

Original Research Article

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Effect of Tillage Management Models and Seed Rates on Growth, Yield Attributes and Yield of Late Sown Varieties of Wheat in Rice Fallow

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ABSTRACT

The field experiment was conducted at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology Kumarganj, Faizabad (U.P.) during *Rabi* season of 2013-14 and 2014-15. Field experiment was conducted to study the effect of tillage management modules, seed rate and varieties on wheat with variety NW-1014 and HUW-234 during *Rabi* season of 2013-14 and 2014-15. The treatment was replicated thrice in Split Plot Design. The experimental soil was silty loam in texture having pH 8.14, OC% 0.32, EC 0.30 dSm⁻¹, available N: 160.40, P: 12.68, K: 218.40 kg ha⁻¹. The crop was sown on 30th December and 6th January and harvested on 3rd and 8th May of 2014-15 and 2015-16. Plant height increased by 6.21% and 3.17% in conventional tillage as compared to reduced tillage at harvest. The dry matter production was found in HUW-234 which was 8.80% and 8.36% higher as compared to the NW-1014 during the year 2013-14 and 2014-15. Highest grain yield was recorded with variety HUW-234 (27.08 and 27.38 q ha⁻¹) as compared to NW-1014 (23.84 and 24.48 q ha⁻¹), maximum straw yield was recorded with HUW-234 variety (31.06 and 33.01 q ha⁻¹) which was significantly superior over NW-1014 (30.00 and 31.12 q ha⁻¹) variety and the maximum biological yield was recorded with HUW-234 which was significantly higher over NW-1014 variety in respective years. The tillage practices altered the grain yield. The maximum value of harvest index in conventional tillage and minimum in zero tillage during the year 2013-14 and 2014-15 respectively.

Keywords

Wheat, Tillage management modules, Seed rates, Yield attributes and yield

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Introduction

Wheat (*Triticum aestivum* L.) is a crop of Poaceae family and one of the most leading cereals of many countries of the world

including India. Wheat is cultivated world-wide over an area of about 222.16 million hectare with an annual production of about 752 million metric tonnes (Anonymous, 2016-17). In India during 2016 total food grains

production was 205.43 mt, out of which, wheat production was 93.50 mt, in 30.93 m ha area with a productivity of 3.09 tones per ha (Anonymous, 2015-16). India is the second largest wheat producing country in the world, contributing about 34 percent of total food grain production. About 91% of the total wheat production is contributed by northern states.

Among them Uttar Pradesh ranks first with respect to area (9.65 m ha) and production of (26.87 mt) but the productivity (2786 kg ha⁻¹) is much lower as compared to Punjab (4596 kg ha⁻¹) and Haryana 4407 kg ha⁻¹ (Anonymous, 2016). The major wheat producing countries are china, India, USA, France, Russia, Canada, Australia, Pakistan, Turkey, UK, Argentina, Iran and Italy. These countries contribute about 78.82% of the total wheat production. As far as India is concerned, about 90% of the total wheat production is contributed by northern states.

The late transplanting of rice or use of long duration varieties in low land delays the sowing of wheat from mid November to December. The preceding crops such as sugarcane, potato, toria etc. and other factors forced to sow the wheat as late as in the month of December and January leads to low production & productivity.

Low temperature, poor mineral accumulation, less translocation of photosynthesis from source to sink, hot desiccating wind during milking stage forced premature drying, unsuitable location specific varieties, imbalanced nutrient management are responsible for yield under late sown wheat.

Wheat yield under late sown condition is poor due to the less exploitation of the potentialities of the crop and available resources. Reduction in yield is mainly caused by delayed emergence of seedlings and curtailing the

growth and development period of the crop. Delayed emergence of crop followed by high temperature and hot desiccating winds during grain filling stage results forced maturity of late sown wheat because of dehydration which ultimately result in heavy reduction in the whole biomass and yield.

The HUW -234 variety was developed by BHU, Varanasi in 1986 with the parents HUW 12/SPRW. The variety was released by CVRC. This variety is suitable for late sown and irrigated conditions. NW 1014 is a wheat variety was release in 1998 by CVRC. The variety was developed by NDKVV, Faizabad.

The variety is widely adopted in the area NEPZ. Zero tillage farming (also called no-till or direct drilling) is a way of growing crops or pasture from year to year without disturbing the soil through tillage.

