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NITROGEN MANAGEMENT IN RYEGRASS (*LOLIUM MULTIFLORUM*)

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SUMMARY

A field experiment was carried out at the Instructional-cum-Research Farm of Assam Agricultural University, Jorhat during *Rabi*, 2016-2017 to study the effect of different levels of nitrogen and time of application on ryegrass (*Lolium multiflorum*) for higher fodder production. Results revealed that application of 90 kg Nitrogen/ha in three splits as 40% basal + 30% after first cut + 30% after second cut produced the highest fodder yields with economic returns. The increase in total green fodder yield due to application of 30, 60 and 90 kg Nitrogen/ha over 0 kg Nitrogen/ha was 50.5, 59.0 and 64.8 per cent, respectively. The corresponding increase in total dry matter yield was 24.7, 33.0 and 38.3 per cent.

Key words : Fodder production, nitrogen management, ryegrass

India is a thickly populated country, therefore, cultivation of different food crops is must. But, in our country, livestock population is also very large (Preeti *et al.,* 2016). India supports nearly 20% of the world's livestock and 16.8% human population and 2.3% of world's geographical area. India is the leader in rearing cattle (16%) and buffalo (5.5%). The livestock sector contributes 32% of the agriculture output (Kumar *et al.,* 2012). Deficiency in fodder has been identified as one of major constraint and we are unable to produce sufficient green fodder to achieve the desired level of livestock production (Preeti *et al.,* 2016).

Feeding the large livestock population of our country with quality fodder uniformly throughout the year is a major challenge for the farmers. India faces a net deficit of 36% and 11% of green fodder and dry fodder, respectively (Tokas *et al*., 2019). Growth of the grasses is monsoon bound and winter months are considered as the lean period for supply of fodder. Ryegrass (*Lolium multiflorum*) is a cool season grass recently introduced in India. Annual ryegrass is an outstanding winter fodder crop that is highly productive. The productivity and number of cuttings of ryegrass depends on application of nitrogenous fertilizer and proper time of its application. As the grass is highly responsive to nitrogen fertilization, the experiment was undertaken to study its effect on fodder production.

MATERIALS AND METHODS

A field experiment was conducted during *Rabi* season, 2016-2017 at the Instructional-cum-Research Farm of Assam Agricultural University, Jorhat (Assam) to assess the nitrogen management in ryegrass. The treatments consisted of three levels of nitrogen (30, 60 and 90 kg N/ha) and three times of its application (All as basal, 50% at basal + 50% after first cut and 40% as basal + 30% after first cut + 30% after second cut) with an absolute control (0 kg N/ha) were laid out in randomized block design with three replications. The geographical location of the experimental site was at 26°47′ N latitude, 94°12′ E longitude and at an altitude of 86.6 m above the mean sea level. The soil of the experimental site was sandy-loam, organic carbon 0.72 per cent, available nitrogen 227.50 kg/ha, phosphorous 22.52 kg/ha and potassium 125.31 kg/ha with pH 5.50. The seeds of ryegrass variety 'Makhan', developed by 'Advanta', were sown on 13 November, 2016 in rows at a spacing of 30 cm using 15 kg seed/ha. A uniform dose each of P_2O_5 and K_2O @ 30 kg/ha was applied one day ahead of sowing along with nitrogen in the form of urea as per treatment. Harvesting of the grass was done three times as on 13 February, 20 March and 10 May, 2017. Different growth, yield attributes, fodder yields and nitrogen uptake were recorded and estimated following standard procedure. The total rainfall received during the crop growing season was 712.7 mm.

RESULTS AND DISCUSSION

Nitrogen fertilization increased the green fodder, dry matter and crude protein yields of ryegrass

TABLE 1
Effect of nitrogen levels and time of application on green fodder, dry matter and crude protein yield, nitrogen uptake and economics of ryegrass

Treatment	Green fodder yield (q/ha)				Dry matter yield (q/ha)				Crude protein yield (q/ha)	Nitrogen uptake (kg/ha)	Net income (Rs./ha)	Benefit-cost ratio
	1st cut	2nd cut	3rd cut	Total	1st cut	2nd cut	3rd cut	Total				
Nitrogen levels (kg/ha)												
N_1–30	60.8	131.3	126.7	318.8	20.9	35.6	38.6	95.1	8.0	167.8	19000	1.71
N_2–60	88.8	156.6	139.5	384.9	26.1	40.0	40.8	106.9	9.5	191.9	21500	1.73
N_3–90	107.9	190.5	149.3	447.8	28.8	44.7	42.6	116.1	10.4	219.0	24600	1.77
S. Em±	4.93	11.62	10.40	18.75	0.96	1.71	1.84	4.02	0.30	12.13	-	-
C. D. (P=0.05)	14.6	34.5	NS	55.7	2.8	5.1	NS	11.6	1.0	37.0	-	-
Time of application (T)												
T_1–All as basal	64.6	150.6	120.1	335.3	21.9	38.3	37.4	98.4	8.4	169.6	17000	1.59
T_2–50% at basal+50% after first cut	83.9	148.8	137.1	369.8	25.0	39.1	40.4	103.7	9.3	194.5	18510	1.59
T_3–40% as basal + 30% after first cut+30% after second cut	108.9	179.1	158.2	446.3	28.9	42.9	44.2	115.9	10.2	214.5	19260	1.66
S. Em±	3.49	8.22	7.37	13.26	0.68	1.21	1.30	2.60	0.22	11.52	-	-
C. D. (P=0.05)	10.4	NS	21.9	39.4	2.0	NS	3.9	8.0	0.7	34.1	-	-
Control vs. Treatment												
Control	22.1	44.7	90.9	157.8	16.9	22.4	32.3	71.6	5.3	110.4	14000	1.06
Treatment	83.8	159.5	138.5	383.8	25.3	40.1	40.7	106.1	9.3	192.9	23000	1.78
S. Em±	5.23	12.33	11.05	19.88	1.02	1.82	1.95	3.90	0.36	14.75	-	-
C. D. (P=0.05)	15.5	36.6	32.8	59.1	3.0	5.4	5.8	12.6	1.1	43.0	-	-

