATERIALS AND METHODS

A field experiment was conducted during rabi season of 2018-19 at Forage Section Research Farm of CCS Haryana Agricultural University, Hisar (Haryana), India (29°10' N of 75°46' E, at an average elevation of 215.2 m above mean sea level). The site has semi-arid and sub-tropical climate with hot dry summers and severe cold winters. Average annual rainfall is about 450 mm, 75 per cent of which is received in three months, from July to September during south-west monsoon. July and August are the wettest months. The crop received 96.6 mm rainfall during crop season. The soil of the experimental field was sandy loam in texture, slightly alkaline in reaction (pH 8.1), low in available nitrogen (165.2 kg/ha), medium in available phosphorus (12.8 kg/ ha) and potassium (242.5 kg/ha). The weekly weather data during the crop season has been depicted in Fig. 1. The experiment was laid out in split plot design with three replications. The main plot consisted of 10 different oat entries [(7 entries *i.e.* SKO-229, HFO-607, HFO-525, JO-05-7, OL-1869-1, OL-1861, OL-1862 + 2 national checks *i.e.* Kent and OS-6 + 1 zonal Check *i.e.* OL-125 (North West Zone)] of single cut fodder oat, whereas sub-plot had four nitrogen levels (30, 60, 90, and 120 kg N/ha).The oat genotypes as per treatment were sown manually on 27 November 2018 in opened furrows at 25 cm apart using the seed rate of 100 kg/ha. All the other standard agronomic practices for the cultivation of oat were followed uniformly in all the treatments. All the genotypes were harvested just after 50 per cent flowering. The harvested green fodder from each plot was weighed in situ in kg/plot and then converted into q/ha. A random sample of 500 g was taken from each plot at

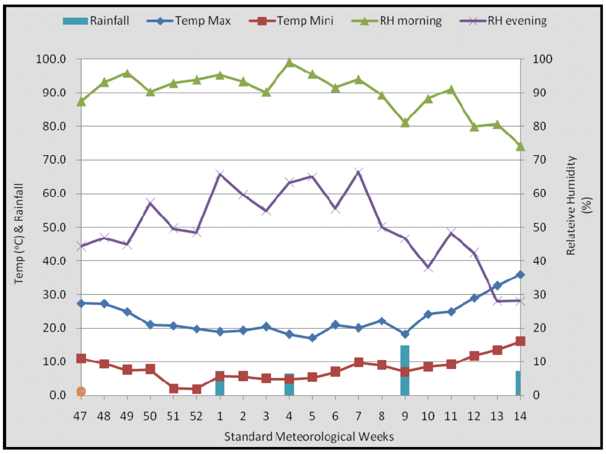

Fig. 1. Weekly weather parameters during the crop season (2018-19).

the time of green fodder at harvest, chopped well and put into paper bag. These bags were aerated by making small holes all over. The samples were first dried in the sun for 15 days and then transferred in an electric hot air oven for drying at a temperature of 60±5°C till constant weight was achieved. On the basis of these samples, the green fodder yield was converted into dry matter yield (q/ha). Crude protein content (%) was estimated in dried and grinded samples (2 mm sieve size), collected at 50 per cent flowering stage. The crude protein content was calculated by multiplying the nitrogen percentage with 5.83 by conventional micro-kjeldal method (AOAC, 1995). Crude protein yield was calculated by the multiplication of crude protein content with dry matter yield (q/ha). Economics was worked out on the basis of prevailing market prices of inputs and outputs in the local market. The experimental data were analyzed by using OPSTAT software available on CCS Haryana Agricultural University home page (Sheoran *et al.,* 1998). The results were presented at 5 per cent level of significance (P=0.05) for making comparison between treatments.

