Forage Res., **41** (4) : pp. 246-248 (2016) **http://forageresearch.in**

PERFORMANCE OF DUAL PURPOSE BARLEY VARIETIES UNDER DIFFERENT NITROGEN APPLICATION SCHEDULES

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(Received : 15 February 2016; Accepted : 28 March 2016)

SUMMARY

A field experiment was conducted at Research Farm of CCS Haryana Agricultural University, Hisar ($29^0$10' N latitude $75^0$46'E longitude and 215 m altitude) during 2009-10 and 2010-11. The experiment was laid out in split plot design comprising two varieties (V_1–RD 2552 and V_2–RD 2035) in main plot and five nitrogen schedules (T_1–½ at basal+½ immediate after cut, T_2–½ at basal+¼ immediate after cut+¼ at next irrigation, T_3–1/3 at basal+1/3 immediate after cut+1/3 at next irrigation, T_4–1/3 at basal+2/3 immediate after cut and T_5–2/3 at basal+1/3 immediate after cut) in sub plots, replicated thrice. Results revealed that variety RD 2035 recorded with 5.6 per cent green fodder yield, 12.4 per cent grains/earhead, 10.0 per cent grain yield and 9.4 per cent grain equivalent yield higher than RD 2552. Among different nitrogen application schedules, highest green fodder yield was obtained when nitrogen was applied in two splits (2/3 at basal+1/3 immediate after cut) whereas highest grain yields of 44.1 and 47.3 q/ha during 2010 and 2011, respectively, were recorded when nitrogen was applied in three equal splits i. e. 1/3 at basal+1/3 immediate after cut+1/3 at next irrigation.

Key words : Green fodder, cutting, nitrogen, grain equivalent yield

Barley (*Hordeum vulgare* L.) is an important course cereal crop of India, being grown in **rabi** season in northern plains as well as in northern hills, mostly under rainfed or limited irrigation condition on poor to marginal soils. Traditionally considered as a poor man's crop, barley in India is favoured because of its low input requirement and better adaptability to harsh environments, likely drought, salinity/alkalinity and marginal lands. Barley occupied nearly 6.72 lac hectare area producing nearly 16.26 lacs tonnes grain, with a productivity of 2422 kg/ha during 2014-15 in India (Anonymous, 2015). Barley has been traditionally used as a grain crop for human consumption and animal feed in India. In the recent years, it has been observed that in the drier parts of northern plains there is an acute shortage of green fodder in **rabi** season. Looking to its high total biomass and salt tolerance nature, there has been an increasing interest in exploiting barley as a dual purpose cereal, which can permit forage production in early season in addition to the grain yield later on (Yadav *et al.*, 2003; Singh *et al.*, 2012a). Since berseem and oats are not available due to water shortage, in such areas, barley being a fast growing crop with high biomass in early stages can be utilized as green fodder with very limited water supply or less rainfall in these areas. In drier parts of northern plains (Rajasthan, Madhya Pradesh, Southern Haryana, South West Punjab and Western U. P.) during **rabi,** farmers can grow dual purpose barley over other forage crops because of its dual utilization and less water requirement (Verma *et al*., 2007). In these regions, animal husbandry occupies an important role and there is a big gap between demand and supply of forage. So, with the development of high yielding dual purpose barley varieties, barley can serve as alternative for augmenting the green forage demand in the arid and semi-arid areas of northern plains under limited irrigations along with satisfactory levels of grain yield from the regenerated crop, which can also be utilized as feed for cattle or for human consumption. So, keeping this in view, an experiment was conducted to evaluate the dual purpose varieties and the nitrogen scheduling for dual purpose varieties to get maximum yield of fodder and grain.

