International Journal of Environment and Climate Change

Volume 13, Issue 9, Page 2183-2189, 2023; Article no.IJECC.102716
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Effect of Fodder Cutting Management on Quality of Different Varieties of Oat (*Avena sativa* L.)

Ashish Kumar Verma [a*], Vishuddha Nand [a], Ravi Verma [a], Utkarsh Singh [a], Deependra Kumar [a] and Rahul Verma [b]

[a] Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.), India.
[b] Department of Agronomy, J.V. College Baraut, Meerut, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i92451

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/102716

Original Research Article

Received: 09/05/2023
Accepted: 17/07/2023
Published: 27/07/2023

ABSTRACT

The present study aims to study the effect of cutting and splitting of nitrogen management on the quality of different varieties of fodder oat (*Avena sativa* L.). The field experiment was conducted at the Genetics and Plant Breeding farm, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.), India during *Rabi* 2019-2020. The experiment was carried out with three treatments consisting of three varieties (RO-19, JHO-851, UPO-212) and four fodder cutting and splitting of nitrogen *viz.* (T_1) Two cuttings (55 DAS & 50% flowering) + 60% N as basal + 40% N at Ist cut; (T_2) Two cuttings (55 DAS & 50% flowering) + 50% N as basal + 50% N at Ist cut; (T_3) Three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 50% N as basal + 25% N at Ist cut + 25% N at IInd cut and (T_4)Three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 40% N as basal + 30% N at Ist cut + 30% N at IInd cut were laid out in split plot design with three replications. As per the results, the values of RO-19 obtained the highest Crude fibre (%),

**Corresponding author: E-mail: ashishverma9787@gmail.com;*

Digestible crude protein (%), Total Digestible Nutrient (%), and Water soluble carbohydrates (%) as compared to JHO-851 and UPO-212. As regarded cutting and splitting of nitrogen management on Crude fibre (%), Digestible crude protein (%), Total Digestible Nutrient (%) and Water soluble carbohydrates (%) were found maximum under Three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 50% N as basal + 25% N at Ist cut + 25% N at IInd cut.

Keywords: Fodder cutting; crude fibre; digestible crude protein; total digestible nutrient; water soluble carbohydrates.

1. INTRODUCTION

Oat (*Avena sativa* L.) is a member of the Poaceae family. The genus *Avena* has diploid, tetraploid, and hexaploidy species, all of which have an x=7 chromosomal number. Jai is the common name for oat. It is a major cereal fodder crop that originated in the Western Mediterranean region and is typically produced during the Rabi season. It is used as green fodder and grain for animal nutrition. In many regions of the world, it is a major winter is a multifunctional crop that can be used for grain, grazing, fodder, or as a rotational crop. The oat plant has a great growth habit, recovers quickly after harvesting, and produces high-quality herbage.

The amount of nitrogen applied and when it is applied have a significant impact on the effectiveness of nitrogen level observation. Nitrogen should be administered to a crop at times when it will not cause substantial losses and will provide sufficient nitrogen when needed. Because of its productivity and profitability, splitting nitrogen application is a key nutrient management approach [1]. Growers can improve nutrient efficiency by splitting the total nitrogen application into two or more splits. Splitting nitrogen can help to reduce leaching and volatilization losses while also increasing the effectiveness of nitrogen application. Cutting management is a critical aspect in determining the growth, productivity, and quality of fodder crops.

Cutting management is a key element that influences the growth, productivity, and quality of fodder crops. For increased yields, general cutting management may be abandoned in fodder crops. Cutting has an impact on the crop's nutritional and natural resource usage [2]. Multi-cut crops absorb more nutrients than single cut crops, this has a direct effect on the crop's nitrogen content, protein content, and other qualitative markers. Because cutting is such an important part of biomass synthesis, It is among the most significant determinants of green and dry forage yields [3]. Two cuts are regularly administered at various times in an oat crop, however the first cut at 55 Days after sowing and the second cut at 50 % flowering, on the other hand, provided the best growth and output [4]. Cutting management may be used in fodder crops in general to increase yields. The purpose of this study was to study the effect of cutting and splitting of nitrogen management on the quality of different varieties of fodder Oat.

