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Research Article

RESPONSE OF NITROGEN LEVELS ON GROWTH, YIELD AND QUALITY OF SINGLE CUT OAT CULTIVARS

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Abstract: A field experiment was conducted at Main Forage Research Station, Anand Agricultural University, Anand during *rabi*-2019-20 to study the effect of nitrogen levels and promising entries on yield and quality of oat. During experimentation evaluated five new cultivars check with two national check single cut oat varieties and one zonal check varieties (V1: SKO 240, V2: OL 1896, V3: HFO-529, V4: HFO-718, V5: JO-05-09, V6: Kent (NC), V7: OS-6 and V8: JHO-2009-1) with four levels of nitrogen (N_1: 30 kg N/ha, N_2: 60 kg N/ha, N_3: 90 kg N/ha and N_4: 120 kg N/ha). The Experiment was laid out in split plot design with three replications. Result revealed that OL 1896 reported significantly higher plant, number of tiller and green fodder dry matter percent. Among various cultivar HFO 718 noted higher green fodder yield, green fodder crude protein yield and dry matter yield. Response of various cultivar on protein content, ADF and NDF was found non-significant. Application of 120 kg N/ha reported significantly higher plant height at harvest, number of tillers, green fodder yield, green fodder crude protein and dry matter percent as well as green fodder crude protein and dry matter yield. ADF and NDF percentage was found significantly lower in 30 kg N/ha treatment.

Keywords: *Oat, Green Fodder yield, Crude protein content, dry matter content, Dry matter yield, Crude protein yield*

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Introduction

Importance of fodder crops in agriculture needs no emphasis because the adequate nutritious regular fodder availability is a basic requirement for livestock production to meet the demand of milk, butter, and other by products for human consumption. There is a great deficit in the current demand and supply of green fodder to feed rapidly expanding livestock industry in India. Oat provides a very nutritious fodder (protein 13- 15%) especially suited to milch animals (Devi et al. 2019). The ever-rising demand for fodder and feed for sustaining livestock production can be met through increasing productivity of fodder. Oat is an important cereal forage crop of winter season, which provides energy rich nutritious and palatable fodder. There were several factors, which affect the productivity and quality of forage oat. Nitrogen is a one of the major components to influence the forage growth, yield and quality. Nitrogen plays vital role in the growth of fodder through the impact on cell elongation, cell division and inter-nodal expansion, it also plays a major role in early establishment of the crop. Amongst various nutrients oat response well to nitrogen application, which produced more tonnage in per unit area per unit time under favorable environmental condition. However, excess application of nitrogen to oat under certain environmental conditions causes large quantities of nitrate accumulation in plant leaves, which may be toxic to ruminants [1]. The profitable production of oat crop may be affected by many factors and among these factors, soil fertility to produce good fodder. These facts necessitate to determinate the adequate supply of nitrogen to the oat based on field experimentation for realizing the genetic yield potential of newly evolved varieties [1]. To study the effect of nitrogen levels and promising entries on yield and quality of oat.

Materials and Method

A field experiment was conducted at Main Forage Research station, Anand Agricultural University during rabi 2019-2020 to study the effect of nitrogen levels and promising entries on yield and quality of oat.

The soil of experimental field was loamy sand in texture, having organic carbon (0.51%), low in nitrogen (222.0 kg/ha), phosphorus (26.0 kg/ha) and sulphur (18.69 kg/ha). Treatment comprising of total eight varieties among these five promising varieties, two national check varieties and one zonal check varieties (V1: SKO 240, V2: OL 1896, V3: HFO-529, V4: HFO-718, V5: JO-05-09, V6: Kent (NC), V7: OS-6 and V8: JHO-2009-1) and four levels of nitrogen (N_1: 30 kg N/ha, N_2: 60 kg N/ha, N3: 90 kg N/ha and N_4: 120 kg N/ha). The experiment was laid out in split plot design with three replications. Nitrogen was given as per treatments through need coated urea, among total nitrogen requirement, 60 % of nitrogen and full dose of phosphorus was applied as basal application and 40 % of nitrogen was applied at 40 DAS. As per the soil analysis all deficient nutrients were applied at time of sowing according to recommendation. Various growth and yield attributing characters and green fodder yield observations were recorded during growing period from net plot area. Plant was harvested at 50% flowering stage. The crude protein yield was calculated by a factor of 6.25. The dry matter yield was recorded.

