Forage Res., **47** (1) : pp. 135-138 (2021) **http://forageresearch.in**

EFFECT OF CUTTING AND NITROGEN SCHEDULES ON GROWTH AND GREEN FODDER YIELD OF DUAL-PURPOSE WHEAT

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(Received : 14 June 2021; Accepted : 28 June 2021)

SUMMARY

Present investigation was conducted during *Rabi* season 2018-19 at Research Area of CCS Haryana Agricultural University, Hisar. The experiment was comprised of three cutting schedules *viz*. 45, 55 and 65 days after sowing (DAS) as main plot treatments and six nitrogen schedules *i.e.* N_1- 1/3 basal +1/3 at first irrigation and 1/3 after cut, N_2- ½ basal + ½ at first irrigation, N_3-½ basal and ½ after cut, N_4- ¼ basal +½ at first irrigation and ¼ after cut, N_5 - ½ basal +¼ at first irrigation and ¼ after cut, N_6 - ¼ basal +¼ at first irrigation and ½ after cut as sub plot treatments. Experiment was laid out in split plot design with four replications. Among different cutting schedules, maximum plant height (65.6cm), dry matter accumulation (76.9g) and green fodder yield (247.98 q/ha) were recorded when crop was cut at 65 DAS for green fodder as compared to rest of the cutting schedules. Whereas, crop cut at 45 DAS for green fodder then left for grain produced maximum grain yield (61.36 q/ha), which was significantly higher than cut at 55 DAS and 65 DAS. Among different nitrogen schedule, at the time of cut, N_2 resulted in significantly taller plants (53.3 cm) and maximum dry matter (63.1 g). Maximum green fodder yield (177.85 q/ha) was recorded when full nitrogen dose was applied before cutting (N_2). Whereas, maximum grain yield (56.88 q/ha) was recorded in N_3, which was significantly higher than treatment N_2 and N_5 but it was at par with in N_1, N_4 and N_6.

Key words : Green fodder, wheat, dual purpose, nitrogen, cutting

India is deficit in dry fodder by about 26 per cent and green fodder by about 35.6 per cent. Increasing milk productivity in view of fodder deficiency, particularly in arid and semiarid regions, has also been a major challenge for the farmers in the country. Area under cultivated fodder crops in India is 8.3 m ha and this area is almost static from last 3-4 decades which is not sufficient to meet the fodder requirement of the huge number of livestock (agropedia.iitk.ac, 2013). It is not possible to further increase the area under fodder crops in *Rabi* season as wheat is the principal grain crop. To reduce competition between the area committed to forage, grain crops and make sure the availability of forage during winter season, there is need to transfer and change from grain-only (GO) to dual-purpose (DP) wheat system of forage plus grain production. Wheat can be grown as a dual purpose crop where it provides both grain and forage from the same patch of land (Shuja *et al*., 2010). Wheat grown for dual-purpose (forage plus grain) can result in maximum income and profit to the farmers. To achieve better regeneration of the crop, cutting time is very important. The time of nitrogen fertilizer application is the most limiting factor in the production of grain and forage production of dual-purpose wheat (Zagonel *et al*., 2002). Time of nitrogen application is very crucial for attaining the normal growth of the regenerated vegetative material in wheat after cutting. Cutting schedules as well as nitrogen schedule both are important aspects need to study to harvest the optimum yield of green fodder and grains from dual purpose wheat.

MATERIALS AND METHODS

The field experiment was conducted at Research Area, CCSHAU, Hisar during *Rabi* season of 2018-19. The experiment was laid out in split plot design with four replications. The main plot treatments were three cutting schedules at 45, 55 and 65 days after sowing (DAS) and six nitrogen schedules *i.e.* N_1- 1/3 basal + 1/3 at first irrigation and 1/3 after cut, N_2 - ½ basal + ½ at first irrigation, N_3 - ½ basal and ½

after cut, N_4 - ¼ basal + ½ at first irrigation and ¼ after cut, N_5 - ½ basal + ¼ at first irrigation and ¼ after cut and N_6 - ¼ basal + ¼ at first irrigation and ½ after cut were taken as sub plot treatments. The soil of the experimental field was sandy loam. The soil of field was almost neutral (pH 7.6) with organic matter content of 0.25%. The available N, P and K content of soil were 128, 16.5 and 243 kg/ha, respectively. Wheat variety HD 3086 was used for dual purpose and crop was sown by hand plough with 20 cm row spacing. Full dose of phosphorus and potassium was applied as basal and nitrogen was applied according to treatments. Weeding and hoeing was done mechanically at 30 DAS and after cutting. Left over operations were performed according to recommended package of practices of CCS HAU, Hisar. Plant height, dry matter accumulation per meter row length and green fodder yield were recorded at the time of cut and grain yield (q/ha) was recorded at harvest as per standard procedure.

