Forage Res., **48**(3) : pp. 379-386 (2022) **http://forageresearch.in**

IMPACT OF GENOTYPES AND NITROGEN LEVELS ON GROWTH AND YIELD OF FODDER OAT (*AVENA SATIVA* L.)

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

SUMMARY

A field experiment was conducted at the Forage Research Block of Cattle Farm, Animal Production Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar to study the impact of various genotypes under varying nitrogen levels on growth and yield of fodder oat (*Avena sativa* L.). The experiment was conducted in split plot design with six genotypes in main plots (Kent, JO-07-28, OS-403, OS-6, HFO-904 and HFO-906) and three nitrogen levels (40, 80, and 120 kg ha^{-1}) in sub-plots with three replications. Results revealed that growth attributes, *i.e.*, plant height (163.3 cm) of HFO-906, number of tillers (122.3) of HFO-904, dry matter accumulation (219.2 g) of JO-07-28, SPAD reading (46.6) of Kent and number of green leaves (3.7) of Kent, JO-07-28 and HFO-904, were found to be higher over the rest of the genotypes. Genotype JO-07-28 outperformed the other genotypes in terms of green fodder yield (39.6 t/ha) and dry matter yield (8.8 t/ha). The leaf to stem ratio was recorded as significantly higher in HFO-904 (0.49) than in the remaining genotypes. Result indicated that plant height, number of tillers per meter row length, dry matter accumulation, and SPAD reading were recorded highest with the application of 120 kg N/ha, which were statistically at par with the application of 80 kg N/ha, except in SPAD reading. Maximum green fodder (37.1 t/ha) and dry matter yield (9.1 t/ha) and leaf to stem ratio (0.41) were registered at 120 kg N/ha, which were statistically on par with the application of 80 kg N/ha.

Key words : Genotypes, nitrogen levels, fodder oat, growth, yield

Oats are one of the major cereal forage crop in India that grows during the *Rabi* season (Paul *et al.*, 2022a; Paul *et al.*, 2022b). Oats produce nutritious and high-quality fodder that is highly succulent and displays good growth and quick recovery after cutting. Oats would be a preferable alternative fodder crop to consider, when a farmer cannot produce legumes like berseem and lucerne due to water restrictions. Due to the growing animal population, there is an increase in demand for fodder throughout the busiest seasons of the year. Since agricultural wastes are the primary source of nutrition for cattle. It then becomes crucial to breed variations based on demand, which indicates that the livestock population will increase at a pace of 1.23%, or about 500 million animals, while meat and milk production will increase by 2.8 and 3.3% annually. Oats are especially grown in the Western, Northern, and Central states of India. The top oat producing nations include Germany, France, UK, USA, Russia, Canada and Poland. The total world area under oats cultivation is approximately 13.9 million hectares (Singh *et al.* 2017). Presently, it is being grown on a massive scale in MP (6%), Haryana (9%), Bihar (16%), Punjab (20%), and UP (34%) and, to a limited extent, in certain parts of Himachal Pradesh, Gujarat, Orissa, Maharashtra, and West Bengal (Chandy, 2002). This crop's vegetative growth is very crucial for a larger production of green feed. Although the vegetative growth of any crop is largely dependent upon the potential of the genotype, nutrient supply system, capacity of the soil to supply the nutrients to the crop and capacity of the plants to take and use the nutrients in unit time.

Nitrogen plays an important role in quantitative and qualitative improvements in fodder production (Nanda and Nilanjaya, 2022). Amongst various nutrients, oat responds strongly when nitrogen is applied and produces more tonnes per unit area per year under favourable environmental circumstances. Fodder production requires nitrogen because it affects cell elongation, cell division, and intercellular expansion. Additionally, it is crucial for the crop's early development. Singh *et al*. (2002) evaluated maximum plant height and tiller count with a treatment of N_{80} P_{40} kg ha^{-1}. Godara *et al*. (2016) revealed that raising the nitrogen concentration from 40 kg/ha to 120 kg/ha had a significant impact on all growth indices. Green fodder yield (GFY) and dry matter yield (DMY) increased in direct proportion to nitrogen content, from 40 kg/ha to 120 kg/ha. As a result, it is evident that oat is very responsive to this nutrient. Depending on the types, oat responded to a treatment of up to 160 kg/ha of N (Joon *et al*., 1993; Pradhan and Mishra, 1994; Singh *et al*., 1998). Since nitrogen is a compound of an amino acid, a lack of it in grains, cereal husks, and fodder crops may result in severe illnesses in both humans and animals (Midha *et al*., 2015). So, it is very essential to find out the optimum dose of nitrogen for a good yield of oats. Hence, taking all the above facts into consideration, the present investigation was undertaken to assess the impact of various nitrogen levels on the growth and yield of fodder oat genotypes.

