International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(2): 1368-1371

Received: 09-01-2020
Accepted: 13-02-2020

Patel PA
Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Gujarat, India

Patel PM
Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Gujarat, India

Patel JM
Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Gujarat, India

Patel CK
Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Gujarat, India

Joshi JR
Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Gujarat, India

Corresponding Author:
Patel PA
Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Gujarat, India

Response to date of sowing and nitrogen levels on growth, yield and yield attributes and economics of fodder barley (*Hordeum vulgare* L.) under north Gujarat condition

Patel PA, Patel PM, Patel JM, Patel CK and Joshi JR

DOI: https://doi.org/10.22271/chemi.2020.v8.i2u.8953

Abstract
A field experiment was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, S.D.A.U., Sardarkrushinagar to study the "Response of fodder barley (*Hordeum vulgare* L.) To date of sowing and nitrogen levels" during *Rabi* season of 2018-19. The soil of experimental field was loamy sand in texture with low in organic carbon (0.25%) and available nitrogen (163 kg/ha), medium in available phosphorus (38.2 kg/ha) and high in available potash (288 kg/ha) having pH value of 7.40. Total twelve treatment combinations comprising four levels of date of sowing in main plot *viz*., 20th October, 1st November, 10th November and 20th November and three levels of nitrogen in sub plot *viz*., 80 kg N/ha,100 kg N/ha and 120 kg N/ha were laid out in split plot design with four replications. Sowing of the fodder barley on 10th November recorded significantly higher growth and yield attributes, green forage (362.7 q/ha), dry fodder (93.7 q/ha), net returns (38,104 Rs/ha) and BCR ratio (2.11) at total of both cuts than other date of sowing. Fertilizing the fodder barley crop with 120 kg N/ha gave significantly higher value for all growth and yield attributes, green forage, dry fodder, net returns and BCR ration than other nitrogen levels.

Keywords: barley, date of sowing, economics, growth, nitrogen levels, yield and yield attributes

Introduction
Agriculture and animal husbandry in India are interwoven with the intricate fabric of the society in cultural, religious and economical ways as mixed farming and livestock rearing forms an integral part of rural living. The farmer possessing the livestock breeds with higher milk yield potential and suffering from deficit in fodder availability in the country. Total forage production in India is 866.6mt. In which 400mt. green fodder production and 446mt. dry fodder production. Whereas, the annual forage requirement is 1706mt. (1097mt. green fodder and 609mt. dry fodder). Deficit in green fodder production is 696mt. (63.50%) and 143mt. (23.56%) deficit in dry fodder (Bhagmal *et al.*, 2014) [3].

Among various cereals, Barley (*Hordeum vulgare* L.) is one of the founder crops of old world agriculture and was one of the first domesticated cereals. Barley is the major cereal in many dry areas of the world and is vital for the livelihoods of many farmers. Barley fodder may be a viable source of income generation for farmers. It has high capacity for tillering and re-growth after cutting and additional capacity for large accumulation of biomass rapidly after re-growth. Its fodder is also palatable.

Date of sowing is one of the important factors for higher production as it determines the optimum time of sowing of the crop. An optimum time of sowing enhances the efficiency of barley by exploiting growth factors in an effective manner. Optimum date of sowing is necessary for maximum possible yield of good quality green fodder because availability of highest nutritive stage for longer duration is desired. It is therefore, almost necessary to determine the optimum date of sowing of barley crop for good quality and quantity of green forage yield.

Plant nutrients also play an important role in fodder crop production. Nitrogen is the key element in achieving consistently high yields in cereals. The major constraints for production in the state are poor nitrogen status of the soils.

Nitrogen is commonly the most limiting nutrient for crop production in the majority of the world's agricultural areas and therefore adoption of good nitrogen management strategies often results in large economic benefits to farmers. Nitrogen is a vitally important and is one of the universally deficient plant nutrients in most of the Indian soils particularly in the loamy sand soils of semi-arid regions. It is an essential constituent of plant proteins and chlorophyll and is present in many other compounds of greater physiological importance in plant metabolism *viz.,* nucleotides, phospholipids, enzymes, hormones, vitamins *etc.* It governs to a considerable degree the utilization of carbohydrates, potassium, phosphorous and other elements. Nitrogen being an essential constituent of protein, nucleic acid and chlorophyll plays a major role in photosynthesis and chlorophyll synthesis (Kanwar, 1976) [12].

