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Effect of nitrogen levels, cutting management and splitting of nitrogen dose on growth, yield and quality of fodder oat (*Avena sativa* L.)

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Abstract
The present research work entitled "Effect of nitrogen levels, cutting management and splitting of nitrogen dose on growth, yield and quality of fodder oat (*Avena sativa* L.)" was conducted during *Rabi* season of 2018-19 at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). Three levels of nitrogen *viz.* 100, 120 and 140 kg N ha^{-1} in main plot and four cutting management with splitting of nitrogen *viz.* two cuttings (50 DAS and 50% flowering) + 60% N as basal + 40% N at 1st cut, two cuttings + 50% N as basal + 50% N at 1st cut, three cuttings (50 DAS, 35-40 days after 1st cut and 35- 40 days after 2nd cut) + 50% N as basal + 25% N at 1st cut + 25% N at 2nd cut and three cuttings + 40% N as basal + 30% N at 1st cut + 30% N at 2nd cut were arranged in sub plot in split plot design with three replications. The result of research work on effect of nitrogen levels, cutting management and splitting of nitrogen revealed that application of 140 kg N ha^{-1} obtained the highest plant height, green fodder and dry matter yield as compared to 120 and 100 kg N ha^{-1}. As regards to cutting management and splitting of nitrogen, Plant height, green fodder yield and dry matter yield were found maximum under three cuttings + 50% N as basal + 25% N at 1st cut + 25% N at 2nd cut.

Keywords: *Avena sativa,* nitrogen levels, cutting management, splitting of nitrogen

Introduction

Livestock play an important role in agriculture and economy because livestock provide nutrient rich food (milk, meat, egg), draught power, dung as organic manure and domestic fuel as a insurance against income shocks of crop failure. Livestock are major energy source for draught power in agricultural operations. The main reason of low productivity of livestock is poor availability of feed resources. Livestock industry depends on good quality fodder availability in large quantity to meet our nutritional requirement for maintenance and production. Feed and fodder deficiency has been identified as a major constraint in achieving the desired level of livestock production. Deficiency of feed and fodders, resulted in the low productivity of livestock, India is facing a crises in feeder and fodders as there is a net deficit of 63% green fodder, 24% dry crop residues and 64% feeds. As estimated the half of the total losses in livestock productivity is due to insufficient supply of feed and fodder. Global production of oats in 2017 was 26 million tonnes, production was lead by Russia and Canada. Other substantial producers were Australia, Poland, China and Finland over one million tonnes (Anonymous, 2017) [1]. In India major growing states are Punjab, Haryana, U. P., limited areas in MP, Orissa, Bihar and West Bengal. In Chhattisgarh, state animal condition is very poor because of state farmer are being fed with low grade roughages such as paddy straw, wheat straw without any processing to improve its quality which directly affect the animals growth and milk production.

Material and Methods

The experiment was laid out during *Rabi* season of 2018-19 at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). Three levels of nitrogen *viz.* 100, 120 and 140 kg N ha^{-1} in main plot and four cutting management with splitting of nitrogen *viz.* two cuttings (50 DAS and 50% flowering) + 60% N as basal + 40% N at 1st cut, two cuttings + 50% N as basal + 50% N at 1st cut, three cuttings (50 DAS, 35-40 days after 1st cut and 35- 40 days after 2nd cut) + 50% N as basal + 25% N at 1st cut + 25% N at 2nd cut and three cuttings + 40% N as basal + 30% N at 1st cut + 30% N at 2nd cut thus making 12 treatment combination. These treatments were replicated three times. Variety used in this experiment was RO-19 and seed rate @ 100 kg ha^{-1}. All the necessary package and practices were adopting to harvest good produce.

