Forage Res., **49**(4) : pp. 481-485 (2024) **http://forageresearch.in**

EFFECT OF DIFFERENT LEVELS AND FOLIAR APPLICATION OF NITROGEN ON OAT UNDER TRANSITIONAL PLAIN OF LUNI BASIN

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(Received : 10 March 2024; Accepted : 30 March 2024)

SUMMARY

The present study was carried out at Agricultural Research Station, Keshwana, Jalore during winter cycle 2018-19 and 2019-20 on "Effect of different levels and foliar application of nitrogen in oat under transitional plain of Luni basin". The soils of the experimental fields were loamy sandy in texture, alkaline in reaction, low in organic matter and nitrogen content and low to medium in Phosphorous medium to high in potassium content. The experiment used a split plot design with three treatment in main plot and three plot in sub plot repeated with three times. The experiment included three levels of nitrogen, namely 50 %, 75% and 100 % of recommended nitrogen i.e. F_1, F_2 and F_3 and 4 urea spray namely water spray, 2% urea spray at 15, 30 and 45 DAS was used. Application of nitrogen as a basal and foliar had a significant effect on the growth, green and dry fodder yields of the oat. Application of 100% RDN showed a significant higher results with respect to tillers per plant, plant height, CGR, RGR, Dry matter percentage during both the year of experiment but it was recorded at par with the 75% RDN during both the years. Green and dry fodder yields during 2018-19 were recorded significantly higher with the Application of 75% RDN, while in succeeding year it was recorded higher with 100% RDN. Foliar spray of urea 2% at 30 DAS recorded significant effect on the growth and yield parameters of the fodder oat but it was at par with the 45 DAS. Positive linear relationships were observed with respect to nitrogen application and green (R^2= 0.7826) and dry (R^2= 0.8019) fodder yields of oat.

Key words: Oat, fodder, nitrogen, growth and yield

India is home to 200 million cattle and 92 million buffalo, making it a sizable bovine population. This represents 19.5% of the world's cattle population. Despite the enormous number of cows, milk output and productivity are much below average for the world. Any dairy industry's success depends on the availability of nutrient-rich fodder (Surje *et al.,* 2015). According to the IGFRI Vision-2050 report, India has a net deficiency of 35.6% green fodder, 11% dry agricultural leftovers, and 44% feeds. The rising demand for fodder and feed to sustain livestock production can be met by increasing productivity of fodder. The availability of quality fodder and feed with better nutritive composition is a decisive factor that controls the productivity and overall performance of livestock. The nutritional composition of fodder and feed directly impacts the health and productivity of livestock. Inadequate and poor-quality feed can lead to a host of health problems in animals, such as reduced weight gain, lower milk productivity, and reduced reproductive efficiency (Kumar *et al*., 2023). Low milk productivity is caused by inadequate and low nutritional quality of fodder and feed. India is facing limitations in terms of the availability of quality green fodder, dry fodder, and other concentrates. Among different *rabi* annual, oat fodder is an energy-rich crop with good regeneration ability and high dry matter content (Kumar *et al*., 2010).

Oat (*Avena sativa* L.) is an important forage crop that is widely grown in temperate regions. It is a cool-season annual cereal that is well adapted to diverse soil and climatic conditions. Oat forage is highly palatable, nutritious, and digestible, making it an ideal feedstuff for ruminants. Oat (*Avena sativa* L.) is the most important cereal fodder crop grown during winter. It is a quick growing crop having good regeneration capacity. Its fodder is palatable, succulent and nutritious in two to three cuttings extending from December to February. (Kumari *et al*., 2023). The imbalance in demand and supply of fodders require quick attention to establish appropriate strategies to close the gap, due to its excellent growth habit, fast