2. MATERIALS AND METHODS

The experiment was carried out during the *Rabi* season 2019-20 at the Genetics and Plant Breeding farm, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.). The field was well leveled having good soil condition. Geographically, Ayodhya (Kumarganj) falls in a subtropical climate and is situated at 26^0 47" North latitude, 82^0 12" East longitudes with an altitude of 113 meters above mean sea level. "The soil of the experiment field was classified as silt loam in texture with alkaline reaction (pH 8.8) Low in organic carbon (0.25%) and available nitrogen (190 kg ha^{-1}), medium in phosphorus (16.5kg ha^{-1}) and potash (238.1 kg ha^{-1}). The experiment was laid out in a split-plot design with three replications. The main plot consisted of three oat varieties (RO-19, JHO-19 and UPO-212), whereas the sub-plot had three nitrogen levels (Two cuttings (55 DAS & 50% flowering) + 60% N as basal + 40% N at Ist cut, Two cuttings (55 DAS & 50% flowering) + 50% N as basal + 50% N at Ist cut, Three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 50% N as basal + 25% N at Ist cut + 25% N at IInd cut and Three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 40% N as basal + 30% N at Ist cut + 30% N at IInd cut). The sowing was done on 18 November 2019 in opened furrows 25 cm apart using the seed rate of 100 kg/ha. Quality parameters determine at a half kilogram (500g) of fresh plant samples (stem and leaf) were taken from each treatment during each cutting and dried in an oven at 80ºC for 24 hours then make powder then 10gm weight the sample for analysis of quality parameters" [5].

2.1 Crude Fibre (%)

To determine crude fibre (%), 1.0 g of oven-dried plant material was taken in a 250 ml beaker, added 1.25% H_2SO_4 and distilled water and made the volume up the 200 ml then placed on flam for 30 minutes filtered and washed. Then again added 1.25% NaOH and distilled water made the volume up to 200ml. Heated again for 30 minutes and residues were washed and filtered again. The residues were put in a pre-weighted crucible and it was placed in an oven at 105ºC for drying for 24 hours. After recording the dry weight (W_1) the samples were placed in a muffle furnace at 600 ºC till grey or white ash was obtained. Then cool it and the weight of ash (W_2) was recorded and the crude fibre (%) was calculated following the formula;

$$\text{Crude fibre} = \frac{(\text{Weight of crucible + dry matter}) \times \text{Weightof crucible ash}}{\text{Amount of substance taken}} \times 100$$

2.2 Digestible Crude Protein

To find out the digestible crude protein (DCP) content of a feed, multiply the digestibility coefficient of the crude protein by the crude protein content of the feedstuff.

DCP= Digestibility Co-efficient x CP

2.3 Water Soluble Carbohydrates

Water soluble carbohydrate was determined by AOAC [6].

2.4 Total Digestible Nutrient

Moore et al. [7] as follows:

TDN (%) = Digestible crude protein (%) + Digestible crude fibre (%) + Digestible Nitrogen free extract (%) + Digestible ether extract (%) x 2.25

3. RESULTS AND DISCUSSION

3.1 Crude Fibre (%)

The crude fibre (%) was non- significant at all cutting stages of the crop. The maximum crude fibre (25.92, 25.52 and 26.30%) was recorded with variety RO-19 at all cutting stages, while minimum crude fibre (24.88, 24.55 and 25.30%) was found with variety UPO-212 during an experiment.