RESULTS AND DISCUSSION

Effect of entries : Data presented in Table 1 revealed that maximum plant height (151.6 cm) was recorded with entry JO-05-7 which was statistically at par with entry OL-1869-1 and OL-1861. However, lowest plant height (114.8 cm) was recorded with entry SKO-229. The maximum number of tillers/m row length (70.9) was recorded with entry JO-05-7 which was statistically at par with entry OL-1869-1 and OL-1861. Whereas, lowest number of tillers/m row length (59.2) was recorded with entry SKO-229. The leaf: stem (L: S) ratio was also measured highest with entry JO-05-7 which was statistically at par with entry OL-1869-1 and OL-1861. The highest per day productivity of green fodder (5.29 q/ha/day) and dry matter (1.45 q/ha/day) was also recorded with entry JO-05-7 which was statistically at par with entry OL-1869-1 and OL-1861. Similarly, the highest green fodder and dry matter yield of oat were recorded with entry JO-05-7 (640.5 q/ha and 176.0 q/ha, respectively) which were significantly higher than other entries except OL-1869-1 and OL-1861. Highest crude protein content (9.42 %) was recorded with entry HFO 607 and OL-125 which was significantly higher than other entries except JO-05-7. While, crude protein yield was recorded highest with entry JO-05-7 (16.6 q/ha) which was significantly higher than rest of entries (Table 2). Economic analysis given in Table 3 revealed that highest net returns (49533 Rs/ha) and B: C ratio

TABLE 1

Growth parameters and productivity of oat as affected by nitrogen levels and promising entries

Treatments	Plant height at harvest (cm)	Tiller numbers/ mrl	L : S ratio	Per day productivity (q/ha)		Green fodder yield (q/ha)	Dry matter yield (q/ha)
				Green fodder	Dry Matter		
Entries-10							
SKO-229	114.8	59.2	0.286	3.27	0.97	395.6	117.2
HFO-607	142.3	68.4	0.422	4.42	1.27	535.1	153.3
HFO-525	141.1	68.3	0.406	4.11	1.16	497.4	140.5
JO-05-7	151.6	70.9	0.538	5.29	1.45	640.5	176.0
OL-1869-1	145.7	69.5	0.460	4.84	1.38	585.4	166.8
OL-1861	148.1	70.0	0.475	4.87	1.39	589.4	168.1
OL-1862	137.5	67.6	0.403	4.08	1.11	493.5	133.7
Kent	125.2	66.3	0.343	3.95	1.07	477.6	130.0
OS-6	120.9	66.3	0.317	3.63	1.02	439.0	124.0
OL-125	127.7	67.0	0.395	3.98	1.09	482.1	131.5
S. Em±	3.03	0.76	0.034	0.23	0.04	27.2	5.36
C. D. (P=0.05)	9.06	2.27	0.102	0.67	0.13	81.5	16.1
Nitrogen levels- 4 (kg N/ha)							
30	126.5	61.8	0.323	3.64	1.04	440.8	125.3
60	134.4	66.9	0.395	4.11	1.19	497.5	143.4
90	139.8	69.9	0.445	4.56	1.26	552.2	152.5
120	141.2	70.7	0.454	4.66	1.28	563.6	155.3
S. Em±	1.72	1.05	0.017	0.11	0.02	13.4	2.74
C. D. (P=0.05)	4.87	2.98	0.048	0.32	0.06	38.1	7.77

(2.62) was fetched with entry JO-05-7 followed by OL-1861.

Effect of nitrogen levels : Data presented in table 1 revealed that maximum plant height (141.2 cm) was recorded with the application of 120 kg N/ ha which was statistically at par with 90 kg N/ha. The maximum number of tillers/m row length (70.7) was also recorded with the application of 120 kg N/ha which was statistically at par with 90 kg N/ha. Similarly, the highest leaf: stem (L: S) ratio was also measured with the application of 120 kg N/ha which was statistically at par with 90 kg N/ha. The highest per day productivity of green fodder (4.66 q/ha/day) and dry matter (1.28 q/ha/day) was also recorded with 120 kg N/ha which was statistically at par with 90 kg N/ha. As nitrogen is an important constituent of protein and chlorophyll. It imparts dark green colour to the plants, promotes vegetative growth and rapid early growth (Godara *et al.,* 2016). This will leads to better crop growth with increase in levels of nitrogen. Sheoran *et al.* (2017) revealed that number of tillers/m row length were influenced significantly with increasing levels of nitrogen from 40 to 120 kg/ha, whereas plant height was increased up to 80 kg N/ha only.