MATERIALS AND METHODS

A field experiment was conducted at Research Farm of CCS Haryana Agricultural University, Hisar

($29^0 10'$ N latitude $75^0 46'$ E longitude and 215 m altitude) during 2009-10 and 2010-11. The soil of experimental site was sandy loam in texture, having a pH 7.9, electrical conductivity 0.27 dS/m, organic carbon 0.27 per cent, available P 12.5 kg/ha and K 338 kg/ha. The experiment was laid out in split plot design comprising two varieties (V_1–RD 2552 and V_2–RD 2035) in main plot and five nitrogen schedules (T_1–½ at basal+½ immediate after cut, T_2–½ at basal+¼ immediate after cut+¼ at next irrigation, T_3–1/3 at basal+1/3 immediate after cut+1/3 at next irrigation, T_4-1/3 at basal+2/3 immediate after cut and T_5–2/3 at basal+1/3 immediate after cut) in sub-plots, replicated thrice. The crop was sown on 18 November during both the years and green fodder cut was taken at 55 days after sowing and regenerated crop was managed for grain production. The yield and yield attributes were recorded at harvest. The grain equivalent yield was computed with the market rate of barley grain (Rs. 1148/q) and fodder (Rs. 72/q).

RESULTS AND DISCUSSION

Green Fodder Yield

Data presented in Table 1 reveal that variety RD 2035 recorded maximum green fodder yield of 196.7 and 151.0 q/ha during 2010 and 2011, respectively. Pooled mean data of two years showed that variety RD 2035 yielded 173.9 q/ha green fodder which was significantly higher than variety RD 2552 (164.6 q/ha). The marked variation in growth of both the varieties could be ascribed to their genetic capabilities to exploit available resources for their growth and development. In nitrogen schedule treatments, highest green fodder yield was obtained when nitrogen was applied in two splits (2/3 at basal+1/3 immediate after cut) i. e. T_5 during both the years. However, the differences were non significant during 2010. On basis of two-year pooled mean data, highest green fodder yield was obtained with nitrogen application in two splits (2/3 at basal+1/3 immediate after cut) which was significantly superior to all other treatments except T_2 (½ at basal+¼ immediate after cut+¼ at next irrigation). Kharub *et al*. (2013) reported that RD 2035 and RD 2552 could be used as dual purpose barley with good yield of the green fodder (15 to 25 t/ha) with grain yield of 20 to 25 q/ha from regenerated crop in northern plains of India.

Yield Attributes and Yield

The numbers of effective tillers were higher in RD 2552 during both the years though the differences were non-significant (Table 1). Similarly, the test weight of RD 2552 was also higher than RD 2035 during both the years (41.33 and 36.87 during 2010 and 2011, respectively). Whereas number of grains/earhead was significantly higher in RD 2035 which resulted in significantly higher grain yield of RD 2035. The highest grain yield (43.0 and 47.7 q/ha in 2010 and 2011, respectively) was recorded in RD 2035 during both the years which was significantly higher than RD 2552. On pooled mean basis, 10.0 per cent higher grain yield in RD 2035 was because of 12.4 per cent higher number of grains per earhead over RD 2552. The grain equivalent yield of RD 2035 was 9.1 per cent higher than RD 2552. Sharma (2009) also reported maximum seed yield in variety RD 2035. Whereas Kharub *et al*. (2013) reported that after harvesting of green fodder, the crop was raised for grain purpose and it was observed that barley variety RD 2552 attained significantly higher total effective tillers compared to RD 2035.

The highest number of effective tillers/m^2 was recorded in T_3, where nitrogen was applied in three equal splits (1/3 at basal+1/3 immediate after cut+1/3 at next irrigation) which was significantly higher than other treatments during both the years except T_4 (1/3 N applied as basal+2/3 N immediate after cut). Similarly, number of grains/earhead was significantly higher in T_3 during 2011, though the differences were non-significant during 2010. The test weight was also higher in T_3 during 2011, while during 2010 highest test weight was found in T_1 (½ at basal+½ immediate after cut), though the differences among different nitrogen schedulings were non-significant during both the years. The highest grain yield of 44.1 and 47.3 q/ha during 2010 and 2011, respectively, was recorded when nitrogen was applied in three equal splits i. e. 1/3 at basal+1/3 immediate after cut+1/3 at next irrigation (T_3), which was significantly higher than other treatments except T_4 (1/3 nitrogen was applied as basal + 2/3 nitrogen applied immediate after cut). On pooled mean basis, highest grain yield (45.7 q/ha) was recorded in the treatment T_3, which was significantly higher than the other treatments except T_4. The grain equivalent yield (GEY) indicated the comprehensive performance of variety i.e. for fodder and

