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Zero-Till Wheat Planting in Rice-Wheat Cropping System

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ABSTRACT

A field experiment was conducted during two consecutive *Rabi* seasons of 2015-16 and 2016-17 at farmer's fields in *Badkisarari* village on clay loam soils to validate zero till sowing of wheat crop in rice-wheat cropping system for realizing higher yield. Zero till sown wheat had significantly lesser weed dry bio mass per unit area as compared to wheat sown in conventional and reduced tillage beside advancement of sowing by 20-25d over conventional and reduced tillage sowing of wheat crop. The population of *Phalaris minor, Avena ludoviciana, Avena fatua, Chenopodium album, Melilotus indica* and *Anagalis arvensis* was reduced significantly under zero tillage as compared to conventional tillage. Excellent suppression in weed density and weed dry weight with higher levels of weed control efficiency and yield were obtained with zero till sown wheat. Zero tillage was also found better in terms of lesser cost of cultivation, higher net returns and B:C ratio.

Key Words: Zero tillage, Rice-wheat cropping system ,Conventional tillage , On farm assessment, Participatory rural appraisal.

INTRODUCTION

Wheat is grown in rotation with rice on forty andsixty per cent area in the country and Gwalior district respectively during the year 2015-16. It was observed in the participatory rural appraisal survey of the village *Badkisarai* in *Harsi*command area of the Gwalior district that very lessswitch over time is left to the farmers for subsequent sowing of wheat after rice harvest at the recommended time. Due to this reason sowing of wheat crop was delayed by at least 20-25 days. The delayed sowing was observed as big stumbling block in realizing the yield potential of newer varieties of wheat despite a seed replacement rate of above 40% among the farmers in the villages.

Farmers were realizing the consequences of late planting of wheat in terms of less tillering and forced maturity in crop due to increased terminal atmospheric temperature.Delay in time of sowing in Rice-wheat cropping system is perhaps the one of the major factors responsible for low crop yield (Kasana *et al*. 2015). Invasion of wheat crop with weeds like *Phalaris minor*, *Avena ludoviciana* and *Avena fatua* were also reported by the farmers during the pre adoption participatory survey of the village beside increased cost of cultivation and reduced yield of subsequent wheat crop in rice-wheat system.When land is cultivated to raise crops, weeds spring-up naturally along with the crop plants. Weeds represent one of the greatest limiting factors to efficient crop production (Kasana *et al,* 2018). Zero till seed drill machine is able to sow the wheat crop after the harvest of transplanted rice in standing rice stubbles.The reduction in wheat yield due to delay in sowing has been recorded as one per cent of total yield /ha/day (Hossain *et al*, 2011). Zero tillage has an advantage of early planting, reduced cost of production as well as chances of greenhouse gas emission. It has been established in various field experiments under climate resilient technology development research projects in Indo-Ganagetic plains (IGP) that zero tillage technique not only overcomes the problem of delayed planting of wheat but also reduced the infestation of weeds like *Phalaris minor*, *Avena ludoviciana* and *Avena fatua*. Keeping in view above eventualities of rice-

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wheat system the present investigation was planned to assess the performance and profitability of zero till wheat sowing technique in clay loam soils at farmer's fields in the adopted village *Badkisarai* under *Bhitarwar* block of district Gwalior.

MATERIALS AND METHODS

The field experiments were conducted for two consecutive years during *Rabi* seasons 2015-16 and 2016-17 at farmers' fields to validate zero till sowing of wheat crop in rice-wheat system for timely sowing of wheat in realizing higher yield. Ten farmers' participatory field trials were conducted during each season in Gwalior district of Madhya Pradesh. The soil of the farmers' fields was clay loam in texture with low organic carbon (0.3-0.8%) (Gupta *et al,* 1975) and available N (201-242 Kg/ha) (Subbiah and Asiza, 1956), medium in available P (15.5-18.6Kg/ha)(Olsen *et al,*1954) and available K (180-240Kg/ha) (Muhur *et al,*1965) with pH 8.2-8.6 (Piper, 1966).

The experiment was laid out in randomized block design (RBD) comprising 03 planting methods of wheat after rice harvest *viz.,* conventional tillage, reduced tillage and zero tillage on 10 farmers' fields considering each field as separate replication. Wheat variety MP4010 was sown during last week of November and first week of December during the year 2014-15 and 2016-17 in zero tillage and during last week of December and first week of January in conventional tillage practice encompasses burning of rice residues followed by pre irrigation water ponding in fields and 3-4 cultivations after getting workable field conditions. The crop was sown in rows, 20cm apart, while wheat crop was sownafter one follow up cultivation after rice harvest followed by pre irrigation and one cultivationunder reduced tillage treatment.

