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INFLUENCE OF SOWING METHODS AND IRRIGATION LEVELS ON YIELD AND ITS ATTRIBUTES OF BARLEY (*HORDEUM VULGARE* L.)

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SUMMARY

A field experiment was conducted to study the effect of irrigation levels on yield attributes and yield 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. The better grain and straw yield in FIRBS 90 cm (3 rows) resulted due to significant increase in productive tillers/m^2. Among the different irrigation levels, application of two and three irrigations in barley being at par and significantly increased the number of productivity tillers/m^2, dry matter accumulation, ear length, number of grains/earhead, test weight, grain and straw yield as compared to one irrigation. Flat sowing with three irrigations resulted in highest consumptive use of water.

Key words : Barley, furrow irrigated raised bed system (FIRBS), irrigation level, yield

Barley (*Hordeum vulgare* L.) is a widely adapted crop which is grown throughout the temperate and tropical regions of the world. In production, it ranks fourth after rice, maize and wheat and the largest producer countries of barley are Canada, Russia, Australia, Ukraine and Germany. In India, production is largely confined to Uttar Pradesh, Punjab, Rajasthan and Haryana and it is grown on 0.7-0.8 million hectares of land with the production and productivity of 1.54 million tonnes and 1.94 tonnes per hectare, respectively (Anonymous, 2009). Impending shortage of irrigation water has driven the researchers to search for an alternate system of barley planting other than the traditional line sowing on flat beds that can help in efficient use of these inputs without having any adverse effect on the crop productivity and environmental sustainability. Furrow irrigated raised bed system (FIRBS) of sowing is a relatively new technology in India, wherein the sowing of crop is accomplished in two rows (20 cm apart) or three rows (10 cm apart) on the top of the raised beds (40 cm wide). The furrows (30 cm wide and 20-30 cm deep) or corrugation between two beds are meant for irrigation. Sayre (2000) reported that sowing on FIRBS, irrigation water requirements of crop could be reduced up to 35 per cent as compared to the conventional row planting in flat beds. Yadav *et al.* (2002) reported a saving of 46-56 per cent in time and quantity of water given through tube-well irrigation and 36 per cent through canal irrigation in wheat under FIRBS as compared to the conventional planting. It was, therefore, realized to study the feasibility as well as to explore the possibilities for introduction of FIRBS and irrigation levels which can help in improving the barley productivity.

MATERIALS AND METHODS

A field experiment was conducted 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 potassium (322.3 kg/ha). The experiment was laid out in split plot design with four methods of sowing, viz.

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flat sowing, FIRBS 75 cm (2 rows), FIRBS 90 cm (2 rows) and FIRBS 90 cm (3 rows) in main plots and three irrigation levels viz., one irrigation (60 DAS), two irrigations (40 and 80 DAS) and three irrigations (40, 60 and 80 DAS) as sub-plot having three replications. The crop was sown on 21 November 2008 and on 26 November 2010 during first and second year of experimentation, respectively. Sowing of barley crop (variety, BH-393) was done by adopting all agronomical practices with conventional drill and bed planters as per treatment requirement. The data on yield contributing characters, grain and straw yield were recorded at harvest. The data were computed using standard methods of statistical analysis.

RESULTS AND DISCUSSION

Yield Attributes

FIRBS 90 cm (3 rows) produced significantly higher number of productive tillers/m^2 as compared to flat sowing during both the years (Table 1). This may be ascribed to higher dry matter production and its translocation to reproductive plant parts. There was not any significant difference in ear length (cm), number of grains/ear and test weight. However, the highest ear length (cm), number of grains/ear and test weight were recorded with FIRBS 90 cm (2 rows) followed by FIRBS 90 cm (3 rows) and flat sowing during both the years. These results are in conformity with the findings of Singh *et al*. (2002)

Three irrigations being at par with two irrigations produced significantly higher number of productive tillers/m^2, ear length, number of grains/ear and test weight than one irrigation during both the years. This may be ascribed to similar differences in dry matter production, among three irrigation levels. Sandhu (2006) also reported that application of three irrigations gave significantly higher test weight as compared to one and two irrigations.