TABLE 1
Effect of nitrogen scheduling on the green fodder yield, yield attributes and grain yield of barley varieties

Treatment	Green fodder yield (q/ha)			No. of effective tillers/m^2			No. of grains/ earhead			Test weight (g)			Grain yield (q/ha)			Grain equivalent yield (q/ha)
	2010	2011	Pooled mean	2010	2011	Pooled mean	2010	2011	Pooled mean	2010	2011	Pooled mean	2010	2011	Pooled mean	
Varieties																
RD 2552	183.7	145.7	164.7	406	413	410	50.2	41.3	45.8	41.33	36.87	39.10	40.3	41.6	40.9	5127
RD 2035	196.7	151.0	173.9	393	411	402	56.4	46.6	51.5	39.58	33.31	36.45	43.0	47.7	45.0	5592
S. Em±	0.1	2.1	2.0	4	2	3	0.2	0.4	0.3	0.68	0.31	0.52	0.1	1.0	0.7	-
C. D. (P=0.05)	0.5	NS	5.0	NS	NS	NS	0.9	1.7	0.7	NS	1.32	1.35	0.6	4.0	1.9	-
Nitrogen schedule																
T_1	190.8	149.0	169.9	386	409	397	53.6	40.3	46.9	41.25	34.39	37.82	39.9	43.4	41.7	5234
T_2	190.5	152.2	171.4	395	409	402	52.9	39.2	46.1	40.33	34.38	37.36	41.2	44.0	42.6	5305
T_3	188.9	140.9	164.9	448	432	440	53.2	51.9	52.5	41.15	35.83	38.49	44.1	47.3	45.7	5603
T_4	188.8	143.7	166.2	401	422	411	52.4	45.8	49.1	40.85	35.39	38.12	43.7	45.3	44.5	5491
T_5	192.0	156.0	174.0	369	389	379	54.3	42.6	48.5	38.68	35.48	37.08	39.2	41.7	40.4	5135
S. Em±	1.2	2.7	1.8	12	10	8	0.9	1.9	1.6	0.89	0.73	0.65	0.8	1.4	0.8	-
C. D. (P=0.05)	NS	5.8	3.6	26	21	16	NS	4.1	3.2	NS	NS	1.31	1.8	2.9	1.5	-

grain yield both. Variety RD 2035 was superior in GEY than RD 2552. The highest GEY was recorded in T_3 followed by T_4 and it was lowest in T_5. Kharub *et al.* (2013) also reported that highest grain yield was obtained when 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). In forage yield, the highest yield was obtained when nitrogen was applied in two splits (2/3 at basal+1/3 immediate after cut) and this was significantly superior to others mainly because of higher application of nitrogen before cut. Singh *et al.* (2012b) also revealed that the application of nitrogen in three splits (1/3 at basal+1/3 immediate after cut+1/3 at 100 DAS) recorded significantly highest grain yield compared to other schedules. The higher yield in three splits may be attributed to better availability of nitrogen to the crop during entire season. However, application of nitrogen in two splits i. e. 2/3 at basal+1/3 immediate after cut was found to be best for obtaining the higher green fodder yield.

CONCLUSION

Based on two-year study, it can be concluded that variety RD 2035 can be taken as dual purpose crop as it is superior in fodder, grain and GEY than RD 2552 and to get best performance of dual purpose barley varieties, nitrogen (75 kg N/ha) should be applied in three splits i. e. 1/3 as basal+1/3 immediate after cut+1/3 at next irrigation.

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