The crude fibre as cutting and splitting of nitrogen at first cut was found not affected significantly. The maximum crude fibre (25.95%) as first cut at two cuttings (55 DAS & 50 % flowering) + 60 % nitrogen as basal + 40 % nitrogen at I^{st} cut whereas minimum crude fibre (25.14%) at two cuttings (55 DAS & 50 % flowering) + 50 % nitrogen as basal + 50 % nitrogen at I^{st} cut and at second cut crude fibre (25.89%) was recorded at two cuttings (55 DAS & 50 % flowering) + 50 % nitrogen as basal + 50 % nitrogen at I^{st} cut significantly higher at par with crude fibre (23.99) at three cuttings (55 DAS, 35 days after 1^{st} cut & 50 % flowering) + 40 % nitrogen as basal + 30% nitrogen at I^{st} cut + 30% nitrogen at II^{nd} cut and at third cut stage of crop as crude fibre (25.36%) at three cuttings (55 DAS, 35 days after 1^{st} cut & 50 % flowering) + 50 % nitrogen as basal + 25 % nitrogen at I^{st} cut + 25 % nitrogen at II^{nd} cut, where recorded minimum crude fibre (24.74%) at Three cuttings (55 DAS, 35 days after 1^{st} cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at I^{st} cut + 30 % nitrogen at II^{nd} cut. The result might be found due to soil moisture having a direct relationship with crude fibre content. Bhilare and Joshi [8], also obtained similar results.

3.2 Digestible Crude Protein (%)

The digestible Crude protein (%) was observed as significantly not affected by varieties at all cut stages of crop and cutting and splitting of nitrogen at 35 Days after the first cut (II^{nd} cut) and 50%flowering (III^{rd} cut) affected significantly except 55 DAS are presented in Table 1. The maximum digestible Crude protein (7.35 and 7.14 and 6.68%) was recorded by variety RO-19 at all cut stages whereas minimum digestible Crude protein (7.08, 6.87 and 6.61%) by variety UPO-212 at all cut stages.

The digestible crude protein was observed as cutting and spitting of nitrogen at the first cut was not affected significantly. The maximum digestible crude protein (7.27%) at three cuttings (55 DAS, 35 days after 1^{st} cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at 1^{st} cut + 30 % nitrogen at 2^{nd} cut whereas minimum digestible crude protein (7.16%) at three cuttings (55 DAS, 35 days after 1^{st} cut & 50 % flowering) + 50 % nitrogen as basal + 25 % nitrogen at 1^{st}

cut + 25 % nitrogen at 2nd cut and at second cut was found digestible crude protein (7.06%) at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at 1st cut + 30 % nitrogen at 2nd cut significantly higher at par with digestible crude protein (6.94%) at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 50 % nitrogen as basal + 25 % nitrogen at 1st cut + 25 % nitrogen at 2nd cut while in third cut digestible crude protein (7.28%) was recorded maximum at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 50 % nitrogen as basal + 25 % nitrogen at 1st cut + 25 % nitrogen at 2nd cut over of the three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at 1st cut + 30 % nitrogen at 2nd cut. Similar finding was reported by White et al. [9].

3.3 Total Digestible Nutrient (%)

The data observed was on total digestible nutrients (%) as significantly was not affected by varieties and cutting and splitting of nitrogen at 35 Days after the first cut (IInd cut) and 50%flowering (IIIrd cut) affected significantly except 55 DAS are presented in Table 1.

The data presented maximum total digestible nutrient (73.64, 71.43 and 73.56%) by variety RO-19 whereas minimum total digestible nutrient (70.84, 68.71 and 73.13%) by variety UPO-212 at all cut stages of crop. The total digestible nutrient was observed as cutting and splitting of nitrogen at first cut was not affected significantly. The maximum total digestible nutrient (72.80%) was found at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at Ist cut + 30 % nitrogen at IInd cut whereas recorded minimum total digestible nutrient (71.68%) at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 50 % nitrogen as basal + 25 % nitrogen at Ist cut + 25 % nitrogen at IInd cut at the first cut stage and at the second cut stage was found that the highest total digestible nutrient (72.62%) significantly at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at Ist cut + 30 % nitrogen at IInd cut at par with total digestible nutrient (70.53%) at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 50 % nitrogen as basal + 25 % nitrogen at Ist cut + 25 % nitrogen at IInd cut and in third cut under was found total digestible nutrient (74.26%) at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at Ist cut + 30 % nitrogen at IInd cut at par with total digestible nutrient (73.11%) at Three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 50 % nitrogen as basal + 25 % nitrogen at Ist cut + 25 % nitrogen at IInd cut. A similar finding was reported by Bhilare and Joshi [8].

