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Evaluation of dual purpose barley for fodder and grain under different cutting schedules

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Abstract

Four varieties and two elite lines of barley were evaluated for fodder production and grain yield at different cutting schedules. Highest mean fodder yield (4.89 t/ha) was recorded in the variety BHS352 followed by HBL276 (4.65 t/ha). Grain yield in the variety HBL276 was consistent under forage harvests and non harvest conditions. The effect of forage harvests on tillers / m^2 was less as compared to dry biomass yield and grain yield. Single forage cutting (75DAS) could be the best practice for getting additional advantage of the crop for fodder production as it had least effect on grain yield. High broad sense heritability suggested the scope of improvement of this character.

Key words : Barley, Fodder yield, Forage, Grain yield

Introduction

Fodder scarcity and availability of limited feed during winter season is a serious problem for livestock production in high altitude of northern hills (Sharma *et al*.,1999). One of the possible reasons for this problem is cultivation of local landraces which are having low yielding ability, high incidence of yellow rust and lodging susceptibility. Farmers' preference for barley cultivation in hills lies in the varieties giving high fodder yield for their livestock and food grain for human consumption. Cultivation of newly released variety "Himadri" having yield potential of 3.86 t/ha with an average yield of 2.10 t/ha, besides blotch and stripe rust resistance would stabilize the barley productivity in northern hills (Kumar and Pal, 2004). The stage of the crop for forage cutting is very important to have maximum fodder with least effect on grain yield. Hence, the research reported in this paper is a step in this direction.

Materials and Methods

The experimental material comprising of four cultivars (BHS 169, BHS 352, HBL 113, HBL 276) and two elite lines (BHS 365, BHS 366) of barley were taken to carry out this study. The seed of each variety was planted @ 100 Kg/ha in 4 rows, 2.5-m long plot, with 23 cm row-to-row distance. The crop with 18 treatments was raised in a randomized block design with three replications at research farm of IARI Regional Station, Tutikandi Centre, Shimla during *Rabi*, 2005-06 under rainfed condition. Recommended dose of fertilizers *i.e.* 40Kg N : 20Kg P_2O_5 as basal and 25% additional dose of nitrogen after each forage cut was applied. Three forage cutting treatments *viz*. C_1 [forage cutting at 65 days after sowing (DAS)] ; C_2 [forage cutting at 75DAS] and C_3 [C_1+ second cutting at 85DAS] were compared for grain yield and agronomic performance of the barley varieties. For forage yield the entire plot was cut and green fodder was weighed. Dry biomass yield of whole plot was recorded after drying the plants in air dryer. Tillers of net plot area ($2.3m^2$) were counted and calculated as tillers / m^2 at the time of maturity. Statistical analysis for significance of varieties and forage cutting treatments was done as per statistical package 'AGRISTAT'. The variability parameters were determined as per the methods suggested by Burton and deVane (1953) and correlation values were worked as per methodology suggested by Dewey and Lu (1959).

Results and Discussion

The analysis of variance revealed significant differences for all the traits among forage cutting and non-cutting treatments. The data observed on the performance of six varieties / elite lines for green fodder, grain yield and other traits at different cutting treatments are presented in Tables 1 and 2.

Table1: Performance of barley varieties for forage and grain yield at different cutting schedules

Cultivar / cutting treatment	BHS169	BHS352	BHS365	BHS366	HBL113	HBL276	Mean
			Green fodder yield (t/ha)				
C_1	1.57	2.33	1.13	2.28	2.65	2.55	2.08
C_2	4.62	6.16	4.41	4.72	4.23	5.35	4.91
C_3	4.12	6.17	3.30	5.48	5.92	6.07	5.18
Mean	3.44	4.89	2.95	4.16	4.27	4.65	4.06
CD (P=0.05) Variety = 0.57 ; Cutting treatment =0.40							
			Dry biomass yield (t/ha)				
C_2	8.25	5.36	7.82	7.82	8.84	7.39	7.58
C_3	4.78	5.65	6.81	6.37	8.54	6.80	6.49
Un-cut	11.3	7.46	8.83	8.54	13.0	8.40	9.59
Mean	8.10	6.15	7.82	7.58	10.14	7.53	7.89
CD (P=0.05) Variety = 0.55 ; Cutting treatment =0.39							
			Grain yield (t/ha)				
C_2	3.13	1.82	2.82	2.52	3.07	2.39	2.62
C_3	1.79	1.81	2.41	1.61	2.32	2.31	2.04
Un-cut	3.62	2.10	3.37	2.52	4.04	2.43	3.01
Mean	2.85	1.91	2.87	2.22	3.14	2.38	2.56
CD (P=0.05) Variety = 0.40 ; Cutting treatment =0.28							

Table 2 : Performance of barley varieties for phenological and growth traits at different cutting schedules.

