

## **Influence of Tillage Options and Crop Residue on Productivity and Profitability of Barley (*Hordeum Vulgare. L.*) Cultivars in North Western Plain Zone**

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### **Abstract**

*A field experiment was conducted during the winter (Rabi) season of 2018-19 at R.B.S. College, Agricultural Research Farm, Bichpuri, Agra, Uttar Pradesh. The soil of experimental site was sandy loam, have low in organic carbon (6.32%), medium in available  $P_2O_5$  (28.30 kg ha<sup>-1</sup>) and rich in  $K_2O$  (290.00 kg ha<sup>-1</sup>). The five cultivars of barley i.e., BH-902, BH-946, RD-2552, DWRB-101 and DWRUB-52 were tested under zero tillage (ZT), conventional tillage (CT) and zero tillage + residue @ 6t ha<sup>-1</sup> (ZT + R). The experiment was laid out in split plot design with four replications. The different cultivars raised with recommended agronomical practices. The tillage practices had significant effect on grain yield of barley. Crop raised under zero tillage + residue @ 6 t ha<sup>-1</sup> (ZT+R) exhibited the higher grain yield (4789 kg ha<sup>-1</sup>) which was more by 10.29 and 16.27 per cent over conventional tillage (CT) and zero tillage (ZT), respectively. Conventional tillage also registered significantly higher grain yield as compared to zero tillage. Among the different tested cultivars, BH-946 ( $V_2$ ) yielded appreciably higher grain yield by 5.89, 8.39, 11.73, and 16.81 per cent as compared to BH-902( $V_1$ ), RD-2552 ( $V_3$ ) DWRB-101 ( $V_4$ ) and DWRUB-52 ( $V_5$ ) respectively. Cultivar BH-902 was at par with RD-2552 and produced conspicuously higher grain yield. The highest net return of Rs. 51291 ha<sup>-1</sup> and B/C ratio (2.70) were obtained with BH-946 under zero tillage + residue @ 6t ha<sup>-1</sup>.*

**Keywords:** Agronomic practices, conventional tillage, crop residue, net return, zero tillage

### **Introduction**

Barley is a valuable crop because it is grown for several purposes such as food and processed food products for human being and feed for cattle and poultry birds. Barley grain is also valued for smothering and cooling effect on the human body for easy digestion. Besides, these conventional uses, it is an important industrial crop because it is used as raw material for beer, whisky and brewing industries. In recent past, India has made an impressive progress in achieving self suffering in food grain production by elevating productivity of several crops. Among them barley is important crop. It is generally grown in areas where irrigation facilities are limited as it can tolerate moisture and salt stress to great extent (Yadav et. al., 2003).

Conservation agriculture is an agricultural management practice in which there is minimum soil

disturbance, retention of residue for soil cover and rotation of major crops (Chhokar et al., 2007). As per FAO definition, CA aims to achieve acceptable profits, conserve, improve and sustained production levels. The main principles of conservation agriculture include minimum soil disturbance by adopting minimum/no tillage, proper crop rotation and minimum traffic for agricultural operations. An extreme tillage requirement with no return of crop residue and other organic materials is loss of organic matter and is not sustainable. Thus, it requires practices to enhance the sustainability of this system, which can be attained by reducing the intensity of tillage and inclusion of organic material in soil. So zero tillage can be preferred over the conventional tillage as its results in minimum compaction and improves natural structural formation, improve soil physical properties. Hence conservation tillage practices, such as zero and minimum tillage and permanent beds, may offset the production cost and

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other constraints associated with land preparation. The farmers in India are yet in grow cereal based cropping systems with conservation agriculture (CA) technology packages, though it is a common practice in many western countries. Bed planting of crops helps in proper plant establishment, increases input efficiency, increases yields, and opens up avenues for double no-till system. Adoption of no-till practice helps in timely seeding either of the crops in sequence, hence leads to increase in productivity (Jat, et. al, 2012).

### Materials and Methods

The trial was conducted at Raja Balwant Singh College, Agricultural Research Farm, Bichpuri, Agra (27°2¢ N, 77°9¢ E, 163.4 m above mean sea-level) U.P. during winter season of 2018.19. The experiment was conducted on sandy loam soil, having pH 8.1, organic carbon 0.32 per cent, available N 183.00 kg/ha, available P 28.30 kg/ha and available K 290.0 kg/ha. The experiment was laid out in split plot design plot design with tillage options in main plot and barley cultivar's in sub-plot using four replications. The five cultivars of barley i.e. BH-902, BH-946, RD-2552, DWRB-101 and DWRUB-52 were tested under zero tillage (ZT), conventional tillage (CT) and zero tillage + residue @ 6t /ha. The recommended dose of 60 kg N + 30 kg P<sub>2</sub>O<sub>5</sub> + 20 kg K<sub>2</sub>O/ha was given to barley. Half dose of nitrogen and whole P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were incorporated in soil, as per the treatments, as basal dose and remaining nitrogen was top dressed at tillering stage of the barley crop. The irrigations were given to barley crop at various growth stages.

