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Response of Barley Cultivars under Conservation Agriculture in Semi-Arid Area of U.P.

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Abstract

The experiment was conducted at RBS College, Agricultural Research Farm, Bichpuri, Agra during Rabi season of 2016-17. The soil of experimental site was sandy loam, have low in organic carbon (0.32%), medium in available P_2O_5 (28.30 kg/ha) and rich in potash (290.00 kg/ha). The five cultivars of barley i.e., BH-902, BH-946, RD-2552, DWRB-101 and DWRUB-52 were tested under zero tillage, conventional tillage and zero tillage + residue @ 6 t/ha. The treatments were allocated in Split Plot Design under four replications. The different cultivars raised with recommended agronomical practices. The tillage practices had significant effect on grain yield of barley. Conventional tillage gave significantly higher grain yield by 46.82 q/ha, which was more by 14.03% and 12.06% over zero tillage and zero tillage + residue @ 6 t/ha, respectively. Among the different tested cultivars, RD-2552 produced significantly higher grain yield by 45.30 q/ha. The lowest yield was noted in DWRUB-52 (41.37 q/ha). Other varieties gave the grain yield between these two limits. The growth and yield traits were concordance to grain yield of barley.

Key words: Concordance, Conventional tillage, Semi-arid, Temperate and tropical, Zero tillage.

Introduction

Barley is the world's fourth most important cereal crop after wheat, rice and maize. It is cultivated throughout the temperate and tropical region of world. It is usually used as food for human being and feed for animal and poultry. It is also a valuable input for industries for extracting malt. It is also utilize in Ayurvedic medicines & straw and fodder for livestock (Meena *et al.* 2012).

Now-a-days, barley has become a viable and useful crop in winter owing to release of improved varieties and upcoming of improved industries in India especially in Punjab, Haryana and Rajasthan. It has low cost of production and input requirement, so it is preferred by the resource poor farmers in country. Barley occupied 1.7 lakh hectare area in Uttar Pradesh with 4.6 lakh mt of production and 27.07 q/ha of average productivity (Anonymous, 2017).

The major challenge at present before the researchers is to develop an alternative system that produce more at least cost with low water & energy and improve farm profitability and sustainability. Therefore, agriculture system needs a combination of new technologies that are capable for higher production. Conservation agriculture is one of important production technique for intensive production systems. By which minimal soil disturbance, permanent surface cover through crop residue, water retentions and diverse crop rotations and associations.

Regular tillage breaks down soil organic matter through mineralization, more so in warmer climates (Kirschbaum, 1995) thus contributing to deteriorating soil physical, chemical and biological properties. The physical effects of tillage also adversely affect soil structure with consequences for water infiltration and soil erosion through runoff and create hard pans below plough layer (Thierfelder and Wall, 2009). These adverse effect of tillage have been addressed over recent decades by the development of conservation agriculture in association with improved & suitable genotypes of different crops.

Keeping the above in consideration a field experiment was conducted with the objective to find out suitable cultivar of barley under different tillage options.

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Materials and Methods

The present experiment was undertaken at Raja Balwant Singh College, Agricultural Research Farm, Bichpuri, Agra during *Rabi* season of 2016-17. The soil of experimental site was sandy laom. The soil was low in organic carbon (0.32 per cent) and available N (183.00 kg/ha), medium in available phosphorous (28.30 kg/ha) and rich in potash (290.00 kg/ha) with slightly alkaline in reaction (pH 8.1). The pH was determined by Electrometric glass electrode method (Richards, 1954), while organic carbon was determined by Walkely and Black method (Piper, 1950). The available N was determined by Alkline Permnagnate method (A.O.A.C., 1960). The available phosphorous and potassium were determined by Olsen's method (Olsen *et al.,* 1954) and Flame photometer (Jackson, 1967), respectively. The five cultivars of barley i.e., BH-902, BH-946, RD-2552, DWRB-101 and DWRUB-52 were tested under zero tillage, conventional tillage and zero tillage + residue @ 6 t/ ha. The experiment was conducted in Split Plot Design with four replications. The recommended dose of 60 Kg N + 30 kg P_2O_5 + 20 kg K_2O/ha was given to barley. Three irrigations were given to barley. Barley was planted on 15th November, 2016 and harvested on 1st April, 2017 after 137 DAP. The other recommended agronomical practices were also followed in barley. The data recorded during field experimentation on various characters were statistically analysed by method of "analysis of variance" as advocated by Gomez and Gomez (1984).

Results and Discussion

The results obtained from the experiment are reported in Table 1 and discussed here under appropriate heads.

A. Effect of tillage practices

Growth parameters:

The growth characters namely plant height, spike/meter^2 and length/spike were considerably increased by 86.85cm, 402.80 and 7.48 cm, respectively under conventional tillage over zero tillage and zero tillage + residue @ 6 t/ha, because the plants on conventional tillage were benefited to soil moisture and nutrient from the soil. In zero tillage and zero tillage + residue @ 6 t/ ha weed intensity were more which observed soil moisture and nutrient considerably from the soil. Thus the growth characters in plants were reduced in zero tillage and zero tillage + residue @ 6 t/ha treatments.

Yield contributing traits:

Results displayed that conventional tillage had significantly higher number of grains/spike by 9.18% and 6.72%, respectively, than that of zero tillage and zero tillage + residue @ 6 t/ha. The variation in number of grains/spike due to zero tillage and zero tillage + residue @ 6 t/ha was nominal and could not reached to the level of significance. The weight of grains/spike was significantly higher with conventional tillage by 25.27% and 16.92%, respectively over zero tillage and zero tillage + residue @ 6 t/ha. The nominal difference was analysed between zero tillage and zero tillage + residue @ 6 t/ha.

