Short communication

Indian Journal of Weed Science **46**(2): 174–175, 2014

Yield performance of zero-till wheat with herbicides in rice-wheat cropping system

R.K. Singh*

Krishi Vigyan Kendra, Narendra Dev University of Agriculture and Technology, Azamgarh, Uttar Pradesh 276 207

Received: 25 April 2014; Revised: 16 May 2014

Key words: Chemical control, Herbicide, Rice-wheat cropping system, Weeds, Zero tillage

Rice-wheat is the most predominant cropping system of India with an area of 13.0 m ha. Twenty five per cent of the rice area of country is grown in rotation-involving wheat, whereas 40% of the wheat is grown in rotation with rice. The productivity of this system is stagnating or declining, which is causing concern about sustainability of rice–wheat production system. The major constraints for wheat are poor crop stand, late planting, poor soil condition due to puddling, imbalance use of fertilizer, problem of weeds specially *Phalaris minor, Avena ludoviciana,* high cost of production due to excess tillage *etc*. Sowing of wheat crop under conventional tillage gets delayed by 10 to 12 days, affecting the yield adversely. The reduction in wheat yield due to delay in sowing has been recorded as one per cent of total yield/ha/day (Pal *et al*. 1996). Zero till drill machine is able to sow the wheat crop after the harvest of transplanted rice in standing rice stubbles.

It has been observed that zero tillage technique not only avoids the problem of delayed sowing but also reduces the incidence of *P. minor* and *A. ludoviciana*, which are most obnoxious weeds of wheat. Zero tillage has certain other advantages like improving soil health and reducing the cost of production. Sulfosulfuron + metsulfuron (MSM) and fenoxaprop-p-ethyl have been mostly used for control of weeds in conventional tillage system of wheat, whether its performance remain same or not in canal command areas under zero tillage, needs confirmation. Therefore, on-farm trials were carried out to evaluate the efficiency of herbicides and to observe the performance and profitability of zero tillage under clay loam soils in wheat at farmers' fields.

Ten on-farm trials were conducted for the two consecutive years during *Rabi* season 2007-08 and 2008-09 at randomly selected locations which come preferably under canal command area (village- Sikraur and Khemaupur of district Azamgarh, UP). The soils of experimental sites were clay loam with normal in reaction and available nitrogen and phosphorus were at lower side while potash represents its richness. The zero tillage (ZT) consisted of direct drilling of wheat seed (100 kg/ha) and di-ammonium phosphate (125 kg/ha) by zero till seed-cum-ferti drill machine without any field preparation in presence of excessive moisture condition and anchored rice residues. However, conventional tillage (CT) consisted of four to five ploughing and more than two planking for fine tilth. A set of two tillage practices like conventional tillage and zero tillage were evaluated with sulfosulfuron 75% + MSM 5% WG (40 g/ha) and fenoxaprop-p-ethyl (10 EC) 1000 ml/ha applied at 25 days after sowing (DAS) with flat fan nozzle using 500 litre water/ha. The prevailing sale rate of wheat produce at ` 900/q was used for economic calculations of treatments and net returns *etc*.

The dominant weeds at trial sites were *Phalaris minor, Chenopodium album, Avena ludoviciana, Melilotus alba, M. indica, Vicia sativa, Cynodon dactylon, Cyperus rotundus, Anagallis arvensis, Convolvulus arvensis, Rumex* species *etc*. Weed density was substantially quite low in zero tillage system at each and every site of trials. This observation is in confirmation to the findings of Singh, (2008). Foliar application of company mixed herbicides at 25 DAS effectively controlled both broad and grassy weeds as compared to weedy check. The weed control efficiency (WCE) of sulfosulfuron + MSM was higher and equally effective in both system of wheat sowing in comparison to fenoxaprop-p-ethyl (Table 1). Similar results of maximum reduction in weed density and weed biomass were obtained with application of broad spectrum herbicides by Singh *et al*. (2002).

Results also revealed that zero tillage system of wheat sowing registered maximum effective tillers (412/m^2) and grain yield (4.16 t/ha) over conventional tillage by increasing 50.2% higher production (Table 2). The benefits due to herbicidal treatment (` 12,510/

***Corresponding author:** rksagron@gmail.com

Table 1. Effect of zero tillage and herbicides on weeds in wheat at farmers' field

Treatment	Dose g/ha (Product)	Mean of 2007-08 and 2008-09					
		Weed density at 25 DAS (no./m^2)		Weed biomass at 45 DAS (g/m^2)		Weed control efficiency (%)	
		ZT	CT	ZT	CT	ZT	CT
Sulfosulfuron + MSM	40	72	169	2.2	1.7	97.2	98.3
Fenoxaprop-p-ethyl	1000	80	193	8.7	14.5	89.0	85.8
Weedy check	-	83	257	78.9	102.3	-	-

Table 2. Effect of zero tillage and herbicides on wheat and economics at farmers' field

Treatment	Dose g/ha (Product)	Mean data of 2007-08 and 2008-09									
		Effective tillers (no./m^2)		Grain yield (t/ha)		Yield increase (%)		Benefit due to herbicide treatment (x10^3 `/ha)		Benefit: Cost Ratio	
		ZT	CT	ZT	CT	ZT	CT	ZT	CT	ZT	CT
Sulfosulfuron + MSM	40	412	386	4.16	3.98	50.2	49.9	12.51	11.92	2.24	1.89
Fenoxaprop-p-ethyl	1000	392	364	3.95	3.91	42.6	47.3	10.62	11.29	2.14	1.86
Weedy check	-	328	262	2.77	2.65	-	-	-	-	1.65	1.39

ha) were obtained with the use of sulfosulfuron + MSM. The present findings are corroborated with the results of Punia *et al*. (2008) as they obtained best yield advantage with application of sulfosulfuron + MSM at 32+2 g/ha. However, there were not much difference in yield of both tillage practices with fenoxaprop-p-ethyl and it also recorded more benefits (` 11,295/ha) than weed control under zero tillage system (` 10,620/ha). Similarly, the profitability of farmers' were more with zero till sown wheat when combined with herbicidal weed control treatments over conventional system of wheat production as well as weedy check. Application of post-emergence herbicides proved to be more effective as compared to without spray in both practice (Chauhan *et al*. 2001). In addition to this, zero tillage also saved cost of production around ` 2,200 – 2,400/ha, and facilitated placement of major fertilizer (DAP) below the seeding zone, light irrigation at every crop growth stages resulting no yellowing, maximum exposure of leaves towards radiation and at least one week advancement in sowing during winter season of eastern Uttar Pradesh.

SUMMARY

Ten on-farm trials (OFTs) were carried out at farmers' fields in participatory mode during the *Rabi* season of 2007-08 to 2008-09 in selected adjoining villages to the Krishi Vigyan Kendra, Azamgarh of eastern Uttar Pradesh. The main objectives of activities were to evaluate the performance and profitability of zero tillage and herbicides on weed control and productivity of wheat crop under rice-wheat cropping system. Zero till sown wheat was found much effective in suppression of weed density and population of *Phalaris minor* in comparison to conventional tillage. A drastic reduction in weed density was obtained with the application of sulfosulfuron + metsulfuron methyl 75 WG at 40 g/ha ready-mix under both method of wheat sowing. The higher average grain yield and monitory returns were also achieved under zero tillage sown wheat combined with sulfosulfuron + metsulfuron methyl as post emergence. However, grain yield obtained under zero tillage was almost comparable to conventional tillage with fenoxaprop-p-ethyl 10 EC at 1000 ml/ha.

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