### Results and Discussion

The data pertaining to different growth, yield attributing traits and yield are presented in Table 1 & 2 and discussed here under appropriate heads.

#### (A) Effect of Tillage Options

##### Growth Characters

It is clear from the Table 1, the growth characters namely no. of shoots/m row length, plant height and dry matter accumulation were considerably increased by 114.87, 73.52 cm and 76.72 (g), respectively at harvest stage under zero tillage + residue @ 6t/ha over conventional tillage and zero tillage, because the plants on zero tillage + residue @ 6t /ha were benefited to soil moisture and nutrient from the soil. In zero tillage and conventional tillage, need intensity were more which observed soil moisture and nutrient removal from

Table 1: Growth and yield attributes of barley as influenced by tillage options and cultivars

Treatments	No. of Shoots/meter row length at harvest	Height of main shoot (cm) at harvest	Dry matter accumulation/ 25 cm row length at harvest	Ear head/m <sup>2</sup>	Length of spike (cm)	No. of grains spike <sup>-1</sup>	Grain weight (g) spike <sup>-1</sup>	1000-grain weight (g)
<b>Tillage options</b>								
Zero tillage (ZT)	105.61	70.68	68.23	234.42	5.82	47.97	1.82	39.19
Conventional tillage (CT)	109.28	71.50	71.17	251.91	6.07	48.77	1.95	39.96
Zero tillage + residue @ 6tha <sup>-1</sup> (ZT+R)	114.87	73.50	76.72	256.26	6.41	50.22	2.28	40.49
SEM±	1.58	0.58	1.60	1.25	0.09	0.37	0.09	0.15
CD at 5%	5.47	2.02	5.54	4.32	0.32	1.27	0.31	0.52
<b>Cultivars</b>								
BH-902 (V <sub>1</sub> )	112.81	73.54	80.25	252.37	6.55	50.41	2.19	40.69
BH-946 (V <sub>2</sub> )	128.54	78.47	87.31	257.31	6.88	51.62	2.38	41.56
RD - 2552 (V <sub>3</sub> )	108.04	70.81	75.03	249.51	6.18	49.03	2.05	39.78
DWRB -101 (V <sub>4</sub> )	102.99	68.64	63.19	247.75	5.64	47.35	1.84	39.21
DWRUB-52 (V <sub>5</sub> )	97.21	68.03	54.41	245.70	5.23	46.53	1.81	38.15
SEM±	2.04	0.75	2.07	1.61	0.11	0.48	0.12	0.19
CD at 5%	5.84	2.16	5.91	4.61	0.34	1.36	0.33	0.55

the soil is maximum because the plants in zero tillage + residue @ 6 t/ha are benefited to soil moisture and nutrient from the soil. The results are close proximity to the results noted by Prasad et al., (2007) and Hasan (2012).

#### *Yield attributes and Yield*

The data assembled in Table-1 shows that, number of spike meter<sup>2</sup>, length of spike, number and weight of grains per spike and 1000-grain weight were appreciable higher with zero tillage + residue @ 6t/ha than conventional tillage and zero tillage.

Results exhibited that zero tillage + residue @ 6t /ha (ZT+R) produced significantly higher biological yield overall other treatments of tillage options tested in this experiment. The magnitude of increase in biological yield with zero tillage + residue @ 6t /ha was to the tune of 10.73 and 5.62 per cent than that of zero tillage (ZT) and conventional tillage (CT), respectively. Conventional tillage also gave appreciably higher biological yield when compare with zero tillage (ZT). The data presented in Table 2 very well indicate that the importance of tillage operations as judged by grain yield production. It may be seen that the grain yield per ha with zero tillage, conventional tillage and zero tillage + residue @ 6 t/ha was 41.19, 43.42 and 47.89 Q/ha, respectively. The magnitude of increase in grain yield with zero tillage + residue @ 6

t/ha, conventional tillage was to the tune of 10.19 and 16.27 per cent, respectively when compared with zero tillage and conventional tillage. Like biological yield and grain yield, straw yield was also significantly affected due to tillage options. Zero tillage + residue @ 6 t/ha produced appreciably higher straw yield than conventional tillage and zero tillage. The results are in corroboration with findings of Djellakh, et, al (2005) and Nafawa et. al. (2016).

