Forage Res., **48**(3) : pp. 372-374 (2022) **http://forageresearch.in**

FORAGE YIELD AND QUALITY OF SINGLE CUT FODDER OATS (*AVENA SATIVA* L.) UNDER DIFFERENT NITROGEN LEVELS IN CHHATTISGARH PLAINS

SUMAN KASHYAP[1,*], S. K. JHA[2], N. PANDEY[3] AND MORAJDHWAJ CHANDRAVANSHI[4]

[1]M.Sc. Student, Department of Agronomy, IGKV, Raipur-492 012 (Chhattisgarh), India
[2]Senior Scientist, Department of Agronomy, IGKV, Raipur-492 012 (Chhattisgarh), India
[3]Professor, Department of Agronomy, IGKV, Raipur-492 012 (Chhattisgarh), India
[4]M. Sc. Student, Department of Agronomy, Btccars, Bilaspur, IGKV, Raipur-492 012 (Chhattisgarh), India
Indira Gandhi Agriculture University, Raipur-492 012 (Chhattisgarh), India
**(e-mail : sumankashyap0212@gmail.com)*

(Received : 10 December 2022; Accepted : 27 December 2022)

SUMMARY

A field experiment was conducted to assess the performance of certain promising entries of fodder oats (*Avena sativa* L.) and different nitrogen levels on yield and quality under single cut system at Research cum Instructional Farm, I.G.K.V, Raipur in Chhattisgarh plains. The experiment consists with ten promising entries of oats viz. OL-1874-1 of PAU, Ludhiana; OL-1876-1 of PAU, Ludhiana; RO-11-1-3 of MPKV, Rahuri; JO-06-23 of JNKVV, Jabalpur; SKO-241 of SKUAST-K, Srinagar; RO-11-1-2 of MPKV, Rahuri; and HFO-806 of CCS HAU, Hisar; and at national check Kent, OS-6 and at zonal check RO-11-1 as a main plot and three nitrogen levels viz. 60, 90 and 120 kg N/ha as a sub plot treatment was laid out in split plot design with three replications. Among different promising entries of oats, OL-1874-1 recorded maximum forage yield (44.9 t/ha), dry fodder yield (9.43 t/ha), forage productivity (0.49 t/ha/day), dry fodder productivity (0.10 t/ha/day), crude protein yield (0.996 t/ha). On the other hand, SKO-241 which was found inferior with respect to grain yield attributes gave the highest content of fodder dry matter (25%). The highest crude protein content of 11.16% was obtained in RO-11-1. As regard to different nitrogen levels, forage yield (34.5 t/ha), dry fodder yield (7.62 t/ha), forage productivity (0.38 t/ha/day), dry fodder productivity (0.08 t/ha/day) and crude protein yield (0.85 t/ha), and crude protein content (11%) increased with 120 kg N/ha but the fodder dry matter showed almost similar performance at 60, 90 and 120 kg N/ha.

Key words : Crude protein, fodder oats, forage yield, nitrogen levels, quality

Globally, India has the largest livestock population with 520 million heads which represents about 15% of the total-herd. The present feed and fodder resources of the country can meet only 48% of the requirement with a vast deficit of 61.1% green fodder and 21.9% dry fodder (Kumar *et al.,* 2018). Hence, low grade roughages such as rice or wheat straw whose availability is easier are provided to cattle without being processed to boost their quality, and in Chhattisgarh state, this directly effects the animal's growth, development and milk production. As a result, providing good quality forages has become the need of the hour for better animal wealth and to fulfill ever increasing consumer demands and thus their production is the mainstay of the livestock industry (Kumar *et al.,* 2018). Oats, being an important *rabi* season fodder crop in India is widely grown for green fodder because of its luxuriant growth, good palatability, higher nutritious nature, fiber and minerals (Kumar *et al.,* 2021). When harvested at the 50% flowering level, oat contains 10.0-11.5% crude protein, 22.0-23.5% cellulose and 17-20% hemi-cellulose on dry matter basis. Many improved oats varieties have emerged in recent years with high yield capacity and the ability to produce both green fodder yield (40-60 t/ha) and can feed double the number of animals per unit area as against the traditional fodder crops. Fertilizer mainly nitrogen is one of the most effective methods for growing forage crop production and nutritional benefit. Oat responses well to nitrogen application, which gives plants their dark green colour and stimulates early vegetative development, among other things (Godara *et al.,* 2016). It raises the protein content, improving efficiency and chlorophyll of fodder crops. the higher nitrogen dose caused crop lodging and may also result in nitrate poisoning for animals. As a result, the appropriate supply of nitrogen to the oat in order to realize the genetic yield ability of newly evolved varieties. Thus, to obtain more fodder, a different single cut variety as well as their nitrogen requirements is needed to be introduced in "Eastern Plateau and Hills

Region" zone as Raipur of Chhattisgarh state falls in this seventh agro climatic zone of India.