Result and Discussion

Plant height

The data presented in Table 1 shows that the plant height significantly affected by nitrogen levels. Application of 140 kg N ha^{-1} produced significantly taller plants at all the stages of observations except at 40 and 60 DAS. At these stages application of 120 and 140 kg N ha^{-1} were found to be comparable with each other. The supply of higher amount of nitrogen might have helped in maintaining better substrate for photosynthesis activity in the leaves. It is well known fact that proper supply of nitrogen helps in increasing the cell elongation and its multiplication. Due to above reasons plant produced higher plant height under 140 kg N ha^{-1}.

An examination of data presented in Table 1 indicate that cutting and splitting of nitrogen, two cuttings + $N_{50\%B}$ + $N_{50\%1^{st}cut}$ obtained maximum plant height but remained at par with two cuttings + $N_{60\%B}$ + $N_{40\%1^{st}cut}$ at 60 DAS, 100 DAS and last cutting. Three cuttings + $N_{50\%B}$ + $N_{25\%1^{st}cut}$ + $N_{25\%2^{nd}cut}$ also found comparable with above treatments at 20 and 40 DAS. Split application of nitrogen in above stages might have resulted in better availability and utilization of nitrogen for longer duration favoured the plant growth and increased the plant height as also reported by Kakol *et al.* (2003) [6]. The lowest plant height was recorded under three cuttings + $N_{50\%B}$ + $N_{25\%1^{st}cut}$ + $N_{25\%2^{nd}cut}$ which was found comparable with the three cuttings + $N_{40\%B}$ + $N_{30\%1^{st}cut}$ + $N_{30\%2^{nd}cut}$ at all stages of observations except 20 and 40 DAS. At these stages, minimum height of plant was noted under the three cuttings + $N_{40\%B}$ + $N_{30\%1^{st}cut}$ + $N_{30\%2^{nd}cut}$.

Table 1: Plant height of oat as influenced by nitrogen levels, cutting management and splitting of nitrogen

Treatment	Plant height (cm)					
	20 DAS	40 DAS	60 DAS	80 DAS	100 DAS	Last cutting
Nitrogen levels (kg ha^{-1})						
100	33.5	70.3	32.5	80.5	90.4	119.1
120	37.1	74.0	37.5	84.3	91.1	119.9
140	38.8	76.5	37.9	93.8	95.4	126.5
SEm±	0.3	0.7	0.5	2.3	0.4	1.1
CD (P = 0.05)	1.4	3.1	1.9	9.0	1.7	4.2
Cutting management and splitting of nitrogen						
Two cuttings (50 DAS & 50% flowering) + 60% N as basal + 40% N at 1st cut	37.9	76.2	36.5	86.3	137.2	141.6
Two cuttings + 50% N as basal + 50% N at 1st cut	37.0	74.0	37.2	86.7	138.0	143.4
Three cuttings (50 DAS, 35-40 days after 1st cut & 35-40 days after 2nd cut) + 50% N as basal + 25% N at 1st cut + 25% N at 2nd cut	37.2	73.1	34.8	86.5	46.7	100.0
Three cuttings + 40% N as basal + 30% N at 1st cut + 30% N at 2nd cut	33.8	71.1	35.4	85.5	47.3	102.3
SEm±	0.9	1.1	0.6	1.1	0.8	1.1
CD (P = 0.05)	2.8	3.3	1.7	NS	2.4	3.2

Green fodder yield

Data (Table 2) shows that the highest green fodder yield was recorded under the application of 140 kg N ha^{-1}. The lowest green fodder yield was noted under 100 kg N ha^{-1} which was comparable with120 kg N ha^{-1} at 1st cut. The response of nitrogen levels was not found significant at 2nd cut. Higher plant height, number of leaves and also more number of tillers resulted in increased the absorption of nitrogen subsequently increased the green fodder yield. This is accordance with the findings of Jehangir (2009) [5] who reported that higher dose of nitrogen is vital for increasing the green fodder yield of oat.