regeneration capacity and better palatability with more protein and minerals content. Oat is the most important winter season crop grown for animal feed under irrigated conditions. It forms an excellent combination when fed along with winter legume fodders like berseem, lucerne, senji or pea. Due to multicut nature, it helps in making up the fodder deficiency during lean period of forage production. The yield and quality of oat forage are influenced by several factors, including genetic makeup, environmental conditions, and cultural practices. Among these, nutrient management plays a crucial role in determining the productivity of the crop. Among three macronutrients, nitrogen is the most essential nutrient, along with phosphorus and potassium, that are essential for plant growth and development, and its availability in the soil is a major limiting factor for crop yields (Wang *et al.,* 2023). Adequate N supply can significantly increase forage yields and improve the quality of the crop by increasing crude protein content and reducing fiber concentrations. It is a crucial component of protein and chlorophyll, gives plant deep green color, encourages vegetative growth and rapid early growth, and improves the quality by increasing the protein content of fodder crops (Patel *et al.,* 2007). In addition, nitrogen has a significant role in how potassium, phosphorus, and other crucial nutritional elements utilization by plants. Proper and optimum, application of fertilizer not only increases the yield but also favorable effects on the quality of the produce. Nitrogen is a significant constituent of protein and chlorophyll in green plants. Nitrogen is most important nutrient for plant growth and is the most important nutrient for plant growth and is the most limiting nutrient in our soils. The nitrogen increase crude protein and metabolizable energy, besides improving succulence and palatability of fodder crops. When plant nutrients are applied to the foliage of plant, smaller quantities of fertilizers required but when applying to soil the loss of nutrients in fixation/leaching etc. these loses minimize when applied through foliar.

MATERIALS AND METHODS

The present study was carried out at Agricultural Research Station, Keshwana, Jalore during Rabi 2018-19 and 2019-20 on "Effect of different levels and foliar application of nitrogen in oat under transitional plain of luni basin" The soils of the experimental fields were loamy sandy in texture, alkaline in reaction, low in organic matter and nitrogen content and low to medium in Phosphorous medium to high in potassium content. The experiment used a split plot design with three treatment in main plot and three plot in sub plot repeated with three times. The experiment included three levels of nitrogen, namely 50%, 75% and 100% of recommended nitrogen i.e.F1, F2 and F3 and 4 urea spray namely water spray, 2% urea spray at 15, 30 and 45 DAS was used. At the time of sowing, half of nitrogen dose was applied as basal dose, and remaining 50 % was applied at 20 DAS. The source for applying of nutrients was used DAP and Urea. The trial was conducted in 4 × 2.4 sq. meter plot size for separate treatment.

The spacing for the experiment was used 30 cm apart from row to row. The green fodder yield recorded as such the dry fodder yield was recorded by keeping the samples in electric oven at 65ºC. The fodder was sale 2.0 rupee per kg on green fodder basis. The gross monetary was observed by green fodder. The cross section data on output of pearl millet crop and input used per hectare have been collected and used for further calculation of cost of cultivation, gross returns, net returns, and benefit cost ratio. The benefit cost ratio (B:C) was calculated dividing by gross monetary returns by the total cost of cultivation.

TABLE 1
Physico-chemical characteristics of the (0-30 cm)

Soil parameters	Value
pH	8.02
EC (dS/m)	0.45
Organic carbon (%)	0.23
Bulk density (Mg/m^{-3})	1.55
Available N (kg/ha)	166
Available P_2O_5 (kg/ha)	18
Available K_2O (kg/ha)	280
Available S (mg/kg)	13.44
DTPA extractable Zn (mg/kg)	0.17
DTPA extractable Fe (mg/kg)	2.70
Soil texture	Sandy loam

RESULTS AND DISCUSSION

3.1 Tillers per plant at harvest

Statistically significant differences were found with respect to various levels of nitrogen and urea spray on tillers per plant at harvest stage (Table 2). Tillers per plant at harvest stage during both the year of experiment was recorded significantly higher with the F_3 (100% of RDN) as well as in pooled but it was at par with the F_2 (75% RDN) during both the year of experiment as well as in pooled. In case of urea spray,

significantly higher tillers per plant were recoded with the spray of 2% urea at 30 DAS as well as in pooled but it was at par with the spray of 2% urea at 45 DAS. The increase in number of tillers might be due to optimum nitrogen use efficiency which lead to increased number of tillers per square meter. Increase in the number of tillers with the increasing of nitrogen application might be due to the role of nitrogen in quick response of vegetative growth of plant. These results were also the collaborated with results of Jayanthi et al., (2002), Ali *et al.* (2017).

3.2 Plant height at harvest

Nitrogen levels and urea spray had significant effect on the plant height of fodder oat (Table 2). The treatment F_3 (100 % RDN) showed significantly higher plant height during both the year of study as well as in pooled but it was at par with the treatment F_2 (75 % RDN) except pooled. In case of urea spray, significantly higher plant height was recoded with the spray of 2% urea at 30 DAS as well as in pooled but it was at par with the spray of 2% urea at 45 DAS. The more plant height might be due to optimum nitrogen application response, subsequent increase in all growth stages of crop because of main constituent of synthesis of food materials, consequences cell elongation and cell division. Significantly plant height increase with the increase in the nitrogen dose and better nitrogen use efficiency also effects to the plant height Ali *et al.*, (2017), Nadeem *et al.*, (2009). Similarly, Gasim (2001) reported that the nitrogen application sources contribute increasing the number and length of internodes and promote plant growth which results in increase of plant height. Sufficient amount of nitrogen improve the photosynthesis activity of the plant. That is why it directly effects to the growth of the plant, Nofal *et al.*, (2012).