MATERIALS AND METHODS

A field experiment was conducted in tropical part of India at Raipur during *rabi* season of 2020-21 at the Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). The average weekly temperature of the site in the summer season goes up to 35ºC and in the winter, at least up to 10ºC. During November to March, Evaporation ranged from 2.57 mm - 3.37 mm. while sunshine ranged from 2.7 to 7.3 hours. The soil of the field was clayey loam in texture with neutral pH, normal EC and low in available nitrogen, medium in available phosphorous and high in exchangeable potassium. Seven promising entries of oats belonging to different zones viz OL-1874-1, OL-1876-1 (PAU, Ludhiana); RO-11-1-3 (MPKV, Rahuri); JO-06-23 (JNKVV, Jabalpur); SKO-241 (SKUAST-K, Srinagar); RO-11-1-2 (MPKV, Rahuri); HFO-806 (CCS HAU, Hisar) were evaluated against two national checks Kent (PAU,Ludhiana); OS-6 (HAU, Hisar) and a zonal check RO-11-1 (MPKV, Rahuri). The trial was sown on 20th November, 2020 keeping a common seed rate of 100 kg/ha of each entry in rows 25 cm apart laid in split plot design with three replications. Fertilizer was applied as per recommended dose of fertilizers *i.e.* (60, 90 and 120 kg N) in the form of Urea, 40 kg P as SSP and 20 kg K as MOP. Full dose of P and K was applied as basal and nitrogen was given as per treatment. The gross plot size of 4×3 meter and net plot size 3.50 × 2.50 was used in this experiment. First irrigation was applied just after sowing the seeds to ensure proper germination. Second and third irrigations were applied at an intervals of 20 days, and last irrigation was applied at the initiation of flowering. Harvesting for green forage yield of different entries of oats were done manually with the help of sickles when the entries attained 50% flowering (07th Feb to 4th March 2021). To analyze Crude protein content of each plot, oven dried samples were grinded by grinder to make powder and then N content (%) were found out. Later, produced N content from each plot were converted into crude protein content (%) by multiplying with 6.25 factor. The experimental data statistically analyzed by using analysis of variance appropriate for Split plot design. The mean results were compared using the least significant difference (LSD) test at a 5% level of significance and whether the F-values were significant was determined (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Number of days to reach 50% flowering was recorded for individual plots is presented in Fig. 1. The days takens to 50 % flowering ranged from 80 in entry RO-11-1 and RO-11-1-3 to 105 in SKO-241. The earliness in entries from Rahauri could be due to their genetic constitution and their adaptability depending on the response to the existing environmental conditions (Fig. 1).

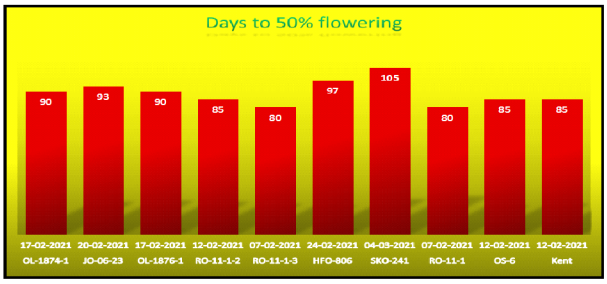

Fig. 1. Days to 50% flowering of oat genotypes

The performance of different promising entries of oat under different nitrogen levels with respect to forage yield, dry fodder yield, forage productivity and dry fodder productivity, crude protein yield and quality in terms of dry matter content and crude protein content is presented in Table 1. These yield related parameters varied significantly among different treatments of promising entries and nitrogen levels. Among different promising entries, yield attributes viz. forage yield, dry fodder yield, forage productivity, dry fodder productivity and crude protein yield (Table 1) were maximum for OL-1874-1 and the differences were found to be significant than all the entries including the national and zonal checks. The significantly highest fodder dry matter was observed in SKO-241 while the maximum crude protein content was observed in entry RO-11-1. The total fodder dry matter and crude protein content generally decreased with the advancement in the growing period and it could be due to the synthesis of structural carbohydrates with advancing plant age.

