Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2017; 6(4): 228-232
Received: 05-05-2017
Accepted: 06-06-2017

Nirmala K Meena
Department of Agronomy
Rajasthan College of Agriculture,
MPUAT, Udaipur, Rajasthan,
India

Versha Gupta
Department of Agronomy
Rajasthan College of Agriculture,
MPUAT, Udaipur, Rajasthan,
India

Hansram Mali
Department of Agronomy
Rajasthan College of Agriculture,
MPUAT, Udaipur, Rajasthan,
India

J Choudhary
Department of Agronomy
Rajasthan College of Agriculture,
MPUAT, Udaipur, Rajasthan,
India

Correspondence
Versha Gupta
Department of Agronomy
Rajasthan College of Agriculture,
MPUAT, Udaipur, Rajasthan,
India

Performance of dual purpose varieties, cutting schedules and fertility levels to growth and productivity of barley (*Hordium vulgare* L.)

Nirmala K Meena, Versha Gupta, Hansram Mali and J Choudhary

Abstract
A field experiment was conducted at Instructional Farm, Department of Agronomy, Rajasthan College of Agriculture, Udaipur (Rajasthan) during the *rabi* 2013-14. The experiment consisted combinations of two dual purpose barley varieties (RD 2715 and RD 2552), three cutting schedules (40, 50 and 60 DAS) and three fertility levels (RDF: 60 kg N+20 kg P2O5/ha, RDF+25% extra N and RDF+50% extra N). These 18 treatment combinations were evaluated under factorial randomized block design with three replications. The results revealed that comparing to variety RD 2552, RD 2715 grew taller and produced significantly higher plant height, number of total tiller, dry matter and LAI at 35 DAS, at fodder cutting and after fodder cutting different successive growth stage and at harvest. Dual purpose barley varieties did not significantly influenced on day to 50 per cent heading and maturity of crop after green fodder cutting. Variety RD 2552 recorded significantly higher grain, straw and biological yield over RD 2715. Various cutting schedules did not significantly influenced on plant height, number of total tiller, dry matter and LAI at 35 DAS. Delaying in cutting of green fodder improved plant height, number of total tillers, dry matter accumulation and LAI at harvest of green fodder. After cutting of green fodder, the plant height and dry matter accumulation at 15, 30, 45 days and at harvest were recorded the maximum when fodder cutting at 40 DAS as compare to 50 and 60 DAS. Days to 50 per cent heading was higher when crop was harvested at 40 DAS for green fodder. Green fodder was cut at 40 and 50 DAS were significantly improved the days to maturity as compare to 60 DAS after green fodder cutting. Green fodder cutting at 60 DAS produced highest green fodder yield (29.80 t ha-1), as compare to 40 DAS and 50 DAS, while grain (4.10 t ha-1), straw (7.09 t ha-1) and biological yield (11.19 t ha-1), produced significantly higher at 40 DAS over 50 DAS and 60 DAS green fodder cutting. Different fertility levels did not significantly influenced on plant height, number of total tiller, dry matter and LAI at 35 DAS. Compared to RDF and RDF + 25 per cent extra N, application of RDF + 50 per cent extra N significantly influenced on plant height, number of total tiller, dry matter and LAI at harvest of green fodder. Application of RDF + 50 per cent extra N significantly increased plant height and dry matter over RDF at 15, 30 and 45 days after green fodder cutting and at harvest. However, found at par with RDF + 25 per cent extra N. Various fertility levels did not significantly influenced on days to 50 per cent heading and maturity after green fodder cutting. Application of RDF + 50 per cent extra N significantly enhanced green fodder, grain, straw and biological yield over application of RDF and RDF + 25 per cent extra N.