Results exhibited that conventional tillage produced significantly higher grain weight/plant by

Table 1: Studies on tillage operations and varietal performance of barley cultivars.

Treatment	Plant height (cm)	Spike/ meter^2	Length /spike (cm)	Grains /spike	Grain weight /s[ike (g)	Grain weight /plant (g)	1000-grain weight (g)	Grain yield (q/ha)	Harvest index (%)
A. Tillage operations									
Zero tillage (ZT)	77.45	346.95	6.68	48.13	1.82	4.88	38.92	41.06	41.26
Conventional tillage (CT)	86.85	402.80	7.48	52.55	2.28	5.50	42.84	46.82	43.73
Zero tillage + residue @ 6 t/ha (ZT+R)	78.18	376.60	6.84	49.24	1.95	4.98	39.26	41.78	42.06
S.E. ($m^{\pm}$)	1.29	7.55	0.12	0.71	0.08	0.12	0.52	0.60	0.44
C.D. 5%	4.48	26.13	0.42	2.46	0.21	0.42	1.80	2.06	1.51
B. Cultivars									
BH-902 (V_1)	78.64	388.67	7.15	52.25	2.12	5.42	42.70	44.70	43.04
BH-946 (V_2)	80.92	377.38	6.98	51.12	2.10	5.16	41.44	43.14	42.18
RD-2552 (V_3)	78.48	408.38	7.44	53.34	2.18	5.60	43.50	45.30	43.17
DWRB-101 (V_4)	82.88	356.28	6.73	46.32	1.94	4.74	37.38	41.59	42.13
DWRUB-52 (V_5)	84.16	354.54	6.70	45.94	1.91	4.68	36.68	41.37	42.16
S.E. ($m^{\pm}$)	0.88	7.11	0.12	0.68	0.05	0.10	0.48	0.51	0.33
C.D. 5%	2.52	20.40	0.36	1.96	0.15	0.30	1.38	1.48	0.94

12.70% and 10.44%, respectively, in comparison to zero tillage and zero tillage + residue @ 6 t/ha, which were not appreciable in this respect. Conventional tillage had significantly higher 1000-grain weight by 10.07% and 9.12%, respectively, as compared to zero tillage and zero tillage + residue @ 6 t/ha. The difference in 1000-grain weight due to zero tillage and zero tillage + residue @ 6 t/ha was nominal and could not reached to the level of significance. As discussed earlier that the plants in conventional tillage operations are benefited to soil moisture and nutrients from the soil as compared to zero tillage and zero tillage + residue @ 6 t/ha.

Grain yield (q/ha):

The tillage options had significant effect on grain yield. Conventional tillage, resulted in, significantly higher grain yield by 14.03% and 12.06%, respectively, as compared to zero tillage and zero tillage + residue @ 6 t/ha, which were nominal and could not reached upto the level of significance. Number of spikes/meter^2, length of spike, grains/spike, grain weight/spike, grain weight/plant and 1000-grain weight, were appreciable increased under conventional tillage over other two practices of tillage options, which were responsible for higher grain yield (q/ha) Al-Issa and Samarah (2007) also reported the similar results.

Harvest index:

The highest harvest index was recorded under conventional system, which was significantly higher than zero tillage and zero tillage + residue @ 6 t/ha.

B. Varietal effect

Growth parameter:

The data presented in Table 1 shows that different varieties had significant effect on plant height. Cultivar DWRUB-52 produced longer plant height which was significantly superior over other genotypes except DWRB-101. The plant height of DWRUB-52 cultivar was at par statistically with DWRB-101. The difference in height of different varieties was due to genetic character. Varieties RD-2552 and BH-902 produced statistically at par spike/meter^2 but both the varieties were significantly superior in comparison to other tested genotypes. The trend was also found in length/spike.

Yield contributing characters:

It is clear from the results that varieties RD-2552 and BH-902 produced statistically at par grains/spike but significantly superior over other tested cultivars. Varieties RD-2552, BH-902 and BH-946 did not differ significantly but superior in comparison to the other cultivars in the productivity of grains weight/spike.

Results displayed that variety RD-2552 did not differ much with BH-902, but both the varieties produced significantly higher grain weight/plant. Almost similar trend was noted in 1000-grain weight.

Grain yield:

Variety RD-2552 produced significantly higher grain yield (45.30 q/ha) over BH-946, DWRB-101 and DWRUB-52 but statistically at par with BH-902 (44.70 q/ha). The reduction in grain yield was noted in varieties BH-946, DWRB-101 and DWRUB-52 by 2.16 q/ha, 3.71 q/ha and 3.93 q/ha, respectively, in comparison to RD-2552. Grain yield contributing characters i.e., grains/spike, grain weight/spike, grain weight/plant and 1000-grain weight also had similar trend to the grain yield (q/ha), might be responsible for higher grain yield of variety RD- 2552 closely followed by BH-902.

The similar observations have also been reported by Awasthi and Bhan (1992), Chakravarti and Kushwaha (2009) and Rai *et al.* (2013).

Harvest index:

Variety RD-2552 did not differ significantly with BH-902, but had appreciably higher harvest index than rest of the varieties.

Thus, the farmers residing in the south-western-semi-arid zone may be advocated for cultivation of RD-2552 with conventional system.

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