

Assessment of Tillage and Crop Establishment Techniques for Productivity of Wheat Cultivation under Northern Part of Madhya Pradesh

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Received: 20.01.2020 | Revised: 24.02.2020 | Accepted: 6.03.2020

ABSTRACT

A field experiment was conducted during the consecutive rabi seasons of 2018 and 2019 on sandy clay loam at Research Farm, College of agriculture, RVSKVV, Gwalior (M.P.) to study the evaluation of tillage and crop establishment techniques for improving productivity of wheat. Variety (V₃) MP3336 were resulted in significantly higher grain yield, straw yield and biological yield, which was statistically at par with variety (V₁) GW-322 over variety RVW-4106. On the basis of resources conservation technique, maximum grain yield, straw yield and biological yield was observed with Furrow irrigated raised bed (S1) which was at par with Zero tillage (S4) in wheat.

Keywords: Grain, Straw, Variety, Tillage and Wheat

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the main cereal crops in India. It is widely cultivated, produced and used throughout the world. India is the second largest producer of wheat in the world. Of all grain crops, wheat is the most popular staple food for human consumption. Belonging to the family of *poaceae*, it is an annual crop of self pollination. It is grown during the *rabi* season in temperate regions and also at high altitude in tropical climates zones in winter. Wheat grains contain starch (60-68%), protein (10-12%), fat (1.5%), cellulose (2.0-2.5%),

minerals (1.8%) and vitamins. Total food grain production estimate hits the record of 277.49 million tonnes in India (Ministry of Agriculture and Farmers Welfare 2017-18). In India, wheat is cultivated in an area of 305.97 Lakh hectares with 98.38 million tonnes production and 3216 kg/hectare productivity (Ministry of Agriculture and Farmers Welfare 2016-17). The major wheat growing states in the India are Uttar Pradesh, Punjab, Haryana and Madhya Pradesh. Uttar Pradesh ranks first among all the states of India in terms of both area and production of wheat. Wheat has got an important role in, 'Green Revolution'.

Cite this article: Tomar, B., Tomar, S. P. S., Singh, S. K., Manekar, U., & Mahore, S. (2020). Assessment of Tillage and Crop Establishment Techniques for Productivity of Wheat Cultivation under Northern Part of Madhya Pradesh, *Ind. J. Pure App. Biosci.* 8(2), 282-288. doi: <http://dx.doi.org/10.18782/2582-2845.8636>

Both vegetarian and non-vegetarian consumer eats wheat and its products. Some of its products are biscuit, bread, noodles, pasta etc. Wheat also contributes essential amino acids, minerals, vitamins, and beneficial phytochemicals with dietary fibre components to the human diet and these are particularly enriched in whole grain products (Shewry, 2009). Wheat is also a good source of traces minerals like selenium and magnesium, Wheat grains are also rich in pantothenic acid, riboflavin and some minerals, sugars etc. (Kumar et al., 2011).

Resource conservation technologies (RCTs) is one of the improved method amongst cultural practices. The most successful resource conserving technology in the wheat systems is zero-tillage, reduced tillage dry sowing, laser leveling, and Furrow Irrigated Raised Bed (FIRB). Zero tillage (ZT) system may involve controlled tillage seed sowing system that do not normally disturb more than 20 to 25 % of the soil surface to reduce soil disturbance, energy use and production costs; and to increase profitability (Mandal et al., 2014). Furrow Irrigated Raised Bed (FIRB) system improved soil structure due to reduced compaction through controlled trafficking, reduced water logging and timely machinery operations due to better surface drainage and opportunity for mechanical weed control and improved fertilizer placement (Naresh et al., 2012).

MATERIALS AND METHODS

An experimental was conducted at R.V.S.K.V.V., Gwalior (26.13° N' and 76.14° E') in Madhya Pradesh during the *rabi* seasons of 2018 and 2019. The area has semi-arid and sub-tropical climate with extreme weather condition having hot and dry summer and cold winter. Generally, monsoon sets in the last week of June. Annual rainfall ranges from 700 to 800 mm most of which falls during last week of June to the middle of September. The maximum temperature goes up to 47°C during

summer and minimum as low as 2.8° C during winter. A combination of 16 treatments, viz. Main plot-Resource conservation techniques, Furrow Irrigated Raised Bed (S₁), Conventional (S₂), Reduced tillage (S₃), Zero tillage (S₄) and Sub plot (Wheat variety), GW-322 (V₁), RVW-4106 (V₂), MP-3336 (V₃) and HI-1544 (V₄), were tested in a split plot design, replicated thrice and sandy clay loam with 58.34% sand, 19.82% silt and 21.84% clay. During the treatment, plot were present available Nitrogen 192.5 and 187.0 kg/ha, available phosphorus 16.5 and 17.2 kg/ha and available potash 236.2 and 228.6 kg/ha with 7.80 and 7.74 pH and 0.41 and 0.43 % of organic carbon. The recommended dose of fertilizers, i.e. 80 kg N/ha, 40 kg P₂O₅/ha and 20 kg K₂O/ha was applied before sowing in the seed row zone. Nitrogen, Phosphorus and potash were applied through urea, single superphosphate and Murate of potash, respectively.