In agronomical research, the major emphasis should be laid in quantification of yield advantages of various tillage management modules over traditional tillage practices and how far the yield advantages can be explained in agronomical term reflecting in the improvement of plant population or in per plant yield or both. The per plant yield can further been explained in the term of number of grain and grain weight.

It is generally believed that tillage management may possibly improve the germination stand and vigour of the individual plant. To fully exploit the potential of high yielding varieties, the development of special non-monetary management practices like tillage practices is a prime need that promotes the efficient utilization of nutrients, water and space, reduces the cost of cultivation, save the seed and fertilizer, causes easiness in intercultural operations, better control of weeds, insect-pest and diseases. Keeping this idea in view, three tillage management

modules are undertaken to find out the best tillage operation for late sown wheat intended for economical production.

Materials and Methods

The farm is located 42 km away from Faizabad city on Faizabad- Raebareilly road at 26.47° N latitude and 82.12° E longitude and about 113 metres above the mean sea level. The treatment included various tillage management modules, seed rate and varieties viz. M₁: (Conventional tillage), M₂= reduced tillage and M₃= zero tillage main plot, b. Seed rate kg ha⁻¹ (sub-plot) viz. S₁= 100 kg ha⁻¹, S₂=125, S₃=150 and c. Wheat varieties (sub-plot) V₁=NW-1014 and V₂ =HUW-234. The treatment were replicated thrice in Split Plot Design. The experimental soil was silty loam in texture having P^H 8.14, OC% 0.32, EC 0.30 dSm⁻¹, available N:160.40, P: 12.68, K: 218.40 kg ha⁻¹.

The crop was sown on 30th December and 6th January and harvested on 3rd and 8th May of 2013-14 and 2014-15. Certified and pure seeds were tested for germination before sowing. Sowing was done on 30th December 2013 and 06 January 2015 using different seed rate 100, 125 and 150 kg ha⁻¹. Sowing was done in rows 20 cm apart using zero tillage, reduced tillage and conventional tillage. Planking was also done in case of reduced tillage and conventional tillage.

In the gross plot a uniform dose of nitrogen @ 60 kg ha⁻¹ (half dose) through urea, phosphorus @ 60 kg ha⁻¹ through single super phosphate and potassium @ 40 kg ha⁻¹ through murate of potash were applied to all treatments as basal dressing. Remaining half dose of nitrogen (60 kg ha⁻¹) through urea was top dressed in two equal doses. Wheat was harvested when the leaves and stems turn yellow and become finally dry. Two rows of border from both the side of the plot and 0.5m

length of both sides were harvested first and removed from the field and after that net plots were harvested separately.

Five plants were randomly selected from each plot. The plant height was measured in cm. From the soil surface to basal portion of flag leaf at 30th, 60th, 90th DAS and harvest stage of crop growth period. Five plants were randomly selected from border rows at 30, 60, 90 DAS and at harvest after sun drying, materials were kept in an oven at 65 °C till the constant weight. The average weight was recorded and presented as dry matter plant⁻¹ (g). Number of effective tillers (ear heads) were counted before harvesting from marked area of m⁻² from three plants and average value was taken. Length of five selected spikes from each plot were measured carefully from the neck node to the tip of last grain and averaged out to get the length of single spike. Total number of spikelets from five selected spikes was counted and average values were recorded. One thousand grains from net plot were counted and weighed to get 1000 grains weight (g).

All the above ground biomass of experimental crop of each plot was harvested, sun dried and weighed in kg plot⁻¹ to represent the biological yield and finally converted in to qha⁻¹. The grains were obtained after threshing of the net plot area and the grain was weighted and expressed as grain yield kg plot⁻¹ and finally converted into q ha⁻¹. The straw yield for each net plot was obtained by subtracting the grain yield from total biological yield and ultimately converted in to q ha⁻¹.

Results and Discussion

Plant height

The data on plant height recorded at 4 phenological growth stages *i.e.* 30, 60, 90 DAS and at harvest as influenced by different

tillage management module, seed rate and varieties are presented in Table 1. No significant difference was noticed in plant height under tillage management module, seed rate and varieties at 30 DAS during both of the year. The plant height was observed significantly higher with Conventional tillage treatment over Reduced tillage but remained at par with Zero tillage at 60, 90 DAS and at harvest during both of the years. Plant height increased by 6.21% and 3.17% in conventional tillage as compared to reduced tillage at harvest during the year 2013-14 and 2014-15, respectively.