3.3 CGR and RGR at harvest

Crop growth rate and relative growth rate were also showed significantly higher CGR and RGR with the F_3 (100 % RDN) during both year of study as well as in pooled but it was recorded at par the F_2 (75% RDN). In case of urea spray, it was recorded significantly higher with the spray of 2 % Urea at 45 DAS during both year of experiment but it was found at par with the 2 % Urea spray at 45 DAS. Significant increases in the CGR and RGR might be due to the application of nitrogen improve the photosynthesis activity of the plant. 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 lead to better crop growth with increase in levels of nitrogen.

1.4 Dry matter at 30 DAS and at harvest

Statistically significant differences were found with respect to various levels of nitrogen and urea spray on dry matter content at 30 DAS and at harvest stage (Table 3). Dry matter content at 30 DAS and at harvest stage during both the year of experiment was recorded significantly higher with the F_3 (100 % of RDN) as well as in pooled but it was at par with the F_2 (75% RDN) during both the year of experiment as well as in pooled. In case of urea spray, significantly higher dry matter content at 30 DAS and at harvest

TABLE 2
Effect of different levels and foliar application of nitrogen on growth parameters of fodder oat

Treatments	Tillers per plant at harvest			Plant height at harvest			CGR (g/plant/day)			RGR (g/g/day)		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
FER												
F_1	3.82	3.82	3.82	88.28	86.25	87.26	0.054	0.057	0.055	0.342	0.360	0.351
F_2	4.53	4.57	4.55	95.36	91.08	93.22	0.060	0.063	0.062	0.388	0.409	0.399
F_3	4.71	4.71	4.71	97.29	95.25	96.27	0.060	0.063	0.062	0.388	0.408	0.398
S. Em±	0.11	0.12	0.08	1.18	1.18	0.83	0.001	0.002	0.001	0.008	0.009	0.006
C. D. (P=0.05)	0.44	0.46	0.26	4.62	4.64	2.72	0.004	0.008	0.004	0.031	0.037	0.020
Urea Spray (2%)												
S_1	3.80	3.81	3.81	89.22	83.78	86.50	0.053	0.057	0.055	0.337	0.360	0.349
S_2	4.23	4.20	4.22	93.89	91.67	92.78	0.059	0.062	0.061	0.381	0.400	0.390
S_3	4.71	4.72	4.72	93.68	91.78	92.73	0.060	0.063	0.061	0.385	0.403	0.394
S_4	4.67	4.72	4.69	97.78	96.22	97.00	0.060	0.063	0.062	0.388	0.406	0.397
S. Em±	0.17	0.17	0.13	2.45	1.96	1.63	0.002	0.002	0.002	0.011	0.010	0.008
C. D. (P=0.05)	0.51	0.51	0.37	7.27	5.83	4.68	0.005	0.006	0.004	0.032	0.031	0.023

TABLE 3
Effect of different levels and foliar application of nitrogen on yield parameters of fodder oat

Treatments	Dry matter at 30 DAS			Dry matter at harvest			Green fodder yield			Dry fodder yield		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
FER												
F_1	0.54	0.55	0.54	2.16	2.25	2.21	199.08	193.50	196.29	32.67	34.94	33.80
F_2	0.60	0.63	0.61	2.41	2.53	2.47	268.83	231.42	250.13	44.94	41.92	43.43
F_3	0.63	0.63	0.63	2.42	2.53	2.47	267.83	237.33	252.58	45.19	43.10	44.15
S. Em±	0.01	0.02	0.01	0.04	0.05	0.03	11.49	8.62	7.18	1.83	1.06	1.06
C. D. (P=0.05)	0.06	0.07	0.04	0.17	0.20	0.11	45.13	33.84	23.43	7.18	4.16	3.45
Urea Spray												
S_1	0.54	0.55	0.55	2.13	2.26	2.20	225.33	193.22	209.28	37.41	35.25	36.33
S_2	0.60	0.61	0.61	2.37	2.48	2.43	245.11	210.67	227.89	40.70	38.16	39.43
S_3	0.61	0.62	0.61	2.40	2.50	2.45	245.67	236.22	240.94	41.58	42.78	42.18
S_4	0.61	0.62	0.62	2.42	2.51	2.47	264.89	242.89	253.89	44.05	43.77	43.91
S. Em±	0.02	0.01	0.01	0.06	0.06	0.04	6.58	9.61	7.01	1.20	1.62	1.16
C. D. (P=0.05)	0.05	0.04	0.03	0.16	0.17	0.13	19.54	28.55	20.12	3.58	4.81	3.33

stage recoded with the spray of 2% urea at 45 DAS as well as in pooled but it was at par with the spray of 2% urea at 30 DAS. Dry matter also increased with increases the nitrogen level from 50 % to 100 % RDN, because nitrogen facilitates the growth of the plant photosynthesis activity of the plant Dubey *et al*. (2013).