Keywords: barley, cutting schedules, RDF, yield

Introduction
Barley (*Hordeum vulgare* L.) is the one of the first domesticated cereals of world agriculture. It is fourth largest cereal crop after maize, wheat and rice in the world with a share of 7 per cent of the global cereal production. The barley is considered as poor man's crop and better adaptable to problematic soils and marginal land. It is not useful for malting, feed and food purpose but also its β – glucanse is useful in lowering the risk of cardio- vascular diseases (Kharub *et al*., 2014) [12]. It is a valuable crop because it is used for food, processed food and feed for livestocks. Besides these conventional uses, it is an important industrial crop. In recent past, India has made an impressive progress in achieving self sufficiency in food grain production by increasing the productivity of several crops. However, forage production for livestock is limited. In India, Rajasthan ranks first in barley area and it was cultivated on 0.31 m ha area during 2012-13 with 0.85 m t of production at an average productivity status of 27.7 q/ha (DWR, 2013-14) [8]. Barley possesses high total biomass, thus the small and marginal farmers of our country used green barley fodder for milch animals. 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 at later stage (DWR, 2010) [7].

Suitable high yielding variety, cutting schedules and mineral fertilization are considered to be most important prerequisite for realizing higher green fodder as well as grain yield (Thomson *et al*., 2009) [22]. Considering these facts and paucity of research findings on these aspects, the present study was undertaken to study in south east Rajasthan.

Material and Methods

The experiment was conducted at Instructional Farm, Rajasthan College of Agriculture, Udaipur. The site is situated in south-eastern part of Rajasthan at an altitude of 579.5 m above mean sea level at 24o35' N latitude and 74o42' E longitude. The region falls under agro-climatic zone IV a (Sub - Humid Southern Plain and Aravalli Hills) of Rajasthan. The experiment consisted of 18 treatment combinations comprising two varieties (RD 2715 and RD 2552), three cutting schedules (40, 50 and 60 DAS) and three fertility levels *viz*., RDF (60 kg N+20 kg P2O5/ha), RDF+25 per cent extra N and RDF +50 per cent extra N. The extra N was applied after green fodder cutting. The experiment was laid out in factorial randomized block design with three replications. The soil of experimental site was clay loam in texture, having slight alkaline reaction (pH 8.1). The soil was medium in available nitrogen (295.3 kg/ha), phosphorus (18.4 kg/ha) and high in available potassium (292.7 kg/ha). The crop was sown manually on 23 November, 2013 in furrows opened at 22.5 cm apart and seeds were placed at a depth of 3-4 cm, using seed rates 100 kg/ha. The dual purpose barley crop was harvested first for green fodder at 40, 50 and 60 DAS as per treatment. After harvest of green fodder, the crop was raised for grain purpose. In RDF, the entire quantity of phosphorus and 1/2 of the nitrogen (30 kg/ha) were drilled in the furrows about 5 cm below seeding zone at the time of sowing and remaining 1/2 dose of nitrogen (30 kg/ha) was top dressed at the time of 1st irrigation, While the extra N was applied after green fodder cutting. The crop was harvested for grain production on 10 April 2014.

Results and Discussion performance of varieties

The data showed that among dual purpose barley varieties, RD 2715 grew taller, having higher plant height, tillers, DMA and LAI at 35 DAS and at harvest of green fodder compared to variety RD 2552 by, Likewise after green fodder cutting, the dual purpose barley variety RD 2715 grew taller, produced higher plant height and dry matter accumulation at 15, 30, 45 days after green fodder cutting and at harvest compared to variety RD 2552. Whereas, results showed that days to 50 per cent heading and days to maturity was not affected by varieties of barley used. The increased number of tillers, plant height and LAI of variety RD 2715 seems to promote leaf formation by higher chlorophyll formation and its stability. Thus increase in these components of photosynthesis process seems to have increased interception, absorption and utilization of radiant energy there by resulting in higher accumulation of photosynthetic and finally dry matter in variety RD 2715 at 35 DAS, at green fodder cutting and different successive stages of crop after green fodder cutting and at harvest compared to RD 2552. These results are in agreement with those obtained by Sirohi (2001) [21]. Barley variety RD 2552 may be attributed to its higher biomass accumulation due to higher number of tillers, plant height and its proper partitioning as evident from equally higher harvest index. Similar results were reported by Shirpurkar *et al.* (2008) [17] and Rawat (2011) [15]. Further higher capability of dual purpose barley variety RD 2552 to produce straw yield seems to be primarily due to increase in morphological parameters (tillers) and stem thickness. The biological yield is a function of grain and straw yields, thus significant increase in biological yield of variety RD 2552 could be ascribed to increase in grain and straw yield. These results are in close agreement with finding of Devaraja and Hegde (2006) [6], Rawat (2011) [15], Vishwakarma *et al*. (2014) [24] and Choudhary *et al*. (2014) [4, 5].