RESULTS AND DISCUSSION

Biological yield (kg/plot)

Resource conservation techniques and Wheat varieties caused significant differences in the biological yield individually but their interaction was non-significant (Table 1.1) during both the years and pooled basis.

Resource conservation techniques:

During first year, the maximum biological yield (13.83kg/plot) was recorded with RCT (S₁) Furrow irrigated raised bed (FIRB) closely followed by sowing method (S₄) Zero tillage with (13.08 kg/plot) biological yield. but second year, the trend was repeat and the maximum biological yield (14.08 kg/plot) was noticed with RCT (S₁) Furrow irrigated raised bed (FIRB) closely followed by (S₄) Zero tillage with 13.52 kg/plot biological yield. And RCT (S₂) Conventional tillage produce lowest biological yield during both the years. On pooled basis, the crop transplanted with RCT (S₁) Furrow irrigated raised bed (FIRB) produced maximum biological yield (13.95

kg/plot) of wheat followed by (13.30kg/plot) wheat RCT (S₄) Zero tillage and RCT (S₂) Conventional tillage produced lowest biological yield (14.11 kg/plot).

Wheat varieties:

The data on biological yield kg/plot indicates significant variations due to wheat varieties during both the years. In general, it was 14.53 to 10.68 and 14.84 to 11.02 kg/plot during first and second years of study, respectively. On pooled basis, maximum biological yield (14.69 kg/plot) was obtained with variety (V₃) MP3336 which was closely followed by variety (V₁) GW-322 with 13.81 kg/plot biological yield. Minimum biological yield (10.85 kg ha⁻¹) was obtained with variety (V₂)

RVW – 4106 which was significantly inferior in the entire biological yield.

The interaction effect due to Resource conservation techniques and Wheat varieties on biological yield kg per plot was found to be non -significant during both the years of study as well as on pooled basis.

Grain yield (kg/ha)

Resource conservation techniques:

Wheat sowing with Resource conservation technique (S₁) Furrow irrigated raised bed (FIRB) produced the highest grain yield (kg/plot) and followed by yield produced by (S₄) Zero tillage Resource conservation technique.

Table 1.1 Effect of Resource conservation techniques and wheat varieties on biological yield (kg/plot) plant of wheat

Treatments	Biological yield (kg/plot)		
	2018	2019	Pooled
Main - plot treatment (Resource conservation techniques)			
S ₁ : Furrow irrigated raised bed (FIRB)	13.83	14.08	13.95
S ₂ : Conventional tillage	11.55	11.98	11.76
S ₃ : Reduced tillage (one cultivation with planking followed by sowing)	12.23	12.47	12.35
S ₄ : Zero tillage	13.08	13.52	13.30
SE (m) ±	0.27	0.18	0.16
CD 5%	0.92	0.62	0.50
Sub - plot treatment (Wheat Varieties)			
V ₁ : GW - 322	13.63	13.99	13.81
V ₂ : RVW - 4106	10.68	11.02	10.85
V ₃ : MP - 3336	14.53	14.84	14.69
V ₄ : HI - 1544	11.86	12.19	12.02
SE (m) ±	0.25	0.26	0.18
CD 5%	0.72	0.77	0.51
Interaction (A X S)	NS	NS	NS

(S₂) Conventional tillage resource conservation technique caused reduction in yield. Thus, sowing with (S₂) Conventional tillage proved to be the lowest yield. RCT of wheat with (S₄) Zero tillage gave statistically at par grain yield with highest (S₁) RCT in both the years of study.

On pooled basis, the (S₁) Furrow irrigated raised bed (FIRB) Resource conservation technique produced maximum grain yield of wheat (4837.29 kg ha⁻¹) followed by S₄ (4543.85 kg ha⁻¹) and S₂ which gave lowest grain yield (4110.38 kg ha⁻¹) respectively.