RESULTS AND DISCUSSION

Plant height

Growth parameters are very important to assess the development of plant. Plant height is a useful and important index of the growth of the plant to give an idea about the dry matter production and number of tillers leading to the yield. In present study, it was observed that plant height was not affected significantly by different cutting and nitrogen schedules at 30 DAS (Table 1). Among different cutting schedules, tallest plants (65.6 cm) were recorded when crop was cut for green fodder at 65 DAS as compared to cut at 55 and 45 DAS at the time of cut. Malik *et al.* (2015) reported maximum plant height when crop was cut at 70 DAS (65.9) followed by cut at 60 DAS (53.8) and 50 DAS (45.9). At the time of cut, maximum plant height (53.3 cm) was recorded when nitrogen was applied in two splits *i.e.* half does of nitrogen was applied as basal and half dose of nitrogen at first irrigation (N_2), which was significantly higher than all other treatments except N_4 (52.0 cm). This tendency could be attributed to higher dose of N, which greatly helped the plant to expose its potential to grow vigorously. Similar findings were reported by Gill *et al.* (2017).

Dry matter accumulation

Dry matter accumulation is a good index to express photosynthetic efficiency of the plants. It was observed that dry matter accumulation was not affected significantly by different cutting and nitrogen schedules at 30 DAS. Among different cuttings schedules, crop cut at 65 DAS for green fodder accumulated maximum dry matter (76.9 g) at the time of cut as compared with cut at 45 and 55 DAS (Table 1). Khalil *et al.* (2011) also reported that early

TABLE 1
Effect of different cutting and nitrogen schedule on growth and yields of dual-purpose wheat

Treatment	Plant height (cm)		Dry matter accumulation (g/mrl)		Green fodder yield (q/ha)	Grain yield (q/ha)
	30 DAS	At cut	30 DAS	At cut		
Cutting schedule						
C_1-45 DAS	24.4	39.2	3.0	44.2	81.18	61.36
C_2-55 DAS	23.8	48.1	2.8	56.1	169.53	56.44
C_3- 65 DAS	24.4	65.6	3.0	76.9	247.98	47.42
SEm ±	0.37	0.3	0.05	0.74	1.10	0.54
CD at 5%	NS	1.19	NS	2.64	3.9	1.93
Nitrogen schedule						
N_1- 1/3 basal +1/3 at first irrigation and 1/3 after cut	24.0	51.0	2.9	60.7	164.39	56.20
N_2- ½ basal +½ at first irrigation	25.0	53.3	3.1	63.1	177.85	52.33
N_3- ½ basal and ½ after cut	23.4	48.6	2.7	52.5	149.27	56.88
N_4- ¼ basal +½ at first irrigation and ¼ after cut	24.6	52.0	2.9	61.3	173.71	55.58
N_5- ½ basal +¼ at first irrigation and ¼ after cut	24.5	51.0	3.1	59.3	176.21	54.09
N_6 - ¼ basal +¼ at first irrigation and ½ after cut	23.4	49.8	2.9	57.6	155.86	55.37
SEm ±	0.49	0.63	0.12	1.14	1.59	0.52
CD at 5%	NS	1.79	NS	3.26	4.5	1.47

cut of wheat (75 DAS) for forage purpose resulted in lower forage dry matter compared with late cut (90 DAS). Among various nitrogen schedules, when nitrogen was applied in two splits *i.e.* half dose of nitrogen as basal and half dose at first irrigation (N_2) resulted in significantly higher dry matter accumulation (63.1 g) at cutting time as compared with N_5, N_6 and N_3, but it was statistically at par with N_4 and N_1. Early cut of wheat for forage purpose resulted in lower forage dry matter compared with late cut. It might be due to the optimum amount of nitrogen available for regeneration of tissues through increased cells expansion and elongation at required stage in life of plant. These results are in collaboration with the findings of Khalil *et al.* (2011) and Naveed *et al.* (2013). Meena *et al.* (2017) revealed that various cutting schedule failed to record perceptible variation on plant height, number of total tillers, dry matter and LAI at 35 DAS. But cutting of barley for green fodder at 60 DAS produced the maximum plant height, number of total tillers, dry matter and LAI as compare to 40 and 50 DAS.