MATERIALS AND METHODS

The present trial was conducted at Forage Research Block of Cattle Farm, Animal Production Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar during Rabi season, 2021-22. Geographically, the test location is in the Indo-Gangetic Plains' sub-tropical zone and is located beside the Budhi Gandak River. It is situated on 250 98′ N latitude, 850 68′ E longitude and at an elevation of 63.9 meters above mean sea level. Average annual rainfall is about 1200 mm of which 941 mm (about 70 percent rainfall) is received during July and September. The crop received 41.9 mm rainfall during the crop season (Figure 1). In a split plot design, the experiment has been replicated three times with eighteen treatment combinations. The treatment combinations include six genotypes, *i.e*., Kent, JO-07-28, OS-403, OS-6, HFO-904 and HFO-906 in main plots and three nitrogen levels, *i.e*., 40, 80, and 120 kg ha^{-1} in sub plots. Fodder oat genotypes were continuously sown at a row spacing of 25 cm keeping a seed rate of 100 kg/ha on November 25, 2021. Half of the amount of nitrogen, full amount of phosphorous and potassium was applied as basal prior to the sowing operation. The remaining amount of nitrogen was applied at 21 days after sowing (DAS). The sources of fertilizers for nitrogen, phosphorous and potassium were urea, diammonium phosphate and muriate of potash, respectively. All other cultural operations were followed as per standard package of practices. Fodder

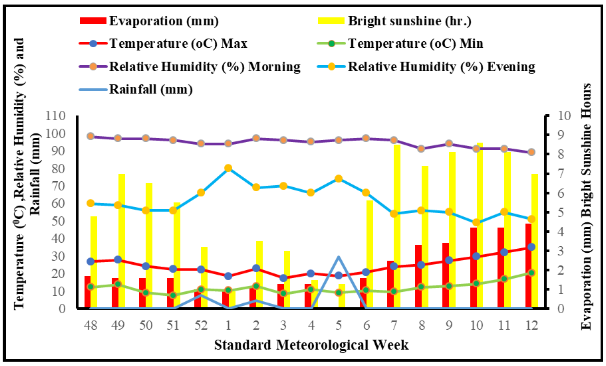

Fig. 1. Standard meteorological week wise data during the experimental period.

oat was harvested manually when it reached 50% flowering stage. The crop stand from each net plot was harvested and was weighed with the help of an electronic weighing machine and the green fodder yield was recorded in kg/plot which was later converted to t/ha. A known quantity of green fodder samples were taken from each plot and placed in hot air oven till constant weight was achieved to determine the dry matter content. Data were subjected to Analysis of Variance for randomized block design (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect on plant height

Plant height is the most crucial vegetative character to measure the growth and vigour of the plants. Different fodder oat genotypes influenced the plant height significantly at 30, 60, 90 DAS and harvest (Table 1). Data presented in Table 1 reveal that genotype OS-403 has shown highest plant height at 30 and 60 DAS, which was significantly higher over all other genotypes. Whereas, HFO-906 had the highest plant height at 90 DAS and at harvest, which was statistically comparable to JO-07-28, OS-403, OS-6 at 90 DAS and JO-07-28, OS-403, OS-6, HFO-904 at harvest. However, it was significantly higher than Kent and HFO-904 at 90 DAS and Kent at harvest. The plant height increased continuously till the final stage, however the increment rate of growth was most fast after 30 DAS, due to the plants' phasic transitions from the vegetative to reproductive phases. Similar pattern of growth in fodder oat was also disclosed by Singh and Nanda (1998) and Kumar *et al*. (2001).