Results and Discussion

Effect of OAT entries

Data presented in [Table-1] indicated that various varieties of oat was grown under middle Gujarat Agroclimatic condition for growth green fodder yield and quality of single cut oat cultivars. Among the various oat varieties, significantly higher plant (153.42 cm), number of tiller (75.92) and green fodder dry matter percent (22.23 %) was observed in OL 1896. While HFO 718 oat cultivar reported significantly higher green fodder yield (467.67 q/ha), green fodder crude protein yield (16.75 q/ha) and green fodder dry matter yield (102.80 q/ha) than rest of oat cultivars. Response of crude protein, ADF and NDF among various cultivate was found non significantly but higher protein content (16.15 %) was reported in OS 6 While, JHO 2009-1 variety reported minimum ADF (39.84 %) and NDF content (65.25 %) compared to other cultivars of single cut oat.

Table-1 *Effect of levels of nitrogen on growth, yield and quality of single cut oat cultivars*

Treatment	Plant height at harvest	No of tillers meter row length	Green fodder yield (q/ha)	Green fodder CP %	Green fodder CPY (q/ha)	Green fodder DM (%)	Green fodder DMY (q/ha)	ADF (%)	NDF (%)
Single cut oat varieties									
SKO 240	153.25	73.08	352.37	15.17	11.50	21.49	75.05	44.66	67.18
OL 1896	153.42	75.92	388.53	14.93	13.22	22.23	87.56	43.60	67.07
HFO 529	134.25	67.50	396.56	16.02	11.81	18.31	73.05	42.22	66.57
HFO 718	148.17	64.83	467.67	16.10	16.75	21.77	102.80	42.14	66.79
JO-05-09	137.83	79.33	421.53	15.96	13.46	20.28	84.75	42.69	66.84
KENT	138.92	57.92	371.53	15.62	12.17	20.65	77.16	44.16	66.93
OS 6	135.25	74.42	366.75	16.15	12.39	20.74	76.71	41.64	65.83
JHO 2009-1	132.33	74.08	285.75	16.10	8.41	18.45	52.27	39.84	65.25
S.Em. ±	2.70	1.87	12.30	0.45	0.62	0.70	3.50	0.99	1.40
CD at 5%	8.19	5.67	37.31	NS	1.88	2.13	10.62	NS	NS
CV%	6.60	9.14	11.18	9.84	17.27	11.90	15.78	8.02	7.29
Nitrogen level (kg/ha)									
N_1 30 kg	129.58	61.88	293.50	14.06	8.40	20.20	59.44	40.61	62.58
N_1 60 kg	140.54	70.88	366.13	16.19	12.18	20.46	75.25	41.56	67.75
N_1 90 kg	143.63	74.17	406.56	16.34	13.49	20.33	83.15	42.73	67.85
N_1 120 kg	152.96	76.63	459.15	16.43	15.78	20.97	96.83	45.57	68.04
S.Em. ±	1.77	0.99	6.42	0.30	0.44	0.48	2.53	0.46	0.71
CD at 5%	5.03	2.81	18.25	0.85	1.24	NS	7.20	1.32	2.02
CV%	6.12	6.83	8.24	9.34	17.18	11.39	15.41	5.34	5.24
(M x S) Int.	NS	NS	*	NS	*	*	*	NS	NS