Yield

The grain, straw and biological yield of barley varied significantly with methods of sowing (Table 2). The grain yield was maximum under FIRBS 90 cm (3 rows) (4354 kg/ha in 2008-09 and 4445 kg/ha in 2010-11) which was significantly higher than flat sowing (3898 and 4059 kg/ha) and FIRBS 90 cm (2 rows) (4036 and 4137 kg/ha) during both the years, respectively. The increase in grain yield of barley with FIRBS 90 cm (3 rows) over flat sowing was to the extent of 11.7 and 9.5 per cent during respective years. Grain yield under FIRBS 75 cm (2 rows) and FIRBS 90 cm (2 rows) was statistically at par during both the years. The increase in grain yield could be attributed to higher number of production tillers, increased number of grains/ear and test weight in FIRBS 90 cm (2 rows) and FIRBS 90 cm (3 rows) than the flat sowing. Higher grain yield with FIRBS 90 cm (3 rows) and FIRBS 90 cm (2 rows) of

TABLE 1
Effect of method of sowing and irrigation level on yield attributes of barley

Treatment	No. of effective tillers/m^2		Test weight (g)		No. of grains/ earhead		Spike length (cm)	
	2008-09	2010-11	2008-09	2010-11	2008-09	2010-11	2008-09	2010-11
Sowing methods								
Flat sowing	318	341	44.53	44.86	50.44	50.84	8.65	8.68
FIRBS 75 cm (2 rows)	333	354	44.74	45.54	50.97	51.19	8.72	8.78
FIRBS 90 cm (2 rows)	303	324	45.00	45.89	51.01	51.75	8.87	8.97
FIRBS 90 cm (3 rows)	374	391	44.60	45.45	50.82	51.14	8.70	8.77
S. Em±	3	3	0.43	0.43	0.48	0.49	0.08	0.08
C. D. (P=0.05)	11	11	NS	NS	NS	NS	NS	NS
Irrigation levels								
One irrigation (60 DAS)	269	289	42.70	43.71	48.69	49.31	8.39	8.43
Two irrigations (40 & 80 DAS)	355	376	45.56	46.23	51.44	51.63	8.84	8.93
Three irrigations (40, 60 & 80 DAS)	371	393	45.89	46.36	52.30	52.75	8.98	9.05
S. Em±	6	6	0.75	0.76	0.85	0.85	0.15	0.15
C. D. (P=0.05)	17	18	2.25	2.29	2.56	2.58	0.44	0.44

NS–Not Significant.

TABLE 2
Effect of method of sowing and irrigation level on grain, straw, biological yield and harvest index of barley

Treatment	Grain yield (kg/ha)		Straw yield (kg/ha)		Biological yield (kg/ha)		Harvest index (%)		Attraction index (%)	
	2008-09	2010-11	2008-09	2010-11	2008-09	2010-11	2008-09	2010-11	2008-09	2010-11
Sowing methods										
Flat sowing	3898	4059	5148	5351	9046	9410	43.1	43.0	75.7	75.6
FIRBS 75 cm (2 rows)	4067	4241	5062	5288	9129	9529	44.5	44.5	80.2	80.0
FIRBS 90 cm (2 rows)	4036	4147	4992	5194	9028	9340	44.6	44.3	80.6	79.6
FIRBS 90 cm (3 rows)	4354	4445	5356	5532	9709	9977	44.7	44.5	81.0	80.1
S. Em±	37	39	50	51	87	89	0.8	0.4	0.7	0.7
C. D. (P=0.05)	130	137	176	179	307	315	NS	NS	2.5	2.6
Irrigation levels										
One irrigation (60 DAS)	3442	3581	4499	4807	7941	8388	43.3	42.7	76.5	74.5
Two irrigations (40 & 80 DAS)	4331	4487	5486	5533	9717	10019	44.5	44.8	80.4	81.1
Three irrigations (40, 60 & 80 DAS)	4493	4601	5533	5684	10026	10285	44.8	44.7	81.2	80.9
S. Em±	69	71	86	89	155	160	0.7	0.7	1.3	1.3
C. D. (P=0.05)	207	214	261	269	468	483	NS	NS	4.0	4.0

NS–Not Significant.

wheat over conventional method has also been reported by Rinwa (2003) and Kumar *et al.* (2013).

The grain, straw and biological yield of barley varied significantly with different irrigation levels. The grain yield was maximum under three irrigations (4493 and 4601 kg/ha) which was significantly higher than one irrigation (3442 and 3581 kg/ha) and statistically at par with two irrigations during both the years. The increase in grain yield of barley with three irrigations over one irrigation was to the extent of 23.4 and 28.5 per cent during respective years. This might be ascribed to better growth and development of barley crop under two and three irrigations. These results are in conformity with those of Mammnouie *et al*. (2006) and Singh *et al*. (2012).

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