Cutting Schedules

The results 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. In general, overall improvement in growth of green fodder could be ascribed to favourable internal environment of the plants as well as external environment (atmospheric conditions) to which it was exposed during its life cycle. Later at 15, 30, 45 days after green fodder cutting and at harvest, plant height and dry matter increased under cutting of forage at 40 DAS over 50 and 60 DAS. Days to 50 per cent heading was recorded significantly increased under cutting of green fodder at 40 DAS, but days to maturity was obtained highest at 60 DAS could be due to the availability of favourable environmental conditions (external and internal) led to better growth of each components and available for each plant which dictated the availability of various growth inputs to individual plants in the community and also the extent of competition between and within plant for various growth inputs. It is an establish fact that the growth of crop is outcome of genomic and environment interaction. The results are in accordance with findings of Siddique *et al.* (2008) [18], Chander *et al*. (2009) [3] and Bakht *et al.* (2010) [2]. The grain, straw and biological yield were significantly higher when cutting was done at 40 DAS for green fodder but green fodder yield was produced highest at 60 DAS. This may be due to the more yield attributes and growth with earlier cutting of green fodder. The similar findings were also reported by Singh and Dubey (2007) [20].

Effect of Fertility Levels

The results showed that increasing level of nitrogen kg ha-1 for dual purpose barley resulted in increased plant height, total number of tillers, dry matter and LAI at different succisive stages of crop after green fodder cutting. Plant height and dry matter at 15, 30, 45 days after green fodder cutting and at harvest improved significantly with application of RDF + 50 per cent extra N and RDF + 25 per cent extra N compare to RDF. This might be due to mineral nutrients N and P are considered to be most important for exploiting genetic potential of crop through growth and development. The fertility levels did not influence days to 50 per cent heading and maturity of crop. Increasing fertility levels enrich the soil media, thus better and higher availability of these nutrients right from sowing caused vigorous growth of individual plant as reflected through increased plant height and dry matter at successive growth stages after green fodder cutting. Similar findings were also reported by Singh *et al.* (2013) [19]. Nitrogen is considered to be essential for synthesis of chlorophyll, which is of great physiological significance in plant system, whereas, P is involved in root growth. It also plays an active role in formation of high energy phosphates which are unstable in water and act as carrier for vital reactions like oxidation of sugars through enhancing

enzymatic activities and in initial reaction for photosynthesis etc. Similar findings have been reported by Havlin *et al*. (2003) [9], Tiwana *et al*. (2012) [23] and Raval *et al.* (2014) [14]. The larger canopy development and plant height under application of increasing level of N could be reason for increased interception, absorption and utilization of radiant energy which in turn increased overall growth, photosynthesis, LAI, total tillers, plant height and finally dry matter. The observed relationship is in close agreement with finding of John *et al.* (2008) [10], Narolia (2009) [13], Rawat (2011) [15] and Raval *et al.* (2014) [14]. The significant improvement in aforesaid yield attributes led
to highest green fodder, grain, straw and biological yield of 29.78, 3.56, 6.86 and 10.42 t ha-1 under application of RDF + 50 per cent extra N as to compared RDF and RDF + 25 per cent extra N. Similar findings were also reported by Arif *et al.* (2010) [1] and Khalil *et al.* (2011) [11]. The significant increase in straw yield with additional N fertilization seems to be due to its direct effect in improving biomass plant-1 at successive growth stages as well as in plant part at harvest of the crop, while the indirect effect might be on account of increase in various morphological parameters *viz.*, plant height and number of tillers. Further, biological yield is a function of grain and straw yield representing reproductive and vegetative growth of the crop. The results of present investigation indicated higher production of dual purpose barley under influence of higher fertility levels. These results are in close conformity with the findings of Sharma and Verma (2010) [16] and Rawat (2011) [15], Tiwana *et al.* (2012) [23] and Raval *et al.* (2014) [14].