Dry matter accumulation (g m^{-2})

Dry matter accumulation increased with the progression in crop age up to maturity. The rate of increase in dry matter accumulation was very slow in initial stage (up to 30 DAS) and it was found faster from 30 DAS to maturity of the crop during both the years of investigation. It is quite evident from the data given in Table 1 that the different tillage management modules and variety had no significant effect on dry matter accumulation but seed rate is significantly influenced at 30 DAS during both the years. Tillage management modules had significant effect on dry matter accumulation from 60 DAS to harvest stage of crop. Conventional tillage practices produce maximum dry matter accumulation at 60, 90 and at harvest. This was significantly higher over the zero tillage and reduced tillage during both the years. Dry matter production increased gradually from 30 DAS onwards but being determinate growth habit of the crop, the maximum dry matter production was recorded at harvest. Among the different seed rate, 150 kg ha^{-1} recorded significantly higher dry matter production over 125 kg ha^{-1} and 100 kg ha^{-1} at 60, 90 DAS and at harvest. At the time of harvest 7.41% and 7.18% dry matter increase was recorded in conventional tillage as compare to

reduced tillage. Dry matter accumulation in wheat was also significantly affected by varieties at 60, 90 DAS and at harvest stages of crop growth. Variety HUW-234 recorded significantly higher dry matter accumulation at every stage of crop growth as compared to NW-1014. At harvest significant highest, dry matter production was found in HUW-234 which was 8.80% and 8.36% higher as compared to the NW-1014 during the year 2013-14 and 2014-15, respectively.

Number of spikes m^{-2}

The data on number of spikes as influenced by various treatments have been presented in Table 2. It clearly indicates that the maximum number of spikes (190.11 and 192.72 m^{-2}) was recorded with the application of conventional tillage significantly higher over zero tillage and reduced tillage treatments. The maximum number of spikes (188.72 and 190.83) was recorded with the application of 100 kg ha^{-1} seed rate significantly influenced over 125 and 150 kg ha^{-1} seed rate during both the year of investigation. It clearly indicates that the maximum number of spikes (193.52 and 196.00) was recorded under HUW-234 significant difference over NW-1014 during the year 2013-14 and 2014-15, respectively. The data of spike length as influenced by different tillage management module, seed rate and varieties presented in Table 2 showed that the tillage management module have varying significant effect on spike length of wheat. The largest spike length (9.12 and 9.14 cm) was recorded with conventional tillage, which was significantly superior over the zero tillage and reduced. Similarly, spike length was significantly affected by seed rate. Largest spike length of wheat was recorded with 100 kg ha^{-1} seed rate which was significantly higher over the 125 kg ha^{-1} and 150 kg ha^{-1} seed rate application. Spike length of wheat was also significantly affected by varieties of the wheat. The variety HUW-234

recorded significantly large spike length (9.26 cm and 9.28 cm) as compared to the NW-1014 (8.60 and 8.62 cm) during the year 2013-14 and 2014-15, respectively.

Spike length (cm)

The data of spike length as influenced by different tillage management module, seed rate and varieties presented in Table 2 showed that the tillage management module have varying significant effect on spike length of wheat. The largest spike length (9.12 and 9.14 cm) was recorded with conventional tillage, which was significantly superior over the zero tillage and reduced tillage during the year 2013-14 and 2014-15, respectively.

Similarly, spike length was significantly affected by seed rate. Largest spike length of wheat was recorded with 100 kg ha⁻¹ seed rate which was significantly higher over the 125 kg ha⁻¹ and 150 kg ha⁻¹ seed rate application. Spike length of wheat was also significantly affected by varieties of the wheat. The variety HUW-234 recorded significantly large spike length (9.26 cm and 9.28 cm) as compared to the NW-1014 (8.60 and 8.62 cm) during the year 2013-14 and 2014-15, respectively.