Materials and Methods

The field experiment was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, S.D.A.U., Sardarkrushinagar to study the "Response of fodder barley (*Hordeum vulgare* L.) To date of sowing and nitrogen levels" during *Rabi* season of 2018-19. Geographically, Sardarkrushinagar Dantiwada Agricultural University, where the experiment was laid out is situated at 24º-19' North latitude and 72º-19' East longitude with an elevation of 154.52 metre from the mean sea level. The climate of this region is sub-tropical monsoon type and falls under semi-arid region. In general, monsoon is warm and moderately humid, winter is fairly cold and dry, while summer is largely hot and dry. The soil of experimental field was loamy sand in texture with low in organic carbon (0.25%) and available nitrogen (163 kg/ha), medium in available phosphorus (38.2 kg/ha) and high in available potash (288 kg/ha) having pH value of 7.40. Total twelve treatment combinations comprising four levels of date of sowing in main plot *viz*., 20th October, 1st November, 10th November and 20th November and three levels of nitrogen in sub plot *viz*., 80 kg N/ha,100 kg N/ha and 120 kg N/ha were laid out in split plot design with four replications. The seed of fodder barley (RD 2052) variety were drilled manually to a depth of 2-3 cm in the previously opened furrows at a distance of 22.5 cm between the two rows and lightly covered with the soil. The crop was fertilized as per treatments where the half dose of nitrogen in the form of urea and full dose of phosphorus in the form of di-ammonium phosphate were applied as basal dose in the previously opened furrow just before sowing. Nitrogen was applied as per treatments in two equal split at basal and after first cut phosphorous was applied as a common dose @ 60kg/ha for all plots as basal. The crop was harvested treatment wise at 50% flowering stage.

Results and Discussion

Growth attributes

Barely crop exhibited significant response to date of sowing and nitrogen level son growth attributes. The periodical observation *viz*., plant height, leaf length, number of leaves per plant, number of tillers per meter row length and leaf: stem ratio (Table 1) at1st and 2nd cut showed significant difference due to date of sowing. The maximum values for plant height (81.55 and 73.51 cm), leaf length (19.80 and 16.07 cm), number of leaves per plant (10.59 and 9.87), number of tillers per meter row length (89.5 and 95.8) and leaf: stem ratio (0.51 and 0.46) at 1st and 2nd cut were recorded under barley sowing during 10th November. The taller plants in the 10th November sowing might be due to favourable temperature effect on the growth of plants. The present findings are in accordance with the findings of Fazal *et al*. (2012a) [9], Khan *et al*. (2014) [13] and Sharma *et al*. (2017) [19]. The application of 120 kg N/ha at 1st and 2nd cut increased plant height, leaf length, number of leaves per plant, number of tillers per meter row length and leaf: stem ratio but, it was statistically Sam bar with nitrogen level 100 kg/ha than 80 kg N/ha. Improvement in growth attributes due to application of nitrogen 120 kg/ha accelerated meristematic activity on account of availability of nitrogen in sufficient quantity and right time during the entire growth period of the crop and higher rate of nitrogen per hectare to enhanced production of leaf material as compared to stem in plant. These results confirm the findings of Fazal *et al*. (2012) [10], Dubey *et al*. (2013) [8], Khan *et al*. (2014) [13] and Aleminew and Legas (2015) [2].