Cultivar / cutting treatment	BHS169	BHS352	BHS365	BHS366	HBL113	HBL276	Mean
			Heading days				
C_1	121.0	116.0	116.0	122.0	130.0	120.0	120.8
C_2	128.0	122.0	123.0	129.0	141.0	125.0	128.0
C_3	116.0	110.0	112.0	119.0	123.0	114.0	116.4
Mean	124.2	116.1	116.9	123.9	131.4	119.8	122.0
CD (P=0.05) Variety = 0.57 ; Cutting treatment =0.40							
			Maturity days				
C_2	161.0	157.0	160.0	157.0	168.0	160.0	160.5
C_3	164.0	161.0	164.0	160.0	169.0	162.0	163.6
Un - cut	159.0	152.0	157.0	154.0	172.0	156.0	158.6
Mean	162.9	156.6	160.4	157.4	169.9	159.0	161.0
CD (P=0.05) Variety = 0.55 ; Cutting treatment =0.39							
			Tillers / m^2				
C_2	222.05	151.88	210.44	218.84	277.67	225.65	217.7
C_3	280.43	168.55	278.54	239.85	303.76	250.58	253.6
Un - cut	252.89	173.91	265.79	267.68	325.50	223.47	251.5
Mean	251.79	164.78	251.59	242.12	302.31	233.23	240.9
CD (P=0.05) Variety =62.6 ; Cutting treatment =44.3							

Forage and grain yield traits: Fodder yield was recorded highest in BHS352 (4.89 t/ha) followed by HBL276 (4.65 t/ha) under all the cutting treatments, revealing their regeneration capabilities. Highest mean fodder yield (5.18 t/ha) was observed under two forage cuttings (C_3) but the yield (4.91t/ha) was at par in single forage cutting (C_2). Thus the treatment C_2 could be considered as best forage cutting time for getting good amount of fodder and grain yield. Highest mean dry biomass yield (10.14t/ha) was recorded in the variety HBL113 followed by variety BHS169. Average effect of double forage cutting on dry biomass yield was more as compared to single forage cutting on the crop. Maximum reduction in yield (32%) was recorded in the variety HBL113 and minimum (8.43%) in the genotype BHS366, when single forage cutting was obtained. The effect of two forage cuttings on dry biomass yield (57.6%) was drastic in the variety BHS169.

Grain yield was maximum (3.13 t/ha) in BHS169 under single cutting (C_2) whereas the variety BHS365 was highest yielder (2.41t/ha) under two forage cuttings (C_3). Average grain yield was significantly reduced due to forage cutting treatments. Many factors like environmental conditions, management practices, soil moisture, soil fertility and plant genotype can interact with forage harvest in affecting grain yield (Poysa, 1985). He suggested that delaying forage harvest of cereals increases forage yield but can drastically reduce grain yield. However grain yield in the variety HBL276 was almost consistent under all the three treatments.

Phenological and growth traits: Flowering and maturity were delayed due to forage cutting in all the varieties except HBL113. Mean flowering was delayed by 5-12 days and maturity by 2-5 days in cut treatments as compared to non cut treatments. The effect was more pronounced on flowering as compared to maturity. Delay in flowering might be due to extra time taken by the plant to complete its vegetative phase. Maximum tillers/ m^2 (302.3) were observed in the variety HBL113 followed by BHS169 (251.8). This trait was least affected as compared to other traits due to forage cutting.

Genetic variation and correlation studies: The estimated GCV- genetic coefficient of variability (12.3, 21.9) were lower in magnitude than PCV- phenotypic coefficient of variability (18.3, 24.9) for forage yield in single and double forage cut due to environmental factors influencing the expression of these characters. However forage yield in double forage cut showed narrow difference in magnitude between GCV (21.9) and PCV (24.9) indicating minimum influence of environment and occurrence of high broad sense heritability (0.77) suggested the scope of improvement of this character. Fodder yield in single cut as well as in double forage cut was negatively correlated with grain yield indicating its adverse effect on grain yield.

The results of the present study indicated that forage harvest has adverse effect on grain yield and other agronomic traits but these traits were least affected when the crop was harvested for green fodder after 75 days of sowing. Though delaying forage harvest results in higher forage yields but it reduced grain yield (Dunphy *et al*., 1982). Therefore, harvesting the crop at 75 DAS could be considered as best forage cutting time for getting good amount of fodder and grain yield to meet the green fodder and food grain requirements of the hill people up to some extent. The varieties *viz*., BHS352, HBL113 and HBL276 had shown their potential to be cultivated as dual purpose barley in the hills. However multi location testing may verify the potential of these varieties for their commercial cultivation in the entire northern hills zone.

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