The zero tillage (ZT) treatment (T_1)consisted of direct drilling of wheat seed (100kg/ha) with di-ammonium phosphate (125kg/ha), Urea (80kg/ha) and muriate of potash (66 kg/ha) by using zero till seed –cum-fertilizer drill machine without any pre sowing tillage operation in presence of sufficient moisture condition after rice harvest in anchored residues . Remaining dose of nitrogen was applied through two equal doses of urea (65kg/ha each) in split application after first and second irrigation at the appropriate moisture level in fields. The conventional tillage (CT); the farmers practice (FP) (T_3) consisted of burning of crop residues followed by one pre sowing irrigation followed by 3-4 ploughings with planking for getting suitable tilth and finally sowing with conventional seed cum ferti drill machine with the same dose of nutrients. The wheat crop sown in reduced tillage (T_2) was also given same dose of nutrients as that applied in zero and conventional tillage. The zero till and reduced till sowing were carried out in advance by 25-30 and 2-5 d, respectively as compare to CT/FP on the farmer's fields. The crop was grown with all other similar package of practices under all the planting methods.

The population and above ground weed bio mass was also recorded at 60 DAS by using a quadrant of 0.5 X 0.5 m for major grassy weeds and broad leaved weeds. Standard methods were followed for weed, crop and economical analysis.

RESULTS AND DISCUSSION

Effect on weed

The farmers' fields *in Harsi* canal command area under rice-wheat cropping system were profoundly infested with grassy weeds *viz., Phalaris minor*, *Avena ludoviciana* and *Avena fatua* beside broad leaved weeds mainly *Chenopodium album , Chenopodium murale, Anagalis arvensis, Melilotus alba* and *Rumex dentotous* under wheat crop sown in conventional tillage (FP) and reduced tillage .On the other hand, zero till sowing resulted in very effective suppression of narrow leaved weeds with fewer number of BLWs *viz.Chenopodium album , Chenopodium murale, Anagalis arvensis, Melilotus alba* and *Rumex dentotous*. Zero till planting (T_1) of wheat gave significantly lower weed density and weed dry weight for narrow leaved weeds

during both the years over farmers practice (T_3) (CT) which gave 85.80 and 89.17 per cent control efficiencies for narrow leaved weeds (NLWs) in the year 2015-16 and 2016-17, respectively at 60 DAS (Table. 1). The similar trends were also observed by Radhey Shyam *et al* (2014). The control efficiencies for NLWs under zero till planting method were statistically superior to rest of the two planting methods used for wheat in rice-wheat system. Singh (2014) also reported better control of narrow leaved weeds in ZT planting (T1) of wheat crop in rice-wheat cropping system. The poor performance of CT in managing the narrow leaved weeds in rice –wheat system was might be due to brought up seeds of narrow leaved weeds from lower layers to upper layer (0-5 cm) of the soil by excessive tillage operations. These seeds got the opportunity to germinate under favorable micro ecological conditions under CT planting (T3) of wheat crop.

The planting methods could not produceany significant difference with respect to dry weight of broad leaved weeds however these were observed in fewer numbers at different locations. Statistically significant difference was observed for density of BLWs under different planting methods. Significantly lower broad leaved weeds density was recorded under T1 and T2as compared to T3during both the years of investigation.

Effect on crop

Wheat crop sown under zero tillage recorded significantly higher number of effective tillers/$m^2$and test weightover reduced and conventional tillage during both the years (Table 2). The significantly higher values for the test weight of wheat crop seed under zero till planting could be ascribed to higher accumulation of photosynthates in seed due to congenial ambient temperature the crop received during maturity under ZT due to advanced planting. Further lesser competition received by the crop from NLWs for growth resources under zero till planting of wheat over rest of the two planting methods hadan added advantage for enhanced growth and development of crop. The higher values for the

Table 1. Effect of tillage practices on weeds in wheat crop at farmers' field.

Treatment	Weed Density NLWs (no/m^2),		Weed Dry Weight NLWs (g/m^2)		Weed Control Efficiency -NLWs (%) at 60 DAS		Weed Density BLWs (no/m^2)		Weed Dry Weight BLWs(g/m^2)		Weed Control Efficiency- BLWs (%) at 60 DAS	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
T1	24.6	14.8	22.6	20.6	86.18	90.30	17.65	19.04	29.22	28.43	1.65	6.93
T2	132.6	120.5	102.6	96.5	25.64	21.00	19.6	19.633	29.94	29.90	-0.75	2.33
T3	178.6	152.6	116.4	112.6	0.00	0.00	21.85	19.07	29.72	30.14	0.00	0.00
SEM	1.86	0.85	36.94	33.15	0.80	0.52	0.19	0.20	0.22	0.53	-	-
CD@5%	5.45	2.48	108.14	97.04	2.33	1.51	0.55	0.58	NS	NS	-	-

NLWs- Narrow leaved weeds; BLWs- Broad leaved weeds, DAS- Days after sowing, T_1-zero tillage (ZT) , T_2-reduced tillage (RT), T_3-farmers practice (CT)

Table 2. Effect of tillage practices on yield attributes and yields of wheat crop.