Number of spikelets spike⁻¹

The highest spikelets spike⁻¹ (13.36 and 13.78) during the year 2013-14 and 2014-15, respectively) were recorded with conventional tillage, which was significantly larger over the zero tillage and reduced tillage. Similarly, seed rate affected the number of spikelets spike⁻¹ was significantly and highest spikelets per spike of wheat values were recorded with 150 kg ha⁻¹ (13.91 and 14.06) level which was significantly higher over the 100 kg ha⁻¹ and 125 kg ha⁻¹ application during the year 2013-14 and 2014-15 respectively. Number of spikelets spike⁻¹ was also found significantly affected by wheat cultivars and the cultivar

HUW-234 recorded significantly more spikelets per spike (13.52 and 14.41) as compared to the NW-1014 (11.96 and 12.81) during the year 2013-14 and 2014-15, respectively.

Grain yield (q ha⁻¹)

The data pertaining to grain yield was recorded and presented in Table 3. The data revealed that the grain yield of wheat was also significantly affected by tillage management modules. The highest grain yield was recorded with conventional tillage (27.58 and 29.70 q ha⁻¹) which was significantly higher over reduced tillage and zero tillage. The grain yield increased by 11.61% and 12.75% in conventional tillage as compare to zero tillage during the year 2013-14 and 2014-15, respectively. The variation in wheat grain yield was observed significant due to seed rate. Grain yield of wheat 27.03 and 27.18 q ha⁻¹ was observed under 150 kg ha⁻¹ which was significantly higher over 100 and 125 kg ha⁻¹ during the year 2013-14 and 2014-15, respectively. Among the varieties, maximum grain yield was recorded with variety HUW-234 (27.08 and 27.38 q ha⁻¹) as compared to NW-1014 (23.84 and 24.48 q ha⁻¹) variety during the year 2013-14 and 2014-15, respectively.

Straw yield (q ha⁻¹)

Data pertaining to straw yield indicated that the tillage management module had significant effect on the straw yield of wheat Table 3. Significantly higher straw yield (33.96 and 34.54 q ha⁻¹) was recorded with conventional tillage than zero tillage and reduced tillage. The effect of seed rate in respect of straw yield of wheat was observed significant during both the years. The significantly higher straw yield was observed with 150 kg seed rate (33.46 and 33.78 q ha⁻¹) over the treatment 100 kg ha⁻¹ and 125 kg ha⁻¹ seed rate during

the year 2013-14 and 2014-15, respectively. Among the varieties, maximum straw yield was recorded with HUW-234 variety (31.06 and 33.01 q ha⁻¹) which was significantly superior over NW-1014 (30.00 and 31.12 q ha⁻¹) variety, respectively during both the year of investigation.

Biological yield (q ha⁻¹)

Data pertaining to biological yield per hectare as influenced by different tillage management module, seed rate and varieties shown in Table 3 revealed that the tillage management module had significant effect and highest biological yield was recorded as 61.55 and 64.24 q ha⁻¹ which was significantly higher over rest of the tillage management module during both the years. The effect of seed rate in respect of biological yield of wheat was observed significant in the year 2013-14 and 2014-15. The seed rate 150 kg ha⁻¹ recorded significantly higher biological yield as compared to the treatment where seed rate was @ 100 and 125 kg ha⁻¹ during both the years. Among the varieties, maximum biological yield was recorded with HUW-234 (58.14 and 60.39 q ha⁻¹) which was significantly higher over NW-1014 variety (53.84 and 55.60 q ha⁻¹) in respective years.

Harvest index

The data on harvest index as influenced by tillage management module, seed rate and varieties are presented in Table 3. Highest harvest index (44.80 and 46.23%) was recorded under conventional tillage and lowest harvest index was observed in zero tillage (43.65 and 43.80%) during both the years, respectively. The effect of seed rate in respect of harvest index was also observed non-significant. The treatment having 100 kg ha⁻¹ seed rate application, recorded the highest harvest index (44.39 and 45.02%) but lowest harvest index (43.59 and 44.51%) was observed with 150 kg ha⁻¹ seed rate during the

year 2013-14 and 2014-15, respectively. Among the varieties, higher harvest index was recorded with HUW-234 in comparison to NW-1014 in both of the years but the varietal effect was non-significant on the harvest index during both the years.

