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EFFECT OF METHOD OF SOWING AND NITROGEN APPLICATION METHOD ON YIELD AND QUALITY OF BARLEY (*HORDEUM VULGARE*)

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SUMMARY

A field experiment was conducted to study the effect of method of nitrogen application on yield and quality of barley under furrow irrigated raised bed system (FIRBS). FIRBS 90 cm (3 rows) resulted in significantly higher grain, straw and biological yield as compared to FIRBS 90 cm (2 rows), FIRBS 75 cm (2 rows) and flat sowing. Application of nitrogen (N) on top of bed also brought significant improvement on grain and straw yield over N application by broadcasting method. Application of N on top of bed increased the protein content, husk content and decreased in the malt yield and hot water extract over N application by broadcasting, however, N application before or after irrigation either on top of bed or broadcast did not reflect any significant variation in terms of yield and quality parameters.

Key words : Barley, furrow irrigated raised bed system (FIRBS), N application method, yield, quality

Barley is usually used as food for human-beings and feed for livestock and pou1try and is also a valuable input for industries for extracting malt to be utilized in brewing, distillation, baby foods, cocoa malt drinks and ayurvedic medicines. Each 100 g of barley grain comprise 10.6 g protein, 2.1 g fat, 64 g carbohydrate, 50 mg calcium, 6.0 mg iron, 0.31 mg vitamin B_1, 0.10 mg vitamin B_2 and 50 mg folate (Vaughan *et al.*, 2006). After the green revolution, introduction of high yielding feed and malt barley varieties coupled with improved method of fertilizer application and irrigation facilities have increased total food grain production. Nitrogen is the most important input for realizing potential yield of any crop as requirement for nitrogen is the highest among all the essential plant nutrients and this nutrient is most limiting under Indian conditions. Nitrogen is the main constituent of amino acids which are precursor to protein. So, malt barley grain yield, grain protein and kernel plumpness are the characteristics strongly related to available nitrogen (Grant, 2000). Time and method of nitrogen application is very important for improving its use efficiency. Application of full dose of nitrogen at sowing may not be able to meet the nutritional requirement of the crop up to maturity and may result in lower grain yield and low nitrogen content. While split application of nitrogen may increase protein content of grain, its higher rates can result in translocation of excessive amount of nitrogen from vegetative organs to grains thereby resulting in poor malt quality. So, improper rates as well as time and method of nitrogen application may reduce grain yield and quality below the acceptable levels. It was, therefore, realized to study the feasibility as well as to explore the possibilities for introduction of FIRBS and suitable method of nitrogen application which can help in improving the barley productivity.

MATERIALS AND METHODS

A field experiment was carried out at Research Farm of Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar during **rabi** 2008-09 and 2010-11. The soil of the experimental site (29°10′N, 75°46′E; 215.2 m ASL) was sandy loam in texture, slightly alkaline in reaction (7.9), low in organic carbon (0.39), poor in available nitrogen (161.4 kg/ha), medium in phosphorus (11.4 kg/ha) and high in available

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potassium (322.3 kg/ha). The experiment was laid out in split plot design with three methods of sowing viz., FIRBS 75 cm (2 rows), FIRBS 90 cm (2 rows) and FIRBS 90 cm (3 rows) in main plot and four nitrogen application methods viz., recommended dose of nitrogen (RDN) applied before 1st irrigation by broadcasting, RDN applied after 1st irrigation by broadcasting, RDN applied before 1st on top of the bed and RDN applied after 1st irrigation on top of the bed as sub-plot having four replications. The crop was sown on 21 November 2008 and on 26 November 2010 during first and second year of experimentation, respectively. Sowing was done by adopting all agronomical practices with conventional drill and bed planters as per treatment requirement. The data on yield were recorded at harvest. The hot water extract and husk content were analyzed using standard method as given by A. S. B. C. (1992). Malting of barley grains was carried out as per the method suggested by Banasik *et al*. (1956). The data were computed using standard methods of statistical analysis.