Yield attributes and yield

Date of sowing influence significantly on green forage and dry fodder yield at first cut, second cut and total of both cuts (Table 2). The better performance of forage barley observed in term of plant height, leaf length, number of leaves per plant, number of tillers per meter row length and leaf: stem ratio was observed by sowing the fodder barley on 10th November which ultimately reflected on higher green forage and dry fodder yield of barely. Significantly the highest green forage yield (207.4, 154.6 and 362.1 q/ha) was recorded by taking first, second and total cut on 10th November sowing. The increased in green forage yield by the 10th November sowing was to the tune of 15.80, 17.03 and 16.31 per cent than that of 20th October sowing at first cut, second cut and total green forage yield, respectively. The remarkable increase in yields with normal sowing might be attributed due to favourable effect on growth attributes. This might have ultimately resulted in higher photosynthetic activities and also in production of more photosynthesis. The increase in green forage yield was also observed by Singh *et al*. (2004) [21] and Sharma *et al*. (2017) [19]. Similar trend was also observed for dry fodder yield (53.7, 39.9 and 93.7 q/ha) of barely because of higher green forage yield, so the dry fodder yield was more in the 10th November of sowing as compared to other date of sowing. The increased in dry fodder yield was also observed by Razzaque and Rafiquzzaman (2006) [17], Shekara and Lohithaswa (2012) [20] and Dar *et al*. (2014) [6]. Significantly higher green forage yield (211.2, 155.0 and 366.3 q/ha) was recorded by the application of 120 kg N/ha at first cut, second cut and total green forage yield, respectively. The percentage increased in green forage yield by the application of 120 kg N/ha was to the tune of 18.05, 15.84 and 17.10 per cent than that of 80 kg N/ha at first cut, second cut and total green forage yield, respectively. The remarkable increase in yields with higher levels of nitrogen might be attributed due to favourable effect on growth attributes (Table 1). The increase in leafy part due to nitrogen application might have ultimately resulted in higher photosynthetic activities and also in production of more photosynthesis. As a result of which, nitrogen yielded better response on forage yield of barely crop. More or less similar response to nitrogen has been reported by Yadav and Mali (2012) [22], Dubey *et al*. (2013) [8], Choudhary *et al*. (2014) [4] and Dahipahle *et al*. (2017) [5]. Similarly, dry fodder yield were also recorded significantly higher with application of nitrogen 120 kg/ha than other treatments. Application of 120 kg N/ha which accounted 8.75, 16.56 and 12.01 per cent higher than that of 80 kg N/ha at first cut, second cut and total dry fodder yield, respectively.

The dry fodder yield followed the same trend as observed in green forage yield due to application of nitrogen. Nitrogen is used largely in synthesis of protein, but structurally it is a constituent of chlorophyll molecule combined with carbohydrates and fatty acids. It helps in formation of protoplasm, which is the physical base of a life of the plant. Thus, more production of dry matter can be explained at higher nitrogen rates. The higher dry matter yield with higher nitrogen rates also reported by Alam and Haider (2006) [1], Meena *et al*. (2012) [15], Dubey *et al*. (2013) [8] and Dahipahle *et al*. (2017) [5].

Economics

Economics is the major consideration for the farmers while taking a decision regarding the adoption of new technology. Fodder barely sowing during 10th November recorded higher net returns (38,104 Rs/ha) and benefit cost ratio (2.11) over other date of sowing (Table 3). This was due to higher green forage yield recoded barely during 10th November sowing. These results are conformity with those reported by Kalhapure and Shete (2013) [11], Dar *et al*. (2016) [7] and Reddy *et al*. (2018) [18]. Application of nitrogen 120 kg/ha recorded higher net returns (46,396 Rs/ha) and benefit cost ratio (2.73) over 100 and 80 kg N/ha. The higher net returns and BCR under these treatments was mainly due to higher yields. Similar results were also reported by Kumpawat (2009) [14], Meena *et al*. (2012) [15] and Puniya *et al*. (2015) [16].

Conclusion

It can be concluded that fodder barley (RD 2052) should be sown during on 1st to 20th November and fertilizing with 120 kg N/ha under North Gujarat condition for obtaining higher green forage yield and net realization.

Table 1: Plant height, leaf length, number of leaves per plant, number of tillers per metre row length and leaf: stem ratio of fodder barley as influenced by date of sowing and nitrogen levels