NS-Non significant.

significantly over no nitrogen application at all the individual and total of all cuts (Table 1). Application of nitrogen levels from 30 to 90 kg N/ha increased the fodder yields significantly and consistently. The increase in total green fodder yield with the application of 30, 60 and 90 kg N/ha over the control was 50.5, 59.0 and 64.8 per cent, respectively. The corresponding increase in total dry matter yield was 24.7, 33.0 and 38.3 per cent. Significant increase in green fodder and dry matter yield in individual cuts reflected the effect

TABLE 2
Effect of nitrogen levels and time of application on plant height (cm), no. of tillers/m2 and nos. of leaves/tiller of ryegrass at different cuts

Treatment	Plant height (cm)			No. of tillers/m^2			No. of leaves/tiller		
	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
Nitrogen levels (kg/ha)									
N_1–30	41.4	46.2	58.6	180.7	240.2	239.0	3.8	3.9	3.9
N_2–60	50.7	47.1	64.7	202.8	254.3	254.3	3.2	3.9	4.2
N_3–90	53.5	48.0	65.8	207.1	263.3	263.3	3.8	4.1	4.6
S. Em±	2.62	2.86	2.44	13.08	132.09	11.58	0.31	0.40	0.37
C. D. (P=0.05)	7.8	NS	7.3	NS	NS	NS	NS	NS	NS
Time of application (T)									
T_1–All as basal	43.3	41.9	63.0	172.9	253.6	252.7	3.2	4.1	4.2
T_2–50% at basal+50% after first cut	50.6	49.6	63.2	217.4	251.6	251.2	3.8	3.8	4.2
T_3–40% as basal+30% after first cut + 30% after second cut	51.7	49.8	62.8	200.2	252.8	252.8	3.8	4.0	4.2
S. Em±	1.85	2.02	1.73	9.25	8.55	8.19	0.22	0.28	0.26
C. D. (P=0.05)	5.5	6.0	NS	27.5	NS	NS	NS	NS	NS
Control vs. Treatment									
Control	31.7	31.3	63.3	130.3	158.3	181.7	3.0	2.7	3.0
Treatment	48.5	47.1	63.0	196.8	252.6	252.2	3.6	3.9	4.2
S. Em±	2.78	3.03	2.59	10.20	11.30	12.40	0.33	0.42	0.39
C. D. (P=0.05)	8.3	9.0	NS	31.5	34.8	27.2	NS	1.3	1.2

NS-Non significant.

on total green fodder and dry matter yields. All the yield contributing characters *viz.*, plant height, tiller/m^2 and number of leaves/tiller of ryegrass in individual cuts (Table 2) behaved similarly with the application of different levels of nitrogen as nitrogen enhances the cell division, cell enlargement and increases the photosynthetic activity of plants which ultimately reflected on fodder yield (Ihtisham *et al*., 2018). Increasing the levels of nitrogen from 30 to 90 kg N/ha the total nitrogen uptake by ryegrass also increased significantly which had direct influence on fodder yields. The results corroborate the findings of Puri and Tiwana (2003), Marino *et al*. (2004), Lippke *et al*. (2006) and McDonagh *et al*. (2017).

Application of nitrogen in three splits as 40% basal + 30% after first cut + 30% after second cut increased the total green fodder as well as dry matter yields significantly over the single and two splits application. Similar effect was noticed in case of total crude protein yield and nitrogen uptake of ryegrass. The increase in total green fodder and dry matter yield due to application on nitrogen in three splits over single and double splits was 24.9 and 17.1 per cent and 15.1 and 10.5 per cent, respectively. It may happen due to uniform availability of nitrogen in different cuttings. Splits application of nitrogenous fertilizers had significant effect on fodder production as reported by many researchers on different grass species (Aavola and Karner, 2008; Sun *et al*., 2008).

In respect of economic benefits, the highest net returns and benefit-cost ratio were obtained with the highest level of nitrogen (90 kg N/ha). Splitting nitrogen in three splits recorded the highest net returns and benefit-cost ratio over the single and double splits.

CONCLUSION

On the basis of findings, it can be concluded that application of 90 kg N/ha in three splits found to be the best for obtaining higher fodder yield of ryegrass with economic benefits.

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