Green fodder yield

Green fodder yield was significantly influenced by cutting and nitrogen schedule (Table 1). Among different cutting schedules, crop cut at 65 DAS resulted in significantly higher green fodder yield (247.98 q/ha) as compared to cut at 55 DAS and 45 DAS. Higher green fodder yield was obtained with delay in cutting of the wheat crop for green fodder. Whereas, minimum green fodder yield (81.18 q ha^{-1}) was recorded when crop was cut at 45 DAS. Cut at 65 DAS resulted in 31.64 and 67.26 per cent higher green fodder yield as compared to cut at 55 and 45 DAS, respectively. Gill *et al.* (2017) also reported that the forage cut at 60 DAS produced significantly higher green fodder yield (13.4 t ha^{-1}) than the forage cut at 45 DAS. Khalil *et al.* (2011) also reported that forage dry matter yield increased with delay in cutting from 75 days to 90 days after sowing.

Among different nitrogen schedules, maximum green fodder yield (177.85 q/ha) was recorded when full nitrogen dose was applied before cutting *i.e.* half nitrogen dose was applied as basal and remaining half dose of nitrogen was applied at first irrigation (N_2), which was significantly higher than the treatments N_1, N_3 and N_6 but at par with rest of the nitrogen schedules. Whereas, minimum green fodder yield (149.27 q/ha) was recorded with N_3. N_2 produced 16.1 per cent higher green fodder yield as compared with N_3. Maximum green fodder yield (266.25 q/ha) was recorded when crop was cut at 65 DAS and nitrogen was applied in three splits *i.e.* ¼ basal + ½ at first irrigation and ¼ after cut (Fig. 1). The production of maximum fresh forage yield might be attributed to maximum availability of nitrogen during early growth stages that resulted in increased vegetative growth and vice versa (Naveed *et al.*, 2013). In forage yield, the highest yield was obtained when nitrogen was applied in two splits (2/3 at basal+1/3 immediately after cut) and this was significantly superior to others treatments mainly because of higher application of nitrogen before cut (Kharub *et al.*, 2013).

Grain Yield

Grain yield was significantly affected by cutting and nitrogen schedules (Table 1). Among various cutting schedule, crop cut at 45 DAS for green fodder produced maximum grain yield (61.36 q/ha), which was significantly higher than cut at 55 DAS and 65 DAS. Whereas, minimum grain yield (47.42 q/ha) was recorded with cut at 65 DAS. The grain yield was decreased by 8.02 and 22.72 per cent by delay in cutting from 45 DAS to cut at 55 DAS and 65 DAS, respectively. The reason of significant reduction of yield in late cut at 65 DAS was possibly due to removal of photosynthetic tissues that resulted in lower crop growth rate, grain weight and number of productive tillers resulted low grain yield (Waheddullah *et al.*, 2018). Among different nitrogen schedule, maximum grain yield (56.88 q ha^{-1}) was recorded when half nitrogen dose was applied as basal and rest was applied after cut, which was significantly higher than the treatment N_2 and N_5 but it was at par with in N_1, N_4 and N_6. Whereas, minimum grain yield (52.33 q/ha) was recorded with N_2. Kharub *et al.* (2013) also revealed that higher grain yield was obtained when

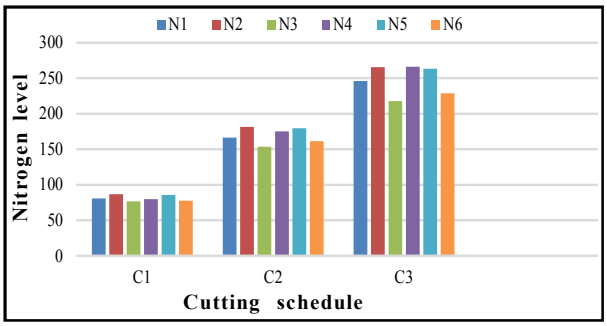

Fig. 1. Effect of different cutting and nitrogen schedule on green fodder yield (q/ha) of dual purpose wheat.

nitrogen applied in three splits (1/3 at basal+1/3 immediate after cut+1/3 tillering stage after cut) closely followed by two splits (1/2 at basal+1/2 immediate after cut).

CONCLUSION

It is concluded that to obtain maximum green fodder yield of dual purpose wheat, crop cut at 65 DAS for green fodder along with nitrogen (150 kg/ha) applied in two splits *i.e.* half dose was applied as basal and remaining half dose of nitrogen was applied at first irrigation (N_2) or in three splits *i.e.* ¼ basal + ½ at first irrigation and ¼ after cut may be followed.

ACKNOWLEDGEMENT

First Author, Mr. Abdul Rauf is thankful to Head of the Department, Department of Agronomy, CCS HAU, Hisar for providing the necessary facilities to conduct his M. Sc. (Agriculture) Agronomy research work.

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