3.4 Water Soluble Carbohydrates (%)

The water-soluble carbohydrates (%**)** were recorded at various cut stages of the crop *i.e* 55 DAS to at each cut as influenced by different cutting and splitting of nitrogen by different varieties of oat is summarized in Table 1.

The data present water-soluble carbohydrates on different varieties not affected significantly. The water-soluble carbohydrates were recorded as maximum (16.55, 16.07 and 12.44%) by variety RO-19 at all cut stages and were recorded as minimum (15.94, 15.48 and 12.14%) by variety UPO-212 at all cut stages. The water-soluble carbohydrates as cutting and splitting of nitrogen at the first cut were not affected significantly. The maximum water soluble carbohydrates (16.38%) as first cut at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at Ist cut + 30 % nitrogen at IInd cut whereas minimum crude fibre (16.10%) at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 50 % nitrogen as basal + 25 % nitrogen at Ist cut + 25 % nitrogen at IInd cut and at second water soluble carbohydrates (15.90%) was recorded at Three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at Ist cut + 30 % nitrogen at IInd cut significantly higher at par with water soluble carbohydrates (15.66%) at three cuttings (55 DAS, 35 days after 1st cut & 50%flowering) + 50% nitrogen as basal + 25% nitrogen at Ist cut + 25% nitrogen at IInd cut and at third cut stage of crop as water soluble carbohydrates (12.56%) found maximum at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at Ist cut + 30 % nitrogen at IInd cut, where recorded minimum water soluble carbohydrates (12.31%) at three cuttings (55 DAS, 35 days after 1st cut & 50 % flowering) + 40 % nitrogen as basal + 30 % nitrogen at Ist cut + 30 % nitrogen at IInd cut. Result might be found due to soil moisture having a direct relationship with crude fibre content. Coblentz et al. [10] also obtained similar results.

Table 1. Crude fibre (%) and digestible crude protein (%) at subsequent cutting as influenced by the splitting of nitrogen on different varieties of oat (*Avena sativa* L.)

Treatments	Crude fibre (%)			Digestible crude protein (%)		
	(Ist cut)	(IInd cut)	(IIIrd cut)	(Ist cut)	(IInd cut)	(IIIrd cut)
Varieties						
RO - 19	25.92	25.52	26.30	7.35	7.14	6.68
JHO – 851	25.84	25.04	25.84	7.22	7.01	6.61
UPO - 212	24.88	24.55	25.30	7.08	6.87	6.00
SEm±	0.53	0.50	0.44	0.12	0.17	0.18
CD at 5%	NS	NS	NS	NS	NS	NS
Cutting and splitting of nitrogen management						
Two cuttings (55 DAS & 50% flowering) + 60% N as basal + 40% N at Ist cut	24.95	25.69	0.00	7.20	6.32	0.00
Two cuttings (55 DAS & 50% flowering) + 50% N as basal + 50% N at Ist cut	25.14	25.89	0.00	7.25	6.05	0.00
Three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 50% N as basal + 25% N at Ist cut + 25% N at IInd cut	24.85	24.59	25.36	7.16	6.94	7.28
Three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 40% N as basal + 30% N at Ist cut + 30% N at IInd cut	25.24	23.99	24.74	7.27	7.06	6.43
SEm±	0.61	0.58	0.26	0.43	0.19	0.10
CD at 5%	NS	1.72	0.78	NS	0.57	0.30

Table 2. Total digestible nutrient (%) and water soluble carbohydrates (%) at subsequent cutting as influenced by the splitting of nitrogen on different varieties of oat (*Avena sativa* L.)

