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Economic feasibility of tillage and crop establishment techniques of wheat cultivation of Madhya Pradesh

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Abstract

Split plot design experiment of 16 treatments on clay soil was conducted in replication during consecutive seasons 2018-19 and 2019-20 on rice at Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya Agricultural College, Gwalior (MP.) Research Farm. Economic potential of agriculture and crop production. The results showed that (V3) MP3336 variety had the largest yield and B:C ratio, while RVW-4106 variety had the smallest yield and B:C ratio.

Keywords: Economics, variety, tillage and wheat

Introduction

Wheat (*Triticum aestivum* L.) is one of the major crops of India. It is widely grown, developed and used worldwide. India is the world's second largest rice producer. Among all food crops, wheat is the most important nutritional source for humans. It belongs to the Gramineae family and is a self-pollinating annual plant. It grows during the Rabi season in temperate climates, and stays at high altitudes in winter in temperate climates. Rice contains starch (60-68%), protein (10-12%), fat (1.5%), fiber (2.0-2.5%), minerals (1.8%) and vitamins. India's total food crop is expected to reach a record high of 277.49 million tonnes (Ministry of Agriculture and Farmers Welfare, 2017-18) [2]. The area under cultivation in India is 30.597 million hectares with a production of 98.38 million tonnes and a yield of 3,216 kg per hectare (Ministry of Agriculture and Farmers Welfare 2016-17) [3]. Rice growing states in India are Uttar Pradesh, Punjab, Haryana and Madhya Pradesh. Uttar Pradesh ranks first among Indian states in rice production and production. Wheat plays an important role in the "Green Revolution". Resource Conservation Technique (RCT) is one of the improvement methods in management. The most cost-saving methods in wheat are; no-till planting, reduced dry planting, laser leveling and furrow-irrigated raised beds (FIRB). Zero tillage (ZT) systems include controlled tillage cropping systems that typically disturb no more than 20% to 25% of the soil surface to reduce soil disturbance, energy use, and production costs. and improve outcomes (Mandal *et al.*, 2014) [6]. Furrow Irrigation Raised Bed (FIRB) systems reduce transportation, improve soil structure, reduce water infiltration and ensure timely operation of the machine through better drainage and irrigation opportunities, controlling weeds and improving fertilization (Naresh *et al.*, 2012) [7].

Materials and Methods

An experiment was carried out at R.V.S.K.V.V. (26.13° North Latitude and 76.14° East Longitude) in Gwalior, Madhya Pradesh during Rabi season 2018 and 2019. The region has a semi-arid and subtropical climate with extreme weather conditions such as hot, dry summers and cold winters. Monsoon usually arrives in the last week of June. Annual rainfall is 700 to 800 mm, with most occurring from the last week of June to mid-September. The highest temperature in summer can reach 47 degrees Celsius, and the lowest temperature in winter can reach 2.8 degrees Celsius. That is a combination of 16 treatments. Key concepts - conservation technology, greenhouse cultivation (S1), signs (S2), reduced tillage (S3), zero tillage (S4) and subplots (wheat variety), GW-322 (V1), RVW-4106 (V2), MP-3336 (V3) and HI-1544 (V4) were tested in a split-plot design with three replicates in sandy, clay loam soil containing 58.34% sand, 19.82% silt, and 21.84% clay. During treatment, nitrogen content in the field was 192.5 kg/ha, potassium content was 236.2 and 228.6 kg/ha, pH was 7.80 and 7.74, organic carbon was 0.41 and ha, pH was 7.80 and 7.74. 'type.

It is 0.41 hectares. %. Use the recommended fertilizer dose of 80 kg N/ha, 40 kg P₂O₅/ha and 20 kg K₂O/ha in the row area before planting. Nitrogen, phosphate and potassium fertilizers are used by urea, superphosphate and potassium sulfate, respectively.

Results and Discussion

Cost of cultivation

Cost of cultivation concluded different for each resource conservation technique during both the years. RCT, FIRB obtained maximum cost of cultivation Rs. 29720/ha and Rs. 30670/ha during 2018-19 and 2019-20 followed by conventional tillage and reduced tillage respectively. And zero tillage recorded minimum cost of cultivation during both the years. Rs. 29020/ha was common for all the wheat variety in 2018-19 and Rs. 29870/ha was common for all the wheat variety in 2019-20 (Table 1).

Gross income and net monetary returns ha⁻¹

Data revealed that maximum gross income of Rs. 100402.62/ha(2018-19) and Rs. 108985.60/ha (2019-20) was obtained from RCT (S₁) Furrow irrigated raised bed (FIRB) progressively over all the RCTs followed by (S₄) Zero tillage with gross income of Rs. 95290.18/ha. (2018-19) and Rs. 101996.31/ha. (2019-20). In the respect of wheat varieties, maximum gross income of Rs. 109012.74/ha (2018-19) and Rs. 119156.98/ha (2019-20) was obtained with variety (V₃) MP-3336 followed by variety GW-322 during both the crop seasons respectively (Table 1).

Net monetary returns ha⁻¹ concluded maximum under RCT, (S₁) FIRB Rs. 70682.62/ha and Rs. 78315.60/ha during 2018-19 and 2019-20 followed by zero tillage respectively. And conventional tillage recorded minimum net monetary returns ha⁻¹ during both the years. Maximum net monetary returns ha⁻¹ Rs. 89286.98/ha was recorded in wheat variety MP-3336. Minimum was concluded in variety RVW-4106 with Rs. 43508.28/ha in 2018-19 and Rs. 50447.91/ha in 2019-20 (Table 1).