Applying 120 kg ha^{-1} of N had recorded maximum plant height at all growth stages, where it was statistically equivalent to 80 kg ha^{-1} (Table 1). Whereas, applying nitrogen at 80 kg resulted in

TABLE 1
Effect of different genotypes and nitrogen levels on growth attributes at different stages of fodder oat

Treatments	Plant height (cm)				Number of tillers/meter row length				SPAD reading			
	30 DAS	60 DAS	90 DAS	Harvest	30 DAS	60 DAS	90 DAS	Harvest	30 DAS	60 DAS	90 DAS	Harvest
Genotypes												
Kent	23.2	80.1	150.1	150.1	75.1	136.8	106.8	106.6	46.8	50.9	46.8	46.6
JO-07-28	22.6	76.3	154.7	160.0	64.0	129.5	116.8	108.4	46.7	50.6	45.7	45.3
OS-403	25.3	87.8	155.3	158.8	62.2	130.3	122.1	113.0	45.6	46.4	44.4	43.6
OS-6	21.1	73.8	157.7	161.4	77.3	126.3	125.3	119.6	45.9	46.6	44.4	44.2
HFO-904	21.9	79.0	151.3	157.6	73.1	137.2	129.9	122.3	44.5	42.7	41.7	41.4
HFO-906	22.0	78.5	159.2	163.3	74.0	134.5	118.6	108.0	43.0	43.4	43.5	42.9
SEm±	0.6	1.2	1.9	2.2	2.0	1.9	2.9	3.1	0.8	0.2	0.9	0.9
CD (p=0.05)	1.9	3.8	5.8	7.1	6.4	6.0	9.2	9.8	2.5	0.6	2.9	2.7
N levels (kg/ha)												
40	21.7	72.5	149.5	153.6	67.1	124.0	111.7	105.9	43.7	44.6	42.2	41.7
80	22.8	82.2	156.3	159.8	71.2	135.4	122.2	115.0	45.9	47.3	44.9	44.3
120	23.5	83.1	158.4	162.2	74.6	137.9	125.8	118.1	46.5	48.5	46.2	46.1
SEm±	0.3	0.8	1.2	1.6	2.3	1.3	1.5	1.4	0.3	0.1	0.3	0.3
CD (p=0.05)	0.9	2.2	3.4	4.6	NS	3.9	4.3	4.2	0.9	0.3	1.0	0.9
Interaction	NS	S	NS	NS	NS	S	NS	NS	NS	S	NS	NS

NS- Non-significant; S-Significant.

significantly higher plant height over 40 kg ha^{-1}. The plant height increases with increasing nitrogen doses is because it encourages plant growth, lengthens internodes, and increases their number, all of which contribute to a gradual increase in plant height (Gasim, 2001). Comparable findings were also revealed by Midha *et al*. (2015), Dubey *et al*. (2013) and Patel *et al*. (2010).

At 30 DAS, it was determined that the interaction impact between genotypes and N levels was non-significant, although found significant at 60 DAS (Table 2). This is due to the nitrogen uptake by oat plants being less during initial development stage and more as the crop grows. Although very young plant growth requires only a little amount of fertiliser, a high concentration of nutrients in the roots zone at that time is advantageous for promoting early growth (Hanway, 1966).

Effect on number of tillers

Different genotypes of fodder oat resulted in marked variation in the number of tillers per meter row length at 30, 60, 90 DAS and harvest (Table 1). The maximum number of tillers was observed in HFO-904, with the exception of 30 DAS, where it was

TABLE 2
Interaction effect of different genotypes and nitrogen levels on growth attributes at different stages of fodder oat at 60 DAS

Genotypes	N levels (kg/ha)											
	Plant height (cm)				Number of tillers/meter row length				SPAD reading			
	40	80	120	Mean	40	80	120	Mean	40	80	120	Mean
Kent	71.24	84.10	84.94	80.10	123.5	145.0	142.0	136.8	48.90	51.45	52.41	50.92
JO-07-28	73.63	77.50	77.81	76.30	118.0	136.5	134.0	129.5	49.18	50.62	52.12	50.64
OS-403	82.97	88.60	91.73	87.80	121.5	139.5	130.0	130.3	44.41	47.06	47.60	46.36
OS-6	65.71	78.93	76.71	73.80	122.0	130.0	127.0	126.3	42.74	47.50	49.59	46.61
HFO-904	65.62	85.81	85.50	79.00	133.5	130.5	147.5	137.2	41.35	42.88	44.02	42.75
HFO-906	75.64	78.17	81.74	78.50	125.5	131.0	147.0	134.5	40.94	44.24	45.12	43.43
Mean	72.50	82.20	83.10		124.0	135.4	137.9		44.6	47.3	48.5	
SEm±		1.88				3.2				0.29		
CD (p=0.05)		5.50				9.4				0.84		

discovered to be higher in OS-6. However, Kent had the minimum number of tillers at 90 DAS and harvest. This could be attributable to specific genotype's traits, which encouraged more tillers. It was noticed that the tillers number considerably increased from 30 to 60 DAS, this might be due to application of irrigation and remaining nitrogen doses at 30 DAS and subsequently, a decrease in tiller number was noticed from 60 DAS to harvest stage.