Treatment	Effective Tillers (no./m²)		Test Weight (g)		Yield (q/ha)	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
T1	408	395	42.2	40.8	57.45	48.14
T2	390	382	41.5	38.6	51.51	44.5
T3	326	308	38.5	37.4	48.65	42.43
SEM	2.024	1.392	0.295	0.415	0.566	0.537
CD@5%	5.925	4.074	0.864	1.215	1.657	1.573

T1-zero tillage (ZT) ,T2-reduced tillage (RT),T3-farmers practice (CT)

Table 3.Economics of different tillage practices in wheat crop.

Treatment	Gross cost (Rs/ha)		Gross returns (Rs/ha)		Net returns (Rs/ha)		B:C	
	2015-16	2016-17	205-16	2016-17	2015-16	2016-17	2015-16	2016-17
T1	18350	19650	87812	79996	69462	60346	4.79	4.07
T2	19950	20530	79042	74041	59092	53511	3.96	3.61
T3	22350	23650	74799	71027	52449	47377	3.35	3.00

T_1-zero tillage (ZT) ,T_2-reduced tillage (RT),T_3-farmers practice (CT)

Note :- Sale price of wheat during 2015-16 (1350 Rs/q)and 2016-17 (1450 Rs/q) and for Straw 2015-16 (150 Rs/q) and 2016-17 (175 Rs/q). Gross cost of experiment was calculated on the basis of prevailing prices of Inputs used.

yield attributes *viz.,* effective tillers and test weight, might be transformed in to significantly higher grain yield under T1 over T2and T3.The zero tillage gave 57.45 and 48.14 q/ha grain yield of wheat in 2015-16 and 2016-17, respectively which was 15.31 and 11.86 per cent higher over conventional planting of wheat crop in rice-wheat system.The present findings corroborated the results obtained by Singh (2014) and Radhey Shyam *et al* (2014) for zero tillage planting in wheat.

Economics

The net returns and benefit: cost ratio was observed maximum for zero tillage (T1) during both the years followed by the reduced tillage (T2) (Table 3). The lowest net returns (Rs.52,449/- and Rs. 47,377/-) and B: C (3.35 and 3), during 2015-16 and 2016-17, respectively were recorded under conventional tillage (T3). The highest values of economical parameter could be attributed by higher grain yield and reduced cost of cultivation under T1 and T2 as compared to T3. Similar findings were reported by Bhatt *et al* (2016) in conservation agricultural practices under RWCS.

CONCLUSION

On the basis of two year farmers led field experimentation, it was concluded that zero till wheat sowing in wheat was found much effective in suppression of weed density and weed dry weight of narrow leaved weeds *viz., Phalaris minor*, *Avena ludoviciana* and *Avena fatua*in comparison to conventional tillage which was also observed significantly lower over reduced till sowing of wheat crop. However differences among planting methods with respect to weed density of broad leaved weeds were not observed statistically significant. The significantly higher grain yield of wheat and higher monitory returns were also achieved under zero tillage sowingduring both the year over rest of planting method.

REFERENCES

Anonymous (2015-16). *mpkrishi.mp.gov.in.*District wise area-production and yield of crops in Madhya Pradesh (2011-12 -2015-16).

Bhatt Rajan, Kukal S S, Busari Mutiu A, Arora and Yadav Sanjay (2016).ustainability issues on rice-wheat cropping system. *Int Soil and Water Conserv Res J* **4** : 64-74

Hossain A, Sarker M A Z , Hakim M A, Lozovskaya MV and Zvolinsky VP (2011). Effect of temperature on yield and some agronomic characters of spring wheat (*Triticum aestivum* l.) Genotypes. *Int J Agril Res Innov & Tech* **1** (1&2): 44-54.

Kasana B S, Singh A K, Tomar R K S and Rikhari Y C (2015). Evaluating the performance of wheat varieties under late sown irrigated condition in Bundelkhand zone.*Inter J App Pure SciAgric***1**: 118-22.

Kasana B S, Gupta M, Gupta Sourav, Yadav Sushil and Sharma R N (2018). Prominent weed flora of Chambal ravine. *J Pharma and Phytochem.* SP **2**: 169-175

Muhur R N, Datta N P, Sankarsubramoney H, Leley V K and L Vey Do naline (1965). *Soil Testing in India*. U.S. Agency for International Development Mission to India, *pp*.39,40,45.

Olsen S R, Cole C V, Watnbe F S and Dean L A (1954). Estimation of available phosphorous in soil by extraction with sodium bicarbonate USDA Circular **939**,1-9.

Piper C S (1950). *Soil and plant analysis*. Indian reprint, Hans Publishers, Bombay.

Radhey Shyam, Singh Rohitasshav and Singh V K (2014). Effect of tillage and weed management practices on weed dynamics, weed seed bank and grain yield of wheat in rice-wheat system. *Indian J Weed Sci* **46** (4):322-325.

Singh R K (2014). Yield performance of zero-till wheat with herbicides in rice-wheat system. *Indian J Weed Sci* .**46** (2):174-175.

Subbiah and Assija A S . (1956). A rapid procedure for the estimation of available nitrogen in soil. *Current Sci* 259-261.

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