Table 2: Green fodder yield and dry fodder yield of oat plant as influenced by nitrogen levels, cutting management and splitting of nitrogen

Treatment	Green fodder yield (t ha^{-1})				Dry fodder yield (t ha^{-1})			
	1st cut	2nd cut	3rd cut	Total	1st cut	2nd cut	3rd cut	Total
Nitrogen levels (kg ha^{-1})								
100	20.4	31.2	20.4	61.8	2.9	6.5	5.5	12.2
120	21.0	33.3	23.1	65.9	3.1	6.9	5.9	13.0
140	25.0	36.8	25.3	74.4	3.6	7.6	6.6	14.6
SEm±	0.7	1.2	--	1.3	0.1	0.4	--	0.4
CD (P = 0.05)	2.6	NS	--	5.1	0.4	NS	--	1.5
Cutting management and splitting of nitrogen								
Two cuttings (50 DAS & 50% flowering) + 60% N as basal + 40% N at 1st cut	22.3	36.4	--	58.7	3.2	9.1	--	12.4
Two cuttings + 50% N as basal + 50% N at 1st cut	22.7	38.7	--	61.4	3.3	9.5	--	12.7
Three cuttings (50 DAS, 35-40 days after 1st cut & 35-40 days after 2nd cut) + 50% N as basal + 25% N at 1st cut + 25% N at 2nd cut	21.5	30.0	21.8	73.3	3.2	4.7	5.6	13.5
Three cuttings + 40% N as basal + 30% N at 1st cut + 30% N at 2nd cut	21.9	30.0	24.0	76.0	3.1	4.8	6.3	14.3
SEm±	0.6	1.1	--	1.3	0.1	0.2	--	0.3
CD (P = 0.05)	NS	3.3	--	4.0	NS	6.7	--	0.9

As regards of cutting and splitting of nitrogen, two cuttings + $N_{60\%B}$ + $N_{40\%1^{st}cut}$ produced comparable green fodder yield with two cuttings + $N_{50\%B}$ + $N_{50\%1^{st}cut}$ and found to be significantly superior over other cutting and splitting of nitrogen at 2nd cut. Moreover, total green fodder yield was maximum under three cuttings $N_{40\%B}$ + $N_{30\%1^{st}cut}$ + $N_{30\%2^{nd}cut}$ which was at par with three cuttings + $N_{50\%B}$ + $N_{25\%1^{st}cut}$ + $N_{25\%2^{nd}cut}$. The minimum total green fodder yield was recorded under two cuttings + $N_{60\%B}$ + $N_{40\%1^{st}cut}$ but remained at par with two cuttings + $N_{50\%B}$ + $N_{50\%1^{st}cut}$. More regeneration capacity of oat after each cutting may be the reason for higher green fodder yield. Similar results have also been reported by Bollaveni *et al*. 2015 [3].

Dry matter yield

Data pertaining to dry matter yield has been presented in Table 2. The significant difference in dry matter yield was not noted due to different nitrogen levels at 2nd cut. The dry matter yield was significantly increased due to the application of 140 kg N ha^{-1}. The lowest dry matter yield was recorded under the application of 100 kg N ha^{-1}. More number of leaves, tillers and dry matter content might have increased the dry matter yield under the application of higher dose of nitrogen. Similar findings have been reported by Bhilare and Joshi (2008) [2].

As regards to cutting and splitting of nitrogen, dry matter yield was maximum under the three cuttings $N_{40\%B}$ + $N_{30\%1^{st}cut}$ + $N_{30\%2^{nd}cut}$ which was statistically at par with three cuttings + $N_{50\%B}$ + $N_{25\%1^{st}cut}$ + $N_{25\%2^{nd}cut}$.Two cuttings + $N_{60\%B}$ + $N_{40\%1^{st}cut}$ or two cuttings + $N_{50\%B}$ + $N_{50\%1^{st}\ cut}$ produced comparable and significantly higher dry matter yield as compared to other cutting and splitting of nitrogen at 2nd cut. Additional dry matter yield in third cuttings may be attributed towards increased the total dry matter yield. This is in agreement with the findings of Demetrio *et al*. (2012) [4].

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