Applying 120 kg ha^{-1} of nitrogen produced the highest number of tillers, which was on par with 80 kg ha^{-1} of N at 60, 90, and harvest; and the minimum number of tillers was observed with 40 kg ha^{-1} (Table 1). Parallel findings were observed by Godara *et al.* (2016), who disclosed that applying nitrogen at 120 kg/ha resulted in maximum tillers, which was at par with applying N at 80 kg/ha but significantly higher than applying 40 kg/ha. Parallel findings are corroborated by Sheoran *et al.* (2017). They reported that tillers number was markedly affected with raising nitrogen doses up to 120 from 40 kg ha^{-1}. Therefore, number of tillers raised significantly with raising nitrogen fertilizer. Similar findings were found in fodder oat by Hasan and Shah, (2000); Ahmad *et al*., (2011).

Treatment combination of HFO-904 along with applying N at 120 kg ha^{-1} produced the maximum tillers number at 60 DAS (Table 2).

Effect on relative chlorophyll content (SPAD reading)

Fodder oat genotypes resulted in significant variation in relative chlorophyll content (SPAD reading) at 30, 60, 90 DAS and at harvest (Table 1). Kent had the maximum SPAD reading and HFO-904 had the lowest SPAD reading across different growth stages of growth, with the exception at 30 DAS, where it was lowest in HFO-906. This could be the result of particular genetic traits that promoted increased photosynthesis and ultimately produced varied SPAD reading. Giunta *et al.* (2008) also highlighted considerable variability in chlorophyll concentration among cultivars, and Ashraf (2000) noted that chlorophyll concentration and net photosynthesis rate were correlated, and genotypes with higher chlorophyll contents had more significant photosynthetic effects.

The SPAD reading differed significantly by the impact of different nitrogen doses across all crop growth stages. Applying nitrogen at 120 kg ha^{-1} resulted in noticeably superior SPAD reading over other nitrogen levels at 60, 90 DAS and harvest, with an exception at 30 DAS, where it was on par with 80 kg but noticeably higher than 40 kg. However, applying N at 40 kg ha^{-1} had the lowest SPAD reading across different stages of crop growth. As a result, it was found that as the nitrogen level increased, the SPAD reading also increased somewhat.

Interaction impact between genotypes and N levels in relation to SPAD reading was found significant only at 60 DAS. Kent with nitrogen at 120 kg ha^{-1} resulted in higher SPAD reading over other nitrogen doses at 60 DAS, however it was statistically similar with the treatment combination of genotype JO-07-28 along with 120 kg (Table 2).

Effect on number of green leaves

Data presented in Table 3 reveal that the number of green leaves/tiller considerably enhanced from 30 to 90 DAS and subsequently, a reduction in the number of green leaves was noticed from 90 DAS to harvest stage. At all crop growth stages, the various genotypes had no discernible impact on the quantity of green leaves.

The number of green leaves differed significantly by the effect of different nitrogen doses at 30 and 60 DAS, but not at 90 DAS and harvest (Table 3). Applying N at 120 kg ha^{-1} resulted in noticeably maximum number of green leaves over other nitrogen doses at 30 DAS, whereas at 60 DAS it was found to be on par with 80 kg but noticeably higher than 40 kg. That is partially close to the findings of Anay *et al.* (2012). The variation in the number of green leaves/plant may result from the nitrogen from the applied fertiliser becoming available when it is needed.

Effect on dry matter accumulation

Fodder oat genotypes significantly influenced the dry matter accumulation (DMA) at 30, 60, 90 DAS and harvest (Table 3). Highest DMA was found in genotype HFO-904 which was significantly higher than Kent, OS-403, OS-6 and statistically similar with JO-07-28 and HFO-906. Whereas, at 60 DAS, OS-403 resulted noticeably higher DMA over all other genotypes except Kent, which was found statistically similar with OS-403. The highest DMA was found in Kent, which was significantly higher than OS-6 and HFO-904 and statistically similar with JO-07-28, OS-403 and HFO-906 at 90 DAS. Analyzing the data at the harvest stage, it was found that maximum DMA was observed in

JO-07-28, which was significantly superior over OS-6 and HFO-904 and statistically similar with Kent, OS-403 and HFO-906. The lowest DMA was found in OS-6 at 30 DAS and at harvest whereas, in HFO-906 at 60 DAS and in HFO-904 at 90 DAS. The variation in the DMA may be due to the genetic variation as well as the impact of macro and micro environmental environments.