Tillage practices significantly affected the plant height with the age of crop (Table 1). Initially, the difference in plant height was non-significant at 30th day stage of the crop which was due to less time available for growth and development of plant. The increased plant height with conventional tillage followed by zero tillage and reduced tillage at later stages might be due to the cumulative effect of seedling method which resulted into good plant establishment and good pulverization with this tillage practice and thus by the effect of these factors, increased plant height was recorded. The similar finding has also been reported Pravesh, R. (2007). Tillage practices brought significant differences in dry matter accumulation at all the stages, except 30th day stage of crop growth. The higher dry matter accumulation was recorded with conventional tillage followed by zero tillage and reduced tillage, respectively. The higher dry matter was associated with conventional tillage and sowing on zero tillage mainly due to good soil environment which resulted in higher growth and development. Similar findings were also observed by Khanali *et al.*, (2012) and Pravash Ram (2007).

The yield attributing characters, number of spike m⁻², spike length and number of spikelets spike⁻¹ enhanced significantly but 1000 grain weight was not significantly affected with each increase in seed rate during both the year. Significant improvement in yield attribute due to increase in 100 to 150 kg ha⁻¹ seed rate have also been recorded by Singh and Prasad (1998).

Table.1 Effect of tillage management models and seed rates on growth of late sown rice

Treatment	Plant height (cm)								Dry matter accumulation (g m ⁻²)							
	30 DAS		60 DAS		90 DAS		At harvest		30 DAS		60 DAS		90 DAS		At harvest	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
Main plot (tillage management module)																
Conventional	18.17	19.67	55.67	59.50	83.67	87.43	86.56	88.50	76.18	79.27	432.11	438.86	606.96	620.60	811.01	820.38
Reduced	17.06	18.39	52.72	57.02	78.61	83.12	81.50	85.78	71.66	73.99	383.88	393.02	555.62	570.28	755.04	765.36
Zero	17.61	19.50	55.06	58.00	80.67	86.67	84.78	86.84	74.60	76.46	403.90	414.85	579.37	596.01	787.78	798.59
SEm±	0.37	0.41	0.65	0.63	1.15	0.55	0.67	0.52	1.55	1.78	0.93	0.79	0.99	0.50	1.45	0.96
CD at 5%	NS	NS	2.26	2.46	4.53	2.14	2.64	2.03	NS	NS	3.64	3.10	3.88	1.96	5.70	3.79
Sub plot (seed rate kg ha⁻¹)																
100	17.44	19.06	53.89	57.17	79.56	85.78	82.17	85.89	72.95	73.59	399.55	407.55	573.82	586.71	775.16	783.02
125	17.00	18.78	55.00	58.22	81.00	85.56	84.44	86.44	74.07	75.16	406.52	415.77	580.06	595.18	784.97	794.44
150	18.39	19.72	56.56	59.78	82.39	87.89	85.22	88.28	75.42	76.97	413.81	423.42	588.08	605.00	793.70	806.87
SEm±	0.54	0.39	0.74	0.73	0.67	1.20	0.59	0.94	0.36	0.33	0.86	0.60	1.63	0.61	1.78	0.85
CD at 5%	NS	NS	2.13	2.10	1.92	3.47	1.71	2.71	1.03	0.97	2.49	1.72	4.70	1.76	5.13	2.46
Sub plot (Variety)																
NW-1014	17.20	18.89	54.20	57.07	78.70	83.04	80.52	83.07	80.44	63.52	382.77	390.58	551.96	566.82	751.53	762.90
HUW-234	18.02	19.48	56.09	59.70	83.26	89.78	87.37	90.67	83.85	86.96	430.49	440.57	609.34	624.43	817.69	826.66
SEm±	0.31	0.36	0.60	0.60	0.54	0.98	0.48	0.77	1.29	1.27	0.70	0.49	1.33	0.50	1.45	0.70
CD at 5%	NS	NS	1.74	1.72	1.57	2.84	1.39	2.21	NS	NS	2.03	1.40	3.84	1.44	4.20	2.01

Table.2 Effect of different treatments on number of spikes m⁻², spike length (cm), number of spikelets spike⁻¹ of wheat under late sown conditions