Table 1: Effect of cutting schedules and fertility levels on plant height, number of total tillers, dry matter and leaf area index of dual purpose barley varieties at 35 DAS

Treatments	Plant height (cm)	Number of total tillers (0.5 m-1 row length)	Dry matter g (0.5 m-1 row length)	Leaf area index
Varieties				
RD 2715	33.70	64.87	18.53	2.08
RD 2552	29.06	58.23	15.82	1.61
S Em±	0.59	0.94	0.18	0.03
C D (P=0.05)	1.71	2.70	0.53	0.07
Cutting Schedules				
40 DAS	31.88	60.22	16.95	1.83
50 DAS	32.18	62.15	17.28	1.84
60 DAS	30.08	62.28	17.30	1.86
S Em±	0.73	1.15	0.23	0.03
C D (P=0.05)	NS	N.S	N.S	N.S
Fertility Levels				
RDF (60 kg N + 20 kg				
P2O5 ha-1)	31.22	61.35	16.85	1.83
RDF + 25 per cent extra N	32.18	61.45	17.14	1.85
RDF + 50 per cent extra N	30.74	61.85	17.54	1.86
S Em±	0.73	1.15	0.23	0.03
C D (P=0.05)	NS	NS	NS	NS

Table 2: Effect of cutting schedules and fertility levels on plant height, number of total tillers, dry matter and leaf area index of dual purpose barley varieties at harvest of green fodder

Treatments	Plant height (cm)	Number of total tillers (0.5 m-1 row length)	Dry matter (g) 0.5 m-1 row length	Leaf area index
Varieties				
RD 2715	57.19	69.17	38.44	3.61
RD 2552	51.34	59.71	32.95	3.09
S Em±	1.04	1.04	0.58	0.02
C D (P=0.05)	2.98	2.98	1.66	0.07
Cutting Schedules				
40 DAS	45.68	60.16	31.36	2.94
50 DAS	54.12	64.98	36.22	3.40
60 DAS	62.99	68.18	39.50	3.71
S Em±	1.27	1.27	0.71	0.03
C D (P=0.05)	3.64	3.65	2.03	0.09
Fertility Levels				
RDF (60 kg N + 20 kg P2O5 ha-1)	50.39	63.30	30.00	2.82
RDF + 25 per cent extra N	55.55	63.71	36.94	3.47
RDF + 50 per cent extra N	56.86	66.32	40.14	3.77
S Em±	1.27	1.27	0.71	0.03
C D (P=0.05)	3.64	3.65	2.03	0.09

Table 3: Effect of cutting schedules and fertility levels on plant height of dual purpose barley varieties after green fodder cutting

Treatments	Plant height (cm)			
	15 DAC	30 DAC	45 DAC	At Harvest
Varieties				
RD 2715	24.28	53.46	70.79	71.16
RD 2552	22.67	49.66	65.60	67.14
S Em±	0.45	0.84	0.80	0.72
C D (P=0.05)	1.29	2.42	2.29	2.07
Cutting Schedules				
40 DAS	25.87	53.53	74.75	74.21
50 DAS	24.48	52.94	69.60	72.74
60 DAS	20.08	48.21	60.24	60.51
S Em±	0.55	1.03	0.98	0.88
C D (P=0.05)	1.58	2.96	2.81	2.53
Fertility Levels				
RDF (60 kg N + 20 kg P2O5 ha-1)	22.74	46.40	66.00	65.12
RDF + 25 per cent extra N	22.13	51.05	67.89	69.49