Likewise, green fodder and dry matter yield were recorded highest with the application of 120 kg N/ha (563.6 q/ha and 155.3 q/ha, respectively) which were significantly higher than lower levels but at par with 90 kg N/ha (Table 1). As nitrogen is one of the most important nutrient it occupies prominent role in plant metabolism. It increase physiological indices by improving leaf production and expansion rate that ultimately achieve more interception of photo synthetically active radiation and consequently more total biomass accumulation (Kumar *et al.*, 2017). The application of 90 kg N/ha significantly increased the green fodder and dry matter yield (440.8 to 552.2 q/ ha and 125.3 to 152.5 q/ha, respectively) over 30 kg N/ha. Midha *et al.* (2015) reveled that the application of 80 kg N/ha significantly increased the green fodder and dry matter yield from 253.4 to 360.5 q/ha and 52.8 to 73.5 q/ha over the treatment 40 kg N/ha. These results are conformity with the results of Uma *et al.* (2019), Satpal *et al.* (2018), Kumar *et al.* (2017), Dabhi *et al.* (2017) and Godara *et al.* (2016).

Crude protein content and crude protein yield were recorded highest with 120 kg N/ha (9.08 % and 14.1 q/ha, respectively) which were significantly higher than lower levels but statistically at par with 90 kg N/ha (Table 2). Protein content was increased with increased in amount of nitrogen application and this may be ascribed due to synthesis of amino acid and protein in plant. Higher crude protein at 120 kg N/ha was attributed to higher uptake of nitrogen which is constituent of amino acids and protein. Godara *et al.* (2016), Midha *et al.* (2015) and Jat *et al.* (2014) also

TABLE 3

Economics of oat as affected by nitrogen levels and promising entries

Treatment	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B : C ratio
Entries-10				
SKO-229	30532	49444	18912	1.62
HFO-607	30532	66892	36360	2.19
HFO-525	30532	62169	31637	2.04
JO-05-7	30532	80065	49533	2.62
OL-1869-1	30532	73179	42647	2.40
OL-1861	30532	73670	43138	2.41
OL-1862	30532	61684	31152	2.02
Kent	30532	59695	29163	1.96
OS-6	30532	54870	24338	1.80
OL-125	30532	60259	29727	1.97
Nitrogen levels- 4 (kg N /ha)				
30	29992	55104	25112	1.84
60	30352	62193	31841	2.05
90	30712	69026	38314	2.25
120	31070	70448	39378	2.27

TABLE 2

Quality of oat as affected by nitrogen levels and promising entries

Treatment	Crude protein Content (%)	Crude protein Yield (q/ha)
Entries-10		
SKO-229	9.06	10.7
HFO-607	9.42	14.5
HFO-525	8.57	12.0
JO-05-7	9.38	16.6
OL-1869-1	8.52	14.3
OL-1861	8.80	14.8
OL-1862	8.75	11.7
Kent	8.73	11.4
OS-6	8.82	10.9
OL-125	9.42	12.4
S. Em±	0.10	0.55
C. D. (P=0.05)	0.29	1.63
Nitrogen levels- 4 (kg/N/ha)		
30	8.81	11.0
60	8.88	12.7
90	9.01	13.8
120	9.08	14.1
S. Em±	0.05	0.27
C. D. (P=0.05)	0.13	0.77

reported improvement in protein content with increase in nitrogen levels. The increase in crude protein yield was owing to increase in protein content as well as dry matter yield of crop since the protein yield proportionally increased with the increase in dry matter yield. Moreover, maximum net returns (39378 Rs/ha) and B: C ratio (2.27) was also recorded with the application of 120 kg N/ha followed by the lower levels of nitrogen application (Table 3).

CONCLUSION

Entry JO-05-7 performed best in terms of green fodder, dry matter, crude protein yield, net returns and B: C ratio. In case of nitrogen levels, 90 kg/ha is sufficient to provide higher green fodder, dry matter, crude protein content and crude protein yield.

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