Treatments	Plant height (cm)		Leaf length (cm)		Number of leaves per plant		Number of tillers per metre row length		Leaf: stem ratio	
	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
Main plot: Date of sowing (D):										
20th October	66.00	61.16	17.12	14.26	9.20	8.61	77.0	85.1	0.37	0.34
1st November	78.18	71.82	19.62	15.02	9.56	9.46	87.7	91.4	0.48	0.45
10th November	81.55	73.51	19.80	16.07	10.59	9.87	89.5	95.8	0.51	0.46
20th November	73.00	65.62	19.50	14.66	9.36	8.81	80.0	85.2	0.41	0.39
S.Em.±	2.495	2.037	0.546	0.377	0.316	0.272	2.62	2.58	0.013	0.012
C.D. at 5%	7.98	6.52	1.75	1.21	1.01	0.87	8.41	8.26	0.04	0.04
C.V. (%)	11.57	10.37	9.94	8.72	11.30	10.25	10.89	10.00	10.36	10.18
Sub plot: Nitrogen levels (N) kg/ha:										
80 kg/ha	65.84	64.21	18.25	14.46	9.20	8.93	80.1	85.3	0.42	0.36
100 kg/ha	76.73	68.96	19.06	15.18	9.88	9.04	84.1	88.6	0.44	0.42
120 kg/ha	81.47	70.91	19.73	15.36	9.96	9.60	86.4	94.3	0.46	0.44
S.Em.±	1.92	1.41	0.38	0.22	0.22	0.19	1.68	2.04	0.01	0.01
C.D. at 5%	5.61	4.11	1.11	0.64	0.65	0.57	4.91	5.95	0.03	0.03
C.V. (%)	10.29	8.28	7.98	5.83	9.18	8.49	8.05	9.11	9.21	9.40

Table 2: Green forage yield and dry fodder yield of fodder barley as influenced by date of sowing and nitrogen levels

Treatments	Green forage yield (q/ha)			Dry fodder yield (q/ha)		
	1st cut	2nd cut	Total	1st cut	2nd cut	Total
Main plot: Date of sowing (D):						
20th October	179.1	132.1	311.3	46.3	34.2	80.6
1stNovember	196.6	146.8	343.4	50.8	38.0	88.9
10thNovember	207.4	154.6	362.1	53.7	39.9	93.7
20thNovember	193.5	143.2	336.7	50.1	37.0	87.2
S.Em.±	5.91	4.31	10.16	1.52	1.17	2.67
C.D. at 5%	18.9	13.8	32.5	4.89	3.75	8.55
C.V. (%)	10.55	10.37	10.41	10.52	10.87	10.57
Sub plot: Nitrogen levels (N) kg/ha:						
80 kg/ha	178.9	133.8	312.8	48.0	34.4	82.4
100 kg/ha	192.4	143.6	336.1	50.4	37.5	87.9
120 kg/ha	211.2	155.0	366.3	52.2	40.1	92.3
S.Em.±	4.25	3.39	6.29	1.06	0.86	1.46
C.D. at 5%	12.4	9.9	18.3	3.09	2.51	4.26
C.V. (%)	8.76	9.41	7.44	8.42	9.21	6.66

Table 3: Economics of the different treatments on fodder barley as influenced by date of sowing and nitrogen levels

Treatments	Green forage yield (q/ha)	Gross realization (Rs/ha)	Cost of production (Rs/ha)	Net realization (Rs/ha)	Benefit: Cost ratio (BCR)
Main plot: Date of sowing (D):					
20th October	311.3	62264	35422	26842	1.76
1st November	343.4	68684	34322	34362	2.00
10th November	362.1	72426	34322	38104	2.11
20th November	336.7	67354	33222	34132	2.03
Sub plot: Nitrogen levels (kg/ha) (N):					
80 kg/ha	312.8	62562	26308	36254	2.38
100 kg/ha	336.1	67224	26586	40638	2.53
120 kg/ha	366.3	73260	26864	46396	2.73