Treatment	Number of spikes m ⁻²		Spike Length (cm)		Number of spikelets spike ⁻¹		1000- grain weight (g)	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
Main plot (tillage management module)								
Conventional	190.11	192.72	9.12	9.14	13.36	13.78	33.58	33.71
Reduced	184.83	187.22	8.78	8.80	12.09	12.83	32.93	32.80
Zero	187.78	190.00	8.89	8.92	12.77	13.22	33.12	33.82
SEm±	0.10	0.14	0.002	0.003	0.21	0.18	0.27	0.34
CD at 5%	0.40	0.55	0.007	0.011	0.64	0.55	NS	NS
Sub plot (seed rate kg ha⁻¹)								
100	186.44	189.06	8.94	8.96	12.11	13.17	33.08	33.15
125	187.56	190.06	8.93	8.95	12.19	13.61	33.26	33.52
150	188.72	190.83	8.92	8.94	13.91	14.06	33.29	33.66
SEm±	0.21	0.18	0.003	0.002	0.57	0.18	0.21	0.33
CD at 5%	0.59	0.52	0.007	0.006	1.72	0.50	NS	NS
Sub plot (Variety)								
NW-1014	181.63	183.96	8.60	8.62	11.96	12.81	33.93	34.26
HUW-234	193.52	196.00	9.26	9.28	13.52	14.41	32.49	32.63
SEm±	0.17	0.15	0.002	0.002	0.21	0.14	0.57	0.58
CD at 5%	0.49	0.42	0.006	0.005	0.64	0.41	NS	NS

Table.3 Effect of different treatments on yields and harvest index (%) of wheat under late sown conditions

Treatment	Grain yield (q ha ⁻¹)		Straw yield (q ha ⁻¹)		Biological yield (q ha ⁻¹)		Harvest index (%)	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
Main plot (tillage management module)								
Conventional	27.58	29.70	33.96	34.54	61.55	64.24	44.80	46.23
Reduced	20.37	21.83	25.85	27.73	46.22	49.56	44.12	44.07
Zero	24.71	26.34	31.79	33.75	56.58	60.09	43.65	43.80
SEm±	0.08	0.09	0.06	0.16	0.11	0.18	0.08	0.12
CD at 5%	0.32	0.34	0.25	0.64	0.42	0.69	0.32	0.38
Sub plot (seed rate kg ha⁻¹)								
100	24.65	24.95	27.55	30.46	51.81	55.11	44.39	45.02
125	25.90	26.05	30.59	31.77	54.64	57.82	43.67	44.94
150	27.03	27.18	33.46	33.78	56.91	60.95	43.59	44.51
SEm±	0.14	0.20	0.09	0.21	0.15	0.34	0.17	0.12
CD at 5%	0.40	0.58	0.26	0.61	0.44	0.97	0.48	0.38
Sub plot (Variety)								
NW-1014	23.84	24.48	30.00	31.12	53.84	55.60	44.27	44.02
HUW-234	27.08	27.38	31.06	33.01	58.14	60.39	46.57	45.33
SEm±	0.11	0.17	0.07	0.17	0.12	0.27	0.14	0.18
CD at 5%	0.33	0.48	0.21	0.50	0.36	0.79	0.40	0.51

The tillage practices affected the grain yield. The higher Grain yield was recorded with conventional tillage followed by zero tillage.

This might be due to surface pulverization of soil comparatively for longer period with conventional tillage, which recorded higher yield attributes resulting in maximum grain yield. Similar research findings were also reported by Khan Ali *et al.*, (2012), Kadian *et al.*, (2005), and Panday *et al.*, (2001).

The tillage practices affected the straw yield. The higher straw yield was recorded with conventional tillage followed by zero tillage and reduced tillage. This might be due to surface pulverization of soil comparatively as discussed in case of grain yield under conventional tillage, which recorded higher yield attributes resulting in maximum straw yield. Similar research findings were also reported by Roy *et al.*, (1993) and Tripathi and

Chauhan (2001). Tillage practices affected the biological yield.

The higher biological yield was recorded with conventional tillage followed by zero tillage and reduced tillage. This might be due to surface pulverization of soil comparatively for longer period which recorded better yield attributes.

Sen *et al.*, (2002) and Halvorson *et al.*, (2000) also reported similar findings. Yield is the result of coordinated inter play of growth characters and yield attributes. Grain and straw yield significantly influenced by different tillage practices. Higher grain yield was recorded under conventional tillage. The tillage practices altered the grain yield. The maximum value of harvest index (44.80 and 46.23) in conventional tillage and minimum in zero tillage. Similar result had also been reported by Singh *et al.*, (2003). On the basis

of results, it may be recommended treatment for farmer M₁S₃V₂ (conventional tillage, 150 kg seed rate ha⁻¹ and HUW-234 for growing of late sown wheat in eastern part of Uttar Pradesh.

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