Table 1.2 Effect of Resource conservation techniques and Wheat varieties on Grain yield (kg/ha) plant of wheat

Treatments	Grain yield (kg/ha)		
	2018	2019	Pooled
Main - plot treatment (Resource conservation techniques)			
S ₁ : Furrow irrigated raised bed (FIRB)	4717.01	4957.57	4837.29
S ₂ : Conventional tillage	3952.85	4267.92	4110.38
S ₃ : Reduced tillage (one cultivation with planking followed by sowing)	4228.19	4464.44	4346.32
S ₄ : Zero tillage	4480.90	4606.81	4543.85
SE (m) ±	106.45	106.65	75.34
CD 5%	368.38	369.08	232.18
Sub - plot treatment (Wheat Varieties)			
V ₁ : GW – 322	4707.71	5034.31	4871.01
V ₂ : RVW – 4106	3337.29	3590.90	3464.10
V ₃ : MP – 3336	5170.00	5473.82	5321.91
V ₄ : HI – 1544	4163.96	4197.71	4180.83
SE (m) ±	121.80	106.95	81.04
CD 5%	355.52	312.17	230.26
Interaction (A X S)	NS	NS	NS

Wheat varieties:

Wheat variety (V₃) MP3336 increased the grain yield progressively and significantly over all the wheat varieties. During first year, the maximum grain yield 5170.00 kg ha⁻¹ was recorded with variety (V₃) MP3336 and second year the trend was repeat and the maximum grain yield (5473.82 kg ha⁻¹) was noticed with (V₃) MP3336 and minimum

grain yield was recorded in wheat variety (V₂) RVW - 4106 during both the year respectively.

The interaction effect due to Resource conservation techniques and Wheat varieties on grain yield (kg/plot) was found to be non - significant during both the years of study as well as on pooled basis.

Straw yield (kg/ha)

Data pertaining to straw yield of wheat plant have been given in Table 4.16. It is clearly evident from data that straw yield per plant was significantly influenced by Resource conservation techniques and Wheat varieties.

Resource conservation techniques:

During first year, the maximum straw yield (6804.82kg ha⁻¹) was recorded with Resource conservation technique (S₁) Furrow irrigated raised bed (FIRB) closely followed by (S₄) Zero tillage with 6420.81 kg ha⁻¹ straw yield. but second year, the trend was repeat and the maximum straw yield (6776.19kg ha⁻¹) was noticed with (S₁) Furrow irrigated raised bed (FIRB) closely followed RCT (S₄) Zero tillage with 6657.61 kg ha⁻¹ straw yield.

On pooled basis, the RCT with sowing method (S₁) Furrow irrigated raised bed (FIRB) produced maximum straw yield of wheat (6790.50 kg ha⁻¹) followed by (S₄) Zero tillage (6539.21 kg ha⁻¹). Wheat sowing with (S₂)

Conventional tillage gave lowest straw yield (5693.43 kg ha⁻¹).

4.4.3.2: Wheat varieties:

It is evident from result (Table 4.16) that using different wheat varieties increased straw yield which was significantly higher (V₃) MP3336 but statistically at par with variety (V₁) GW-322 during the first season and in the case of second season the trend was repeated respectively.

On pooled basis, maximum straw yield (6917.67 kg ha⁻¹) was obtained with variety (V₃) MP3336 which was closely followed by (V₁) GW-322 with 6634.61 kg ha⁻¹ straw yield. Minimum straw yield (5578.81 kg ha⁻¹) was obtained with (V₂) RVW - 4106 which was inferior in all the wheat varieties.

The interaction effect due to Resource conservation techniques and Wheat varieties on straw yield per hectare was found to be non-significant during both the years of experimentation as well as on pooled basis.

Table 1.3: Effect of Resource conservation techniques and Wheat varieties on Straw yield (kg/ha) plant of wheat

Treatments	Straw yield (kg/ha)		
	2018	2019	Pooled
Main - plot treatment (Resource conservation techniques)			
S ₁ : Furrow irrigated raised bed (FIRB)	6804.82	6776.19	6790.50
S ₂ : Conventional tillage	5674.47	5712.38	5693.43
S ₃ : Reduced tillage (one cultivation with planking followed by sowing)	5967.16	5926.76	5946.96
S ₄ : Zero tillage	6420.81	6657.61	6539.21
SE (m) ±	171.57	146.04	112.65
CD 5%	593.72	505.37	347.15
Sub - plot treatment (Wheat Varieties)			
V ₁ : GW - 322	6647.71	6621.50	6634.61
V ₂ : RVW - 4106	5561.07	5596.54	5578.81
V ₃ : MP - 3336	6942.37	6892.97	6917.67
V ₄ : HI - 1544	5716.11	5961.93	5839.02
SE (m) ±	191.15	189.03	134.42
CD 5%	557.96	551.78	381.90
Interaction (A X S)	NS	NS	NS

CONCLUSION

Based on the pooled results of two year experimentation, it is concluded that higher productivity with efficient Application of Variety (V₃) MP3336 were higher biological yield, grain yield and straw yield with Furrow irrigated raised bed (S1), followed by Zero tillage (S4) and reduced tillage (S4) can be achieved in *rabi* season in northern part of Madhya Pradesh.

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