Effect of levels of nitrogen

Nitrogen is one of the most important primary plant nutrients responsible for plant growth and developments, impact of cell elongation, cell division and inter nodal expansion, it is also play major role in early establishment of the crops. Plant height of oat was significantly influenced by nitrogen application. Resulted revealed that increasing levels of nitrogen from 30 to 120 kg N/ha resulted in corresponding increase in plant height (152.96 cm) at harvest [Table-1], higher plant height by higher dose of nitrogen might be due to nitrogen attributed synthesis of food materials, resulting in greater cell division and cell elongation. Therefore, elongation in plant increased with increasing nitrogen levels. Data presented in [Table-1] indicated that application of 120 kg N/ha (N_4) reported significantly higher number of tillers in meter row length (76.63) compared other levels of nitrogen except treatment N_3 (90 kg N/ha).

Green fodder yield of oat was correspondingly increased with increase in levels of nitrogen levels up to 120 kg N/ha (459.15 q/ha). Thus, it is obvious that oat is highly responsive to nitrogen nutrient. Increasing green fodder yield by application of higher levels of nitrogen might be due to higher plant height and number of tillers per meter row length directly response on green fodder yield of oat. The higher green fodder yield was found with increasing levels nitrogen might be attributed to the significant enhancement in performance of yield is well linked with corresponding significant higher performance of growth parameters (plant height and number of tillers in meter row length) and also due to higher availability of metabolites. Such improvement in various growth attributes ultimately resulted in higher fodder yield. Similar effect nitrogen on fodder yield was also reported by Jat *et al*. (2015) [2] and Satpal *et al.* (2016) [3].

Nitrogen is an essential part of protein and is a constituent of physiologically important compound like nucleotides, vitamins, enzymes and hormones that promotes growth and development in crop plants and also improves the meristematic activities. Quality parameter of promising entries of oat was significantly influenced levels of nitrogen. Data presented in [Table-1] indicated that application of 120 kg N/ha (N_4) reported significantly higher green fodder crude protein content (16.43 %) and significantly the maximum green fodder crude protein yield (15.78 q/ha) and green fodder dry matter yield (96.83 q/ha) reported in same treatment but response of levels of nitrogen on green fodder dry matter percent was found non-significant. Application of 30 kg N/ha reported significantly lower ADF (40.61 %) and NDF (62.58 %) over other levels of nitrogen. The improvement in these parameters due to application of nitrogen at right quantity, right time to oat crop might be due to supply of plant nutrients improves soil physical and biological properties and increased the availability of nutrients. This cloud be also explained based on better availability of desired and required nutrients in crop root zone and enhanced photosynthesis and metabolic activities resulting in better partitioning of photosynthesis to sinks, which reflected in quality enhancement like green fodder crude protein, dry matter content, crude protein yield as well as dry matter yield of oat.

Data presented in [Table-2] indicated that application of 120 kg N/ha to HFO 718 variety reported significantly the maximum green fodder yield (591.67 q/ha) than rest of treatment, its magnitude to increase 35.97 % higher green fodder yield compared to 30 kg N/ha to HFO 718 varieties. Significantly lower green fodder yield (244.33 q/ha) was reported in JHO 2009-1 variety fertilized with 30 kg N/ha.

Application of 120 kg N/ha to HFO 718 variety reported significantly the highest crude protein yield (23.36 q/ha). Significantly minimum crude protein yield (6.32 q/ha) in JHO 2009-1 was reported in lower levels of nitrogen application (30 kg N/ha).

Table-2 *Interaction effects of nitrogen levels and oat cultivars on green fodder yield*

Main Plot	Green fodder yield (q/ha) Sub Plot			
	30 kg N/ha	60 kg N/ha	90 kg N ha	120 kg N ha
SKO 240	259.03	333.44	389.00	428.00
OL 1896	280.78	378.67	430.33	464.33
HFO 529	266.56	419.67	433.44	466.56
HFO 718	377.89	419.44	481.67	591.67
JO-05-09	347.22	394.44	419.44	525.00
KENT	280.56	350.00	397.22	458.33
OS 6	291.67	350.00	416.67	408.67
JHO 2009-1	244.33	283.33	284.67	330.67
S.Em. ±	18.15			
CD at 5%	51.61			
CV%	8.24			