RESULTS AND DISCUSSION

Yield

A perusal of the data in Table 1 reveals that the grain, straw and biological yield of barley varied significantly with different methods of sowing. The grain yield was highest under FIRBS 90 cm (3 rows) during both the years (4414 kg/ha in 2008-09 and 4570 kg/ha in 2010-11) which was significantly superior over FIRBS 90 cm (2 rows) (4077 and 4188 kg/ha). The increase in grain yield of barley with FIRBS 90 cm (3 rows) over FIRBS 90 cm (2 rows) was to the extent of 8.2 and 9.1 per cent during respective years. The straw and biological yield of barley was significantly higher under FIRBS 90 cm (3 rows) followed by FIRBS 75 cm (2 rows) and FIRBS 90 cm (2 rows) during both the years, respectively. Higher grain yield with FIRBS 90 cm (3 rows) and FIRBS 90 cm (2 rows) of wheat over conventional method was also reported by Virdi (2003).

N application top of bed significantly influenced the grain, straw and biological yield of barley over broadcast application of nitrogen. The increase with application of N on top of bed and application before irrigation was 9.9 per cent for grain, 4.5 per cent for straw and 6.9 per cent for biological yield over broadcast before irrigation in 2008-09. Corresponding increase in grain, straw and biological yield during 2010-11 was 10.3, 6.2 and 7.9 per cent, respectively. The increase with application of N on top of bed and N after irrigation was 9.6 and 9.0 per cent for grain, 6.0 and 5.0 per cent for straw and 7.6 and 6.9 per cent for biological yield during 2008-09 and 2010-11, respectively. Increase in

TABLE 1

Effect of method of sowing and nitrogen application method on grain, straw, biological yield and protein content of barley

Treatment	Grain yield (kg/ha)		Straw yield (kg/ha)		Biological yield (kg/ha)		Protein content (%)	
	2008-09	2010-11	2008-09	2010-11	2008-09	2010-11	2008-09	2010-11
Sowing methods								
FIRBS 75 cm (2 rows)	4212	4353	5341	5632	9553	9985	9.56	9.80
FIRBS 90 cm (2 rows)	4077	4188	5223	5479	9300	9668	9.60	9.83
FIRBS 90 cm (3 rows)	4414	4570	5499	5970	9913	10541	9.50	9.70
S. Em±	15	16	20	21	35	37	0.03	0.03
C. D. (P=0.05)	54	57	69	73	123	129	NS	NS
N application method								
N_1	3974	4089	5158	5450	9132	9540	9.34	9.58
N_2	4101	4247	5271	5620	9373	9867	9.41	9.61
N_3	4368	4513	5395	5788	9763	10302	9.70	9.94
N_4	4495	4632	5592	5917	10087	10549	9.75	9.98
S. Em±	51	55	68	64	114	120	0.11	0.12
C. D. (P=0.05)	148	161	198	186	334	351	0.33	0.34

NS–Not Significant.

straw and biological yield of barley with application of N on top of bed probably resulted through favourable influence of increase in availability of nitrogen at vegetative growth in terms of plant height and dry matter accumulation. Similar findings were reported by Liben *et al*. (2011).

Quality

The protein content in grain did not show any significant difference among different methods of sowing during both the years (Table 1). The highest protein content was observed in FIRBS 90 cm (2 rows) followed by FIRBS 75 cm (2 rows) and FIRBS 90 cm (3 rows). The methods of sowing in barley did not show any significant impact on malt yield, hot water extract and husk content of barley during both the years (Table 2). The highest hot water extract was obtained in FIRBS 90 cm (2 rows) (75.53% in 2008-09 and 75.00% in 2010-11) followed by FIRBS 75 cm (2 rows) (74.82% in 2008-09 and 74.44 % in 2010-11) and FIRBS 90 cm (3 rows) during both the years. However, the highest husk content (10.80 and 10.87%) was obtained in FIRBS 90 cm (3 rows) followed by FIRBS 90 cm (2 rows) and FIRBS 75 cm (2 rows) during 2008-09 and 2010-11, respectively. Similar findings were reported by Singh and Singh (2005).