Benefit: cost ratio (B:C)

From the economics point of view, maximum B:C ratio was obtained with (S₄) zero tillage, followed by (S₁) furrow irrigated raised bed (FIRB) during both the crop seasons. Whereas, the minimum B:C ratio obtained 2.9 and 3.1 from conventional tillage (S₂) during 2018-19 and 2019-20 respectively. Under different wheat varieties, maximum B:C ratio was obtained with (V₃) MP-3336, followed by (V₁) GW-

322. Whereas, the minimum B:C ratio (2.5) first year and (2.6) second year obtained from variety RVW-4106 respectively (Table 1).

Monetary returns per day (Rs./ha)

The results indicated that the highest monetary returns per day Rs. 465.02 ha⁻¹ and Rs. 518.65 ha⁻¹ was registered with RCT (S₁) Furrow irrigated raised bed, followed by (S₄) Zero tillage with registered Rs. 457.04 ha⁻¹ and Rs. 499.51 ha⁻¹ during the year 2018-19 and 2019-20 respectively. The lowest monetary returns per day Rs.362.25 ha⁻¹ (2018-19) and Rs. 421.94 ha⁻¹ (2019-20) was registered under conventional tillage (S₂) (Table 1).

Under different wheat varieties, maximum net returns of monetary returns per day Rs. 526.27 ha⁻¹ and Rs. 591.30 ha⁻¹ was obtained with variety MP-3336, followed by GW-322 with monetary returns per day Rs. 466.43 ha⁻¹ and Rs. 531.68 ha⁻¹ during the year 2018-19 and 2019-20 respectively. Whereas, the minimum monetary returns per day Rs. 286.24 ha⁻¹ (2018-19) and Rs. 334.09 ha⁻¹ (2019-20) obtained from variety RVW-4106 during the year 2018-19 and 2019-20 respectively (Table 1).

(FIRB) produced the highest yield (kg/parcel), followed by (S₄) yields from zero-related conservation strategies. (S₂) Resource-saving traditional agriculture has led to a decrease in crop yields. Therefore, (S₂) cultivation with conventional tillage proved to be least effective. Randomized controlled trials (RCTs) of zero-till rice provided statistics on mean yield up to maximum (S₁) RCTs in the two years of this study.

In summary, (S₁) Furrow Irrigated Raised Bed (FIRB) conservation technology produced the highest yield (4837.29 kg ha⁻¹), followed by S₄ (4543.85 kg ha⁻¹) and S₂ produced the lowest yield. yield (in 4110.38 kg ha⁻¹).

Wheat varieties

The yield increase of rice variety (V₃) MP3336 was significantly higher than all rice varieties. In the first year (V₃), MP3336 variety recorded the highest yield with 5170.00 kg ha⁻¹. The same situation was repeated in the second year, the highest yield (5473.82 kg ha⁻¹) was recorded with (V₃) MP3336, and in the second year, the Wheat variety (V₂) RVW - 4106 was recorded.

The study found that the interaction between the use of conservation technology and crop diversity on grain yield (kg/plot) was not significant over the study period and context.

Table 1: Effect of Resource conservation techniques and wheat varieties on economics of wheat.

Treatments	Cost of cultivation		Gross return		Net return		Monetary returns per day (Rs./ha)		B:C ratio	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
Main - plot treatment (Resource conservation techniques)										
S ₁ :	29720	30670	100402.62	108985.60	70682.62	78315.60	465.02	454.13	3.3	3.6
S ₂ :	29020	29870	84081.38	93582.22	55061.38	63712.22	362.25	499.51	2.9	2.6
S ₃ :	28370	29220	89733.02	97793.99	61363.02	68573.99	403.70	518.65	3.1	3.9
S ₄ :	25820	26570	95290.18	101996.31	69470.18	75426.31	457.04	421.94	3.6	3.1
Sub - plot treatment (Wheat Varieties)										
V ₁ : GW - 322	29020	29870	99917.28	110153.47	70897.28	80283.47	466.43	518.65	3.4	3.6
V ₂ : RVW - 4106	29020	29870	72528.28	80317.91	43508.28	50447.91	286.24	334.09	2.5	2.6
V ₃ : MP - 3336	29020	29870	109012.74	119156.98	79992.74	89286.98	526.27	591.30	3.7	3.9
V ₄ : HI - 1544	29020	29870	88049.08	92729.78	59029.08	62859.78	388.35	591.30	3.0	3.1

Basic cost of cultivation = Rs 29020/ha Price of wheat grain = Rs. 1840/q, & straw= Rs. 200/q

Table 2: 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 :	13.83	14.08	13.95
S ₂ :	11.55	11.98	11.76
S ₃ :	12.23	12.47	12.35
S ₄ :	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 :	13.63	13.99	13.81
V ₂ :	10.68	11.02	10.85
V ₃ :	14.53	14.84	14.69
V ₄ :	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

Table 3: 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 :	4717.01	4957.57	4837.29
S ₂ :	3952.85	4267.92	4110.38
S ₃ :	4228.19	4464.44	4346.32
S ₄ :	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 :	4707.71	5034.31	4871.01
V ₂ :	3337.29	3590.90	3464.10
V ₃ :	5170.00	5473.82	5321.91
V ₄ :	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

Conclusion

Based on the pooled results of two year experimentation, it is concluded that higher economically feasible with efficient Application of Variety (V₃) MP3336. MP3334 variety can be used to get maximum economic return with Furrow irrigated raised bed (S₁), followed by by Zero tillage (S₄) and reduced tillage (S₄) can be achieved in *rabi* wheat of Madhya Pradesh.

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