Table 4: Effect of cutting schedules and fertility levels on dry matter accumulation of dual purpose barley varieties after green fodder cutting

Treatments		DMA (g) 0.5 m-1 row length		
	15 DAC	30 DAC	45 DAC	at harvest
Varieties				
RD 2715	7.32	21.46	29.11	87.00
RD 2552	7.34	17.49	26.59	84.07
S Em±	0.17	0.36	0.36	0.91
C D (P=0.05)	NS	1.03	1.03	2.62
Cutting Schedules				
40 DAS	8.39	22.11	33.31	105.07
50 DAS	8.08	21.03	26.12	94.33
60 DAS	5.50	15.28	24.11	57.22
S Em±	0.21	0.44	0.44	1.12
C D (P=0.05)	0.59	1.26	1.27	3.21
Fertility Levels				
RDF (60 kg N + 20 kg P2O5 ha-1)	6.96	18.64	25.91	83.24
RDF + 25 per cent extra N	7.28	19.52	28.90	85.53
RDF + 50 per cent extra N	7.74	20.26	28.73	87.85
S Em±	0.21	0.44	0.44	1.12
C D (P=0.05)	0.59	1.26	1.27	3.21

Table 5: Effect of cutting schedules and fertility level on days to 50 % heading and maturity of dual purpose barley varieties after green fodder cutting

Treatments	Days to 50 % heading	Days to maturity
Varieties		
RD 2715	78.63	123.22
RD 2552	79.89	123.30
S Em±	1.04	0.26
C D (P=0.05)	NS	NS

Conclusion

The results of present investigation indicated that significantly higher grain (3.52 t ha-1) and straw yield (6.48 t ha-1) were recorded with barley variety RD 2552. The variety RD 2715 gave higher green fodder yield (28.46 t ha-1) but found at par with RD 2552. The cutting of barley for green fodder at 40 DAS recorded significantly higher grain (4.09 t ha-1) and straw yield (7.07 t ha-1) while highest green fodder yield was obtained highest when cutting was done at 60 DAS however, it was at par with cutting at 50 DAS. Though significant results for green fodder and grain yield were obtained by applying RDF + 25 per cent extra N but significantly higher straw yield was obtained by apply RDF + 50 per cent extra N.

References

1. Arif M, Jan NU, Khan H, Akbar SA, Khan SA, Khan MJ *et al*. Impact of plant populations and nitrogen levels on maize. Pakistan Journal of Botany. 2010; 42(6):3907-3913.
2. Bakht J, Shafi M, Khan MA, Shah Z. Effect of foliage VS soil application of nitrogen on yield and yield components of wheat varieties. Pakistan Journal of Botany. 2010; 42(4):2737-2745.
3. Chander S, Sharma KC, Jat HS, Meena RP. Influence of varieties and cutting schedules of perennial pasture grasses on soil fertility, nutrients content and uptake, productivity and economics in hot arid conditions of Rajasthan. Indian Journal of Agricultural Science. 2009; 79(10):798-803.
4. Choudhary KK, Yadav NS, Yadav SL, Jat RC. Green fodder yield and quality of barley (*Hordeum vulgare* L.) as affected by levels of nitrogen. Forage Research. 2014; 39(4):190-196.
5. Choudhary M, Prabhu G. Quality fodder production and economics of dual- purpose pearl millet (*Pennisetum glaucum*) under different fertility levels and nitrogen scheduling. Indian Journal of Agronomy. 2014; 59(3):410-414.
6. Devaraja M, Hegde R. Yield attributes of malt barley (*Hordeum vulgare* L.) as influenced by nitrogen, phosphorus, potassium and their correlation and regression with yield. Agricultural Science Digest. 2006; 26:48-50.
7. DWR. Progress Report, All India Coordinated Wheat