3.5 Green and dry fodder yield (qt/ha)

Regarding the green and dry fodder yields different nitrogen levels and foliar application of 2% urea showed significant behavior (Table 3). Significantly higher green fodder yield (268.83 qt/ha) was obtained with the treatment F_2 (75% RDN) during 2018-19 but in succeeding year it was recorded significantly higher with the treatment F_3 (100 % RDN) as well as in pooled. Foliar spray of urea @ 2% also had significant effect on the green fodder yield of the fodder oat. With respect to foliar application of urea @ 2%, treatment S_4 (2% spray at 45 DAS) was recorded significant higher as compared to the other treatments during first year and in pooled but in succeeding year of study it was recorded at par with the treatment S_3 (2 % spray at 30 DAS). The same trend was recorded with respect to dry fodder yield during both the year of study. Application of nitrogen has significant effect on the vegetative growth of the plant and these vegetative growth convert into the biomass of the plant. So, optimum amount of the nitrogen plays a significant role to increase the green and dry fodder yields of the fodder crops. However, when nitrogen application was increased from optimum level it caused the more vegetative growth which caused lodging problem which reduced forage yield. Similar results were observed by Singh and Dubey (2008) and May *et al.*, (2004). The results also collaborated with the findings of Iqbal *et al.*, (2009), Haider (2008) and Kumar *et al.,* (2017).

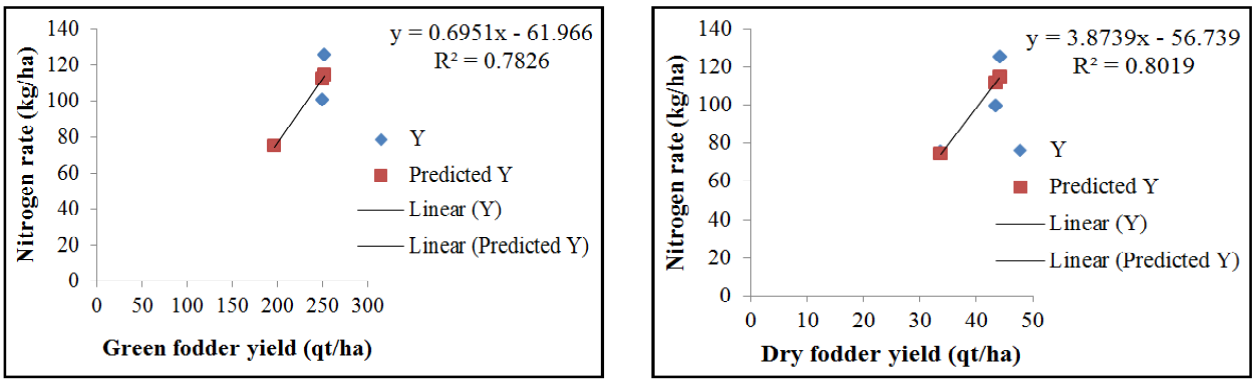

Fig. 1. Relationship of green and dry fodder yields with nitrogen levels on pooled basis.

1. Regression analysis between nitrogen levels and green and dry fodder yield on the pooled basis

The data related to the regression analysis is depicted in the Fig. 1. The regression analysis showed linear and positive relationship between the green and dry fodder yields and levels of nitrogen. The regression coefficient was R^2=0.7826 for the green fodder yield and R^2=0.8019 for the dry fodder yield.

CONCLUSION

On the basis of results, it is concluded that the application of nitrogen and foliar application of urea spray has significant effect on the growth and yield parameters of the fodder oat. Application of 125% RDN and foliar spray of 2% urea at 30 DAS consistently leads to enhanced oat growth, green and dry fodder yields.

ACKNOWLEDGEMENTS

Authors acknowledge support of colleagues at Agricultural Research Station Keshwana, Jalore, Agriculture University, Jodhpur (Raj.) India.

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