Table-3 *Interaction effects of nitrogen levels and oat cultivars crude protein yield*

Main Plot	CPY (q/ha) Sub Plot			
	30 kg N/ha	60 kg N/ha	90 kg N ha	120 kg N ha
SKO 240	7.92	12.37	12.89	12.83
OL 1896	7.90	10.98	15.11	18.88
HFO 529	6.56	12.87	14.23	13.58
HFO 718	11.27	16.47	15.91	23.36
JO-05-09	10.98	14.05	14.28	14.56
KENT	8.10	10.78	12.99	16.81
OS 6	8.19	11.14	13.83	16.39
JHO 2009-1	6.32	8.77	8.65	9.88
S.Em. ±	1.24			
CD at 5%	3.52			
CV%	17.18			

Application of 120 kg N/ha to OS-6 variety reported significantly higher dry matter (25.0 %) than rest of nitrogen levels and varieties. Significantly lower dry matter (16.50 %) was reported in JHO 2009-1 variety fertilized with 120 kg N/ha.

Table-4 *Interaction effects of nitrogen levels and oat cultivars on dry matter*

Main Plot	Dry matter (%) Sub Plot			
	30 kg N/ha	60 kg N/ha	90 kg N ha	120 kg N ha
SKO 240	22.83	22.97	21.00	19.17
OL 1896	20.83	18.80	24.33	24.93
HFO 529	17.27	17.83	19.13	19.00
HFO 718	20.13	23.30	20.50	23.13
JO-05-09	20.50	23.43	20.17	17.00
KENT	20.13	19.93	19.53	23.00
OS 6	19.50	18.03	20.43	25.00
JHO 2009-1	20.43	19.37	17.50	16.50
S.Em. ±	1.35			
CD at 5%	3.83			
CV%	11.39			

Table-5 *Interaction effects of nitrogen levels and oat cultivars on dry matter yield*

Main Plot	Dry matter yield (q/ha) Sub Plot			
	30 kg N/ha	60 kg N/ha	90 kg N ha	120 kg N ha
SKO 240	59.15	77.34	81.71	82.00
OL 1896	58.54	71.21	104.71	115.77
HFO 529	45.81	74.87	82.92	88.62
HFO 718	76.24	98.96	98.98	137.03
JO-05-09	72.89	92.35	84.59	89.18
KENT	56.27	69.77	77.21	105.42
OS 6	56.72	62.90	85.12	102.09
JHO 2009-1	49.92	54.64	49.95	54.55
S.Em. ±	7.17			
CD at 5%	20.38			
CV%	15.78			

Perusal of data presented in [Table-5] reported that dry matter yield (137.03 q/ha) when HFO 718 variety fertilized with 120 kg N/ha during investigation. Application of 30 kg N/ha to JHO 2009-1 variety reported significantly lower dry matter yield (49.92 q/ha) than rest of treatment varieties × levels of nitrogen combinations.
Thus, it appears that improvement in these parameters due to application of nitrogen at right quality and right time to the oat crop might be due to supply of plant. Plant nutrients improves availability of nutrients. This could be explained based on better availability of desired and required nutrients in crop root zone and enhanced photosynthetic and metabolic activities resulting in better partitioning of photosynthates to sinks, which reflected in quality enhancements.

Conclusion

From the ongoing research it can be concluded that application of 120 kg nitrogen recorded significantly higher green fodder yield, crude protein yield as well as dry matter yield of oats cultivars. Under middle Gujarat condition HFO 718 and JO-05-09 perform better as compared to another oat cultivars.

Application of research: To find out optimum levels of nitrogen for different cultivar of single cut oat

Research Category: Agronomy

Abbreviations: N: Nitrogen

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University: Anand Agricultural University, Anand, 388110, India
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Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Forage Research Station, Anand, 388110

Cultivar / Variety / Breed name: Nil

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
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