References

1. Alam MZ, Haider SA. Growth attributes of barley (*Hordeum vulgare* L.) cultivars in relation to different doses of nitrogen fertilizer. Journal of Life Earth Science. 2006; 1(2):77-82.
2. Aleminew A, Legas A. Grain quality and yield response of malt barley varieties to nitrogen fertilizer on brown soils of Amhara Region, Ethiopia. World Journal of Agricultural Sciences. 2015; 11(3):135-143.
3. Bhagmal Sing KA, Roy AK, Ahamad Shahid, Malaviya DR. Hand Book of Agriculture, 2014, 1353-1417.
4. Choudhary KK, Yadava 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. Dahipahle AV, Sharma M, Kumar S, Singh H, Kashyap SK, Kumar V. Appropriate nitrogen management: A tool for potential fodder oat production. International Journal of Current Microbiology and Applied Science. 2017; 6(5):1860-1865.
6. Dar NA, Singh KN, Ahmad L, Sofi JA, Bhat EM, Kotru R. Influence of dates of sowing, cultivars and different fertility levels on fodder oat (*Avena sativa* L.) under temperate conditions of Kashmir valley (India). Range Management and Agroforestry. 2014; 35(1):51-55.
7. Dar NA, Singh KN, Ahmad L, Sofi JA, Bhat EM, Kotru R. Influence of dates of sowing, cultivars and different fertility levels on fodder oat (*Avena sativa* L.) under temperate conditions of Kashmir valley (India). Range Management and Agroforestry. 2016; 41(4):249-252.
8. Dubey A, Rathi JS, Sahu R. Effect of nitrogen levels on green fodder yield of oat (*Avena sativa* L.) varieties. Forage Research. 2013; 39(1):39-41.
9. Fazal H, Arif M, Hussain F. Response of dual purpose barley to rates and methods of nitrogen application. ARPN Journal of Agricultural and Biological Science. 2012a; 7(7):512-521.
10. Fazal H, Hussain F, Arif M. Effect of different nitrogen levels and cutting on growth behaviour of dual purpose barley. Journal of Agricultural Science. 2012b; 2(10):263-268.
11. Kalhapure AH, Shete BT. Response of rainfed sorghum (*Sorghum bicolor* L.) to moisture conservation techniques and sowing dates in *Rabi* season. Karnataka Journal of Agricultural Sciences. 2013; 26(4):502-505.
12. Kanwar JS. Soil fertility, theory and practices. ICAR Publication, New Delhi, India, 1976.
13. Khan A, Munsif F, Akhtar K, Afridi MZ, Zahoor Ahmad Z, Fahad S *et al*. Response of fodder maize to various levels of nitrogen and phosphorus. American Journal of Plant Sciences. 2014; 5(15):2323-2329.
14. Kumpawat BS. Effect of soil ameliorates and nitrogen on growth and yield of barley (*Hordeum vulgare* L.) under alkali water conditions. Haryana Journal of Agronomy. 2009; 25 (1-2):35-38.
15. Meena LR, Mann JS, Meena SL. Effect of levels and mode of nitrogen application on dual purpose barley (*Hordeum vulgare* L.) under semi-arid condition. Indian Journal of Agronomy. 2012; 57(2):168-170.
16. Puniya MM, Yadav SS, Shivran AC. Productivity, profitability and nitrogen-use efficiency of barley (*Hordeum vulgare* L.) as influenced by weed management and nitrogen fertilization under hot semi-arid ecologies of Rajasthan. Indian Journal of Agronomy. 2015; 60(4):564-569.
17. Razzaque MA, Rafiquzzaman S. Effect of time of sowing on the yield and yield attributes of barley under rainfed condition. Bangladesh Journal Science of Inlands Research. 2006; 41(1-2):113-118.
18. Reddy BC, Singh R. Effect of sowing dates and levels of nitrogen on growth and yield of barley (*Hordeum vulgare* L.). Journal of Pharmacognosy and Phytochemistry. 2018; 7(4):1500-1503.
19. Sharma V, Singh P, Sharma S. Effect of sowing dates and initial cutting time on forage yield and quality of oat in mid hills of North West Himalayas. International Journal of Science, Environment and Technology. 2017; 6(3):2030-2035.
20. Shekara BG, Lohithaswa HC. Effect of time of sowing, seed rate and planting geometry on green forage yield and quality of fodder oat. Forage Research. 2012; 38(2):122-124.
21. Singh M, Harphoolsingh R, Choudhary R, Jat BL. Effect of date of sowing and seed rate on forage production of barley (*Hordeum vulgare* L.). Forage Research. 2004; 30(3):137-139.
22. Yadava NS, Mali OP. Nitrogen management in dual purpose barley (*Hordeum vulgare* L.) a suitable crop diversification in western Rajasthan. International Agronomy Congress. 2012; 2:522-523.