Dry matter differed significantly by the impact of different nitrogen doses across all growth stages of crop (Table 3). Applying nitrogen at 120 kg ha^{-1} produced noticeably higher DMA over other nitrogen doses at 30, 60 and 90 DAS, except at harvest, where it was statistically similar with 80 kg but noticeably higher compared to 40 kg. However, applying nitrogen at 40 kg ha^{-1} observed the lowest DMA across all stages of crop growth. As a result, it was noticed that the DMA raised as the nitrogen level was raised. The increase in dry matter of oat crop as because of the increase leaf count, along with the better photosynthesis and as further synthesised additional food. These conclusions were supported by Roshan *et al*. (2012), Singh *et al*. (2002), and and Bhilare (2009a). Similar findings were observed by Mangesh *et al*. (2016).

Interaction impact between different genotypes and N levels in relation to dry matter accumulation was found to be significant only at 30 and 60 DAS (Table 4). The treatment combinations of HFO-904 with nitrogen at 120 kg/ha at 30 DAS, Kent with 120 kg, and OS-403 with 80 kg at 60 DAS produced the highest DMA.

Effect on leaf: stem ratio

The leaf: stem ratio is a crucial indicator of the forage's quality. The data related to leaf: stem ratio of fodder oat as influenced by different genotypes of fodder oat have been given in Table 3. The highest leaf: stem ratio was recorded with HFO-904, which was noticeably superior over other genotypes. OS-6 had the lowest leaf: stem ratio among all genotypes. This may be related to the genotype HFO-904's phenotypic traits, which include larger leaves and thicker stems than other genotypes.

Perusal of data from Table 3 revealed that maximum leaf: stem ratio was found due to applying 120 kg ha^{-1} of N, which was statistically comparable with 80 kg while applying nitrogen at 40 kg ha^{-1} registered the lowest leaf: stem ratio over all other nitrogen levels. Parallel observations were disclosed by Godara *et al*. (2016). Comparable observations were also revealed by (Luikham *et al*. 2012), (Dawit and Wegi 2014) in fodder oat and (Gasim, 2001 and Sharma *et al*. 2016) in fodder maize. In general, nitrogen influenced leaf area and chlorophyll content, which in turn served to increase photosynthetic activity and

TABLE 3

Effect of different genotypes and nitrogen levels on Number of green leaves, dry matter accumulation and leaf: stem ratio of fodder oat

Treatments	Number of green leaves/tiller				Dry matter accumulation (g/m)				Leaf: stem ratio
	30 DAS	60 DAS	90 DAS	Harvest	30 DAS	60 DAS	90 DAS	Harvest	Harvest
Genotypes									
Kent	2.2	3.1	3.7	3.7	4.2	80.7	216.1	217.3	0.33
JO-07-28	2.3	3.0	4.4	3.7	5.4	73.5	208.8	219.2	0.41
OS-403	2.1	3.0	4.2	3.1	4.5	83.2	197.7	212.0	0.40
OS-6	2.6	3.1	3.8	3.1	3.9	73.2	180.0	187.6	0.29
HFO-904	2.4	3.4	4.7	3.7	5.7	74.7	177.6	190.0	0.49
HFO-906	2.1	3.0	4.0	3.1	5.2	64.8	197.6	211.5	0.35
SEm±	0.1	0.2	0.3	0.2	0.3	1.1	6.9	6.5	0.01
CD (p=0.05)	NS	NS	NS	NS	0.9	3.6	21.6	20.4	0.04
N levels (kg/ha)									
40	2.0	2.8	3.9	3.2	3.8	63.8	170.2	179.8	0.33
80	2.3	3.2	4.2	3.4	4.9	77.2	203.0	214.3	0.39
120	2.6	3.3	4.3	3.6	5.7	83.9	215.6	224.7	0.41
SEm±	0.1	0.1	0.1	0.1	0.1	1.1	3.9	4.3	0.01
CD (p=0.05)	0.2	0.3	NS	NS	0.4	3.3	11.3	12.7	0.02
Interaction	NS	NS	NS	NS	S	S	NS	NS	NS

NS- Non-significant; S-Significant.