Nitrogen fertilization had significant effect on forage yield, dry fodder yield, forage productivity, dry fodder productivity and crude protein yield with 120 kg N/ha. Nitrogen is used largely in synthesis of protein, but structurally it is constitutent of chlorophyll molecule combined with the carbohydrate and fatty acids. It help in formation of protoplasm, which is physical base of life of plant. Thus, more production of dry fodder yield and productivity at 120 kg N/ha can be observed at higher rate. The highest dry fodder yield with higher nitrogen rates also reported by Midha *et al.* (2015).

TABLE 1
Yield and quality parameters of various promising entries of single cut fodder oat genotypes under different nitrogen levels

Treatment Genotypes	Forage yield (t/ha)	Dry fodder yield (t/ha)	Forage productivity (t/ha/day)	Dry fodder productivity (t/ha/day)	Crude protein yield (t/ha)	Dry matter content (%)	Crude protein content (%)
Promising entries							
OL-1874-1	44.9	9.43	0.499	0.105	0.996	21.00	10.53
JO-06-23	40.5	8.73	0.435	0.094	0.907	21.80	10.36
OL-1876-1	35.7	6.87	0.397	0.076	0.692	19.20	10.07
RO-11-1-2	30.7	6.71	0.361	0.079	0.704	22.10	10.45
RO-11-1-3	29.5	6.30	0.368	0.079	0.698	20.60	11.06
HFO-806	38.9	8.61	0.401	0.089	0.937	22.10	10.83
SKO-241	24.9	5.61	0.237	0.062	0.684	25.00	10.38
RO-11-1	29.4	6.23	0.368	0.078	0.696	22.40	11.16
OS-6	25.0	6.55	0.294	0.066	0.570	22.30	10.07
Kent	26.2	5.39	0.308	0.063	0.573	20.60	10.63
S. Em±	0.78	0.17	0.009	0.002	0.027	0.88	0.28
C. D. (P≤0.05)	2.32	0.51	0.026	0.006	0.081	2.62	0.83
Nitrogen levels (kg/ha)							
60	30.4	6.45	0.342	0.073	0.652	21.40	10.10
90	32.8	7.04	0.369	0.079	0.734	21.66	10.50
120	34.5	7.62	0.388	0.086	0.851	21.10	11.10
S. Em±	0.34	0.08	0.004	0.001	0.012	0.84	0.12
C. D. (P≤0.05)	0.97	0.24	0.010	0.003	0.035	NS	0.35

Note : kg/ha, kilogram per hectare; t/ha, tonne per hectare; t/ha/day, tonne per hectare per day; %, per-cent.

The increase in crude protein yield was due to increase protein content and dry fodder yield of oat crop because the protein yield proportionally increased with the increase in dry fodder yield of oat. Similar results were also observed by Godara *et al.* (2016).

Quality parameters *viz*. fodder dry matter showed almost similar performance at 60, 90 and 120 kg N/ha. Variation in nitrogen did not influence fodder dry matter content appreciably also reported by Roshan *et al.* (2012). The application of 120 kg N/ha recorded significantly higher crude protein content (11.10 %). This increase in crude protein content of forage oat could be attributed to increase in nitrogen content in plant along with increase in nitrogen rate which might have helped in synthesis of more protein as nitrogen being a constituent of various metabolites including protein and amino acids. Increase in crude protein content with increase in level of nitrogen in forage oat has been reported by Midha *et al.* (2015).

Thus, In the light of the above results obtained from the experiment, it can be concluded that, of the seven entries and the three checks of oats, OL-1874-1 from Punjab is the most suitable entry of single cut oats for higher forage yield and quality and it was very closely followed by JO-06-23 from Jabalpur for better palatability, productivity and nutritional quality under Chhattisgarh plain. Application of 120 kg N/ha significantly increased yield and quality parameters instance fodder dry matter.

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