Treatments	Total digestible nutrient (%)			Water soluble carbohydrates (%)		
	(Ist cut)	(IInd cut)	(IIIrd cut)	(Ist cut)	(IInd cut)	(IIIrd cut)
Varieties						
RO - 19	73.64	71.43	74.84	16.55	16.07	12.44
JHO – 851	72.24	70.07	73.56	16.25	15.77	12.29
UPO - 212	70.84	68.71	73.13	15.94	15.48	12.14
SEm±	1.28	1.42	1.34	0.28	0.28	0.21
CD at 5%	NS	NS	NS	NS	NS	NS
Cutting and splitting of nitrogen management						
Two cuttings (55 DAS & 50% flowering) + 60% N as basal + 40% N at Ist cut	71.96	67.89	0.00	16.20	14.32	0.00
Two cuttings (55 DAS & 50% flowering) + 50% N as basal + 50% N at Ist cut	72.52	68.13	0.00	16.30	14.86	0.00
Three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 50% N as basal + 25% N at Ist cut + 25% N at IInd cut	71.68	70.53	73.11	16.10	15.66	12.31
Three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 40% N as basal + 30% N at Ist cut + 30% N at IInd cut	72.80	72.62	74.26	16.38	15.90	12.56
SEm±	1.48	1.64	0.78	0.33	0.32	0.18
CD at 5%	NS	4.39	2.34	NS	0.94	0.54

4. CONCLUSION

Conclusively as per the results the values of RO-19 obtained the highest Crude fibre (%), Digestible crude protein (%), Total Digestible Nutrient (%) and Water soluble carbohydrates (%) significantly. Cutting and splitting of nitrogen management, Crude fibre (%), Digestible crude protein (%), Total Digestible Nutrient (%) and Water soluble carbohydrates (%) were found maximum under Three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 50% N as basal + 25% N at Ist cut + 25% N at IInd cut.

ACKNOWLEDGEMENT

The authors are highly thankful to the Department of Agronomy, Acharya Narendra Deva University of Agriculture and Technology, Ayodhya, for providing all the required facility to carry out the experiment.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Khosla R, Alley MM, Davis PH. Nitrogen management in no- tillage grain sorghum production: Rate and time of application. J. Agron. 2000;92:321-328.
2. Kumar A, Jaiswal RS, Verma ML, Joshi YP. Effect of nitrogen level and cutting management on yield and quality of different varieties of oat fodder. Indian Journal of Animal Nutrition. 2001;18(3): 262-266.
3. Patel JR, Rajagopal S. Response of oat (Avena sativa L.) to nitrogen and phosphorus levels. Indian J. Agronomy. 2002;47(1):134-137.
4. Sharma SK, Bhunia SR. Response of oat (Avena sativa L.) to cutting management, method of sowing and nitrogen. Indian Journal of Agronomy. 2001;46(3):563-567.
5. Singh U, Verma AK, Jha SK, Verma N, Porte DP. Quality of oat fodder (Avena sativa L.) as influenced by different doses of nitrogen, cutting management and splitting of nitrogen. Journal of Pharmacognosy and Phytochemistry. 2020;9(4):3003-6.
6. AOAC. Official methods of analysis. Association of Official Agricultural Chemists. 11th ed. Washington; 1975.
7. Moore LA, Irwin HM, Shaw JC. Relationship between TDN and energy values of feeds. J. Dairy Sci. 1953; 36:93.
8. Bhilare RL, Joshi YP. Productivity and quality of oat (*Avena sativa* L.) in relation to cutting management and nitrogen levels. Indian Journal of Agronomy. 2007;52:247-250.
9. White LM, Hartman GP, Bergman JW. *In vitro* digestibility, crude protein, and phosphorus content of straw of winter wheat, spring wheat, barley, and oat cultivars in eastern Montana 1. Agronomy Journal. 1981;73(1):117-121.
10. Coblentz WK, Nellis SE, Hoffman PC, Hall MB, Weimer PJ, Esser NM, Bertram MG. Unique interrelationships between fiber composition, water-soluble carbohydrates, and *In vitro* gas production for fall-grown oat forages. Journal of dairy science. 2013; 96(11):7195-7209.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/102716