N application on top of bed increased protein content than N application by broadcast (Table 1). This was attributed to significant increase in N content of grain with N application top of bed. The increase in protein content with drilling of N has also been reported earlier. A perusal of the data in Table 2 reveals that the application of nitrogen by broadcasting produced significantly higher malt yield than application of nitrogen on top of bed during both the years. The N applied on top of bed before or after irrigation and the nitrogen applied as broadcast before or after irrigation did not bring any significant difference in malt yield during both the years. The application of nitrogen by broadcasting produced significantly higher hot water extract than application of nitrogen on top of beds during both the years. The N applied on top of bed before or after irrigation as well as and the nitrogen applied as broadcast before or after irrigation did not show any significant difference in hot water extract during both the years. The application of nitrogen on top of bed produced significantly higher husk content than nitrogen applied by broadcasting during both the years. The N applied on top of bed before or after irrigation and the nitrogen applied as broadcast before or after irrigation did not bring any significant difference in husk content during both the years. These findings are in conformity with those of Jasvinder Singh *et al*. (2012).

TABLE 2

Effect of method of sowing and nitrogen application method on malt yield and grain quality characters of barley

Treatment	Malt yield (%)		Hot water extract (%)		Husk content (%)	
	2008-09	2010-11	2008-09	2010-11	2008-09	2010-11
Sowing methods						
FIRBS 75 cm (2 rows)	86.25	85.00	75.15	74.65	11.10	11.25
FIRBS 90 cm (2 rows)	87.10	85.45	75.53	75.00	11.05	11.10
FIRBS 90 cm (3 rows)	86.13	84.50	74.82	74.44	11.53	11.55
S. Em±	0.32	0.30	0.27	0.27	0.18	0.18
C. D. (P=0.05)	NS	NS	NS	NS	NS	NS
N application method						
N_1	89.07	86.73	77.15	76.65	10.63	10.53
N_2	87.67	86.53	77.05	76.41	10.77	10.67
N_3	84.90	83.33	73.33	72.96	11.60	11.82
N_4	84.33	83.33	73.13	72.76	11.90	12.18
S. Em±	1.03	1.01	0.95	0.94	0.13	0.14
C. D. (P=0.05)	3.01	2.96	2.77	2.75	0.39	0.39

NS–Not Significant.

REFERENCES

A. S. B. C., 1992 : *Methods of Analysis of the ASBC, 8th edn.* American Society of Brewing Chemists, St. Paul, MN.

Banasik, O. J., D. Myhre, and R. H. Harris, 1956 : A micro-malting method for nursery samples. 1. Apparatus and development of the method. *Brew. Dig.,* **31** : 50.

Grant, D. J. 2000 : Nitrogen fertilization of dry land malt barley for yield and quality. *Fertil. Facts*, **24.**

Jasvinder Singh, S. S. Mahal, and S. S. Manhas, 2012 : Effect of sowing methods, nitrogen levels and irrigation scheduling on yield and quality of malt barley (*Hordeum vulgare* L.). *Indian J. Agron.,* **57** : 259-264.

Liben, M., A. Assega, and T. Tadesse, 2011 : Grain yield and malting quality of barley in relation to nitrogen application at mid and high altitude in Northern-Western Ethiopia. *J. Sci. and Dev.,* **1** : 75-88.

Singh, R. K., and R. K. Singh, 2005 : Effect of times and levels of nitrogen application malt barley (*Hordeum vulgare*). *Indian J. Agron.,* **50** : 137-139.

Vaughan, J. G., P. A. Judd, and D. Bellamy, 2006 : *The Oxford Book of Health Foods. http://books.google.co.in/books.* p. 37.

Virdi, P. 2003 : Effect of various moisture regimes and irrigation depths on growth, water use and yield of bed planted wheat (*Triticum aestivum* L.). M. Sc. thesis submitted to CCSHAU, Hisar.