TABLE 4
Interaction effect of different genotypes and nitrogen levels on dry matter accumulation (g/m) of fodder oat

Genotypes	N levels (kg/ha)							
	Dry matter accumulation (g/m) (30 DAS)				Dry matter accumulation (g/m) (60 DAS)			
	40	80	120	Mean	40	80	120	Mean
Kent	3.68	4.33	4.65	4.22	67.00	85.50	89.50	80.67
JO-07-28	4.02	5.80	6.27	5.36	61.00	73.33	86.17	73.50
OS-403	4.26	4.27	4.94	4.49	77.00	89.50	83.00	83.17
OS-6	2.92	4.05	4.83	3.93	58.50	74.00	87.00	73.17
HFO-904	4.42	5.39	7.14	5.65	63.50	73.50	87.00	74.67
HFO-906	3.54	5.40	6.58	5.17	56.00	67.50	71.00	64.83
Mean	3.80	4.90	5.70		63.80	77.20	83.90	
SEm±	0.33	2.75						
CD (p=0.05)	0.97	8.03						

finally resulted in improved oat crop growth. This has been confirmed with those conclusions of Dubey *et al*. (2013), Roshan *et al*. (2012) and Pathan and Bhilare (2009).

The interaction impact between genotypes and N doses in relation to LSR was observed non-significant. Comparable results were also reported by Kaur *et al*. (2017). The variation in leaf: stem ratio is attributed to the variation in leaf and stem dry matter accumulation as influenced by the application of different doses of nitrogen.

Effect on yield

Fodder oat genotypes caused significant variation in the green fodder and dry matter yield among the treatments (Table 5). The maximum green fodder and dry matter yield were recorded by genotype JO-07-28. However, the lowest green fodder and dry matter yield were observed in OS-6. This was due to better growth as tillers, more plant height and maximum dry matter accumulation, which are directly related to the production of bulk herbage. Comparable observations were also revealed by Godara *et al*. (2016), Satpal *et al*. (2018) and Patel *et al*. (2021).

Data presented in Table 5 reveal that applying nitrogen at 120 kg ha^{-1} produced maximum green fodder and dry matter yields which were statistically comparable with 80 kg, while applying nitrogen at 80 kg increased the green fodder and dry matter yield significantly over 40 kg. These results have been agreed of the observations by Godara *et al*. (2016), Dabhi *et al*. (2017). The lowest green fodder and dry matter yield were found with nitrogen at 40 kg ha^{-1}. The

TABLE 5
Effect of different genotypes and nitrogen levels on green fodder and dry matter yields of fodder oat

Treatments	Green fodder yield (t/ha)	Dry matter yield (t/ha)
Genotypes		
Kent	35.8	8.8
JO-07-28	39.6	8.8
OS-403	32.8	8.6
OS-6	31.9	7.6
HFO-904	35.9	7.7
HFO-906	36.3	8.5
SEm±	1.0	0.3
CD (p=0.05)	3.2	0.9
N levels		
40	32.9	7.3
80	36.2	8.7
120	37.1	9.1
SEm±	0.7	0.17
CD (p=0.05)	1.9	0.5
Interaction	NS	NS

NS- Non-significant.

production of green fodder and dry matter yield in oats increased proportionately as nitrogen level was raised up to 120 kg N/ha. It is clear that oats respond quite well to nitrogen fertiliser. Higher plant height and more tillers may directly affect the green fodder yield of oats, increasing it when higher nitrogen levels are applied. The significant improvement in performance of yield is directly related to noticeably better performance of growth parameters as well as higher availability of metabolites, which may explain why a higher yield of green fodder was observed with raising nitrogen doses. Maximum fodder yield was ultimately achieved as a result of this improvement in numerous growth qualities. Similar observations on the impact of nitrogen on the yield of fodder were also disclosed by Jat *et al*. (2015).

CONCLUSION

Based on the results, it was concluded that among genotypes, JO-07-28 proved to be significantly superior for green fodder (39.6 t/ha) and dry matter yield (8.8 t/ha) to rest of the genotypes except Kent, OS-403 and HFO-906 (8.8, 8.6 and 8.5 t/ha) in case of dry matter yield. Among different nitrogen levels, the maximum green fodder (37.1 t/ha) and dry matter yield (9.1 t/ha) were recorded with application of 120 kg N/ha, which was at par with 80 kg N/ha.

ACKNOWLEDGEMENT

The first author is thankful to Head, Department of Agronomy, PGCA, RPCAU, Pusa for all the help during the course of investigation and acknowledges all the help received from staffs of AICRP on FCU, RPCAU, Pusa.

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