Indian Journal of Weed Science **49**(1): 20–22, 2017
DOI: 10.5958/0974-8164.2017.00005.3

Tillage and weed management on yield and nutrient uptake of wheat under maize-wheat cropping system in Western Himalayas

Lobzang Stanzen*, Anil Kumar, R. Puniya, Neetu Sharma, Amit Mahajan and Ashu Sharma
Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Main Campus Chatha, Jammu, Division of Agronomy, 180 009

Received: 24 December 2016; Revised: 21 January 2017

ABSTRACT

A field experiment was conducted during *Rabi* season of 2013-14 and 2014-15 at SKUAST-Jammu to study the effect of tillage and weed management on yield and nutrient uptake of wheat under maize-wheat cropping system in sub-tropical irrigated conditions. The results revealed that different tillage systems recorded non-significant grain yield of wheat. However, ZT in wheat either preceded by conventional tillage (CT) or zero tillage (ZT) in maize was more beneficial as it recorded higher net returns and benefit: cost ratio than CT in wheat. Among the weed management, post-emergence application of metribuzin at 200 g/ha resulted in lowest total weed density and biomass of weeds, which was statistically at par with two hand weedings and significantly lower than weedy check. The post-emergence application of metribuzin at 200 g/ha also recorded highest weed control efficiency (WCE), net returns and B:C ratio during both the years of experimentation followed by two hand weedings.

Key words: Cropping system, Nutrient uptake, Tillage, Weed management, Wheat, Yield

Wheat is the most important cereal crop and an integral component of food security at global level. At present, the soil resources are under stress owing to intensive cropping with a raising of more than two crops in a year without replenishing this resource as is desirable. Repeated conventional tillage coupled with other faulty land utilization practices have caused large scale degradation of our soils over the past 50-60 years and most of the soils have lost up to one-half of their native organic matter content and fauna (Malik *et al.* 2006). Traditional tillage practices also contribute to the energy and labour cost in crop production systems resulting in lower economic returns (Saharawat *et al.* 2010 and Kumar *et al