Improvement Project, Directorate of Wheat Research, Karnal, Haryana. 2010; 6(4):28-4.31.
8. DWR. Progress Report, All India Coordinated Wheat Improvement Project, Directorate of Wheat Research, Karnal, Haryana. 2013-14; 6:1-1.
9. Havlin JL, Beaton JD, Tisdale SL, Nelson WL. Soil fertility and fertilizer, IV Edition, Pearson Education Pvt. Ltd. Indian Branch, 482 FIE Patpargani, Delhi, India. 2003.
10. John T, Donovan O, Georage WC, Clayton A, Grant K, Neil HT. Effect of nitrogen rate, placement and seeding rate on barley productivity and wild oat fecundity in a zero tillage system. Crop Science. 2008; 48:1569- 74.
11. Khalil SK, Khan F, Rehman A, Muhammad F, Amanullah, Khan AZ. Dual purpose wheat for forage and grain yield in response to cutting, seed rate and nitrogen. Pakistan Journal of Botany. 2011; 43(2):937-947.
12. Kharub AS, Verma RPS, Kumar Dinesh Kumar, Vishnu, Selvakumar, Rajan. Dual purpose barley (*Hordeum vulgare* L.) in India: Performance and potential. Journal of Wheat Research. 2014; 5(1):55-58.
13. Narolia GP. Response of malt barley (*Hordeum vulgare* L.) to levels and scheduling of nitrogen application under varying growing environments. Ph.D. Thesis, Department of Agronomy, SKRAU, Bikaner. 2009.
14. Raval CH, Patel AM, Rathore BS, Vyas KG, Bedse RD. Productivity, quality and soil as well as economics of multi-cut summer forage pearl millet as influenced by varying levels of irrigation and nitrogen. Research on crops. 2014; 15(4):785-789.
15. Rawat DS. Performance of dual purpose barley (*Hordeum vulgare* L.) varieties under varying seed rates and fertility management. M.Sc. (Ag.) Thesis, Department of Agronomy, MPUAT, Udaipur. 2011.
16. Sharma RK, Verma RPS. Effect of irrigation, nitrogen and varieties on the productivity and grain malting quality in barley. Cereals Research Communication. 2010; 38:419-428.
17. Shirpurkar GN, Wagh MP, Patil DT. Comparative performance of wheat genotypes under different sowing dates. Agricultural Science Digest. 2008; 28:231-232.
18. Siddiqui MH, Mohammad F, Khan MN, Mansoor M, Khan A. Cumulative effect of soil and foliar application of nitrogen, Phosphorus and sulphur on growth, physiobiochemical parameters, yield attributes and fatty acid composition in oil of erucic acid free rapeseed mustard genotypes. Journal of Plant Nutrition. 2008; 31:1284-1298.
19. Singh J, Mahal SS, Singh A. Productivity and quality of malt barley (*Hordeum vulgare* L.) as affected by sowing date, rate and stage of nitrogen application. Indian Journal of Agronomy. 2013; 58:72-80.
20. Singh SD, Dubey SN. Soil properties and yield of fodder oats (*Avena staiva* L.) as influenced by sources of plant nutrient and cutting management. Forage Research. 2007; 33(2):101-103.
21. Sirohi A. Effect of sowing dates and fertility levels on productivity of different varieties of barley (*Hordeum vulgare* L.). M.Sc. (Ag.) Thesis, Maharana Pratap University of Agriculture and Technology, Udaipur. 2001.
22. Thomason WE, Brooks WS, Griffey CA, Vaughn ME. Hulless barley seeding rate effect on grain yield and yield components. Crop Sciences. 2009; 49:342-46.
23. Tiwana US, Singh A, Rani U. Productivity, quality, nitrate- N and disease incidence in fodder pearl millet (*Pennisetum glaucum*) as influenced irrigation and nitrogen levels. Range management and Agroforestry. 2012; 33:69-72.
24. Vishwakarma SR, Kumar B, Kumar Y, Singh Y. Emerging dual purpose barley for green forage and grain yield under partially reclaimed soils. Annals of Agricultural Bio Research. 2014; 19(2):256-258.