The maximum harvest index (40.77%) was recorded with zero tillage + residue @ 6 t/ha (ZT +R) which was significantly higher than zero tillage (ZT) and conventional tillage (CT) which were statistically at par in this respect.

#### *(B) Effect of Cultivars*

##### *Growth characters*

The data presented in Table-1 revealed that different varieties had significant effect on plant height, no. of shoots per meter row length and dry matter accumulation (g) in plants of 25 cm row length. Variety BH-946 (V<sub>2</sub>) produced significantly longer shoots over all the varieties under test at all the stages of crop growth. Variety BH-902 (V<sub>1</sub>) also produced appreciably longer shoots than that of rest of the varieties at all the stages of crop growth. The differences in shoot height due to RD-2552 (V<sub>3</sub>) and DWRB-101 (V<sub>4</sub>) were nominal and could not reach the level of

Table 2: Biological, Grain, Straw yield, Harvest index, Net return (Rs. ha<sup>-1</sup>) and B : C ratio of barley crop as influence by tillage options and cultivars

Treatments	Biological yield (q ha <sup>-1</sup> )	Grain yield (q ha <sup>-1</sup> )	Straw yield (q ha <sup>-1</sup> )	Harvest Index (%)	Net return (Rs. ha <sup>-1</sup> )	B : C ratio
<b>Tillage options</b>						
Zero tillage (ZT)	106.08	41.19	64.89	38.83	44176.20	2.62
Conventional tillage (CT)	111.21	43.42	67.79	39.04	46180.06	2.36
Zero tillage + residue @ 6tha <sup>-1</sup> (ZT+R)	117.46	47.89	69.57	40.77	49072.60	2.58
SEm±	0.94	0.64	0.51	0.50	-	-
CD at 5%	3.24	2.21	1.76	1.72	-	-
<b>Cultivars</b>						
BH-902 (V <sub>1</sub> )	113.86	45.16	68.70	39.66	47286.00	2.55
BH-946 (V <sub>2</sub> )	117.66	46.82	70.84	39.79	48695.00	2.59
RD – 2552 (V <sub>3</sub> )	111.95	44.12	67.83	39.41	46450.00	2.52
DWRB -101 (V <sub>4</sub> )	109.66	42.80	66.86	39.03	45402.67	2.48
DWRUB–52 (V <sub>5</sub> )	106.45	41.94	64.51	39.40	44548.67	2.46
SEm±	1.21	0.82	0.66	0.64	-	-
CD at 5%	3.46	2.36	1.88	NS	-	-

significance. The trend was also found in no. of shoots per meter row length and dry matter accumulation (g) in 25 cm row length.

#### *Yield attributes and yield*

The data portrayed in Table 1 & 2 shows that variety BH-946 had significantly higher number of spikes, meter<sup>2</sup>, length of spike, number of grains and grain weight per spike and 1000-grain weight than rest of the varieties. Variety BH-902 also had, considerably more number of spikes meter<sup>2</sup>, length of spike, number and weight of spikes than RD-2552, DWRB-101 and DWRUB-52 variety. Similar results also reported Ali, (2011) and Ram and Dhaliwal (2012).

Variety BH-946 produced maximum biological yield (117.66 q ha<sup>-1</sup>) than all other varieties tested and the magnitude of increase was 3.34 to 10.53 per cent. Variety BH-902 (V<sub>1</sub>) did not differ much with RD-2552 (V<sub>3</sub>), produced significantly higher biological yield than that of DWRB-101 (V<sub>4</sub>) and DWRUB-52 (V<sub>5</sub>).

Variety BH-946 (V<sub>2</sub>) yielded appreciably higher grain yield by 5.89, 8.39, 11.73 and 16.81 per cent as compared to BH-902 (V<sub>1</sub>), RD-2552 (V<sub>3</sub>), DWRB-101 (V<sub>4</sub>) and DWRUB-52 (V<sub>5</sub>), respectively. Variety BH-902 was at par with RD-2552 and produced conspicuously higher grain yield. The maximum straw yield (70.84 q ha<sup>-1</sup>) was found with BH-946 (V<sub>2</sub>) and minimum with DWRUB-52 (V<sub>5</sub>). Maximum harvest index was noted with variety BH-946 (V<sub>2</sub>) when compared with all other varieties tested in this experiment.

#### *Economics*

The Table 2 under reference shows that the total cost of cultivation, gross returns net returns and benefit : cost ratio were obtained maximum and minimum under zero tillage (ZT) residue @ 6 t/ha (ZT+R) and Zero tillage (ZT) respectively. Amongst the cultivars, the highest cost of cultivation, gross returns and net returns were recorded with BH-946 (V<sub>2</sub>) followed by BH-902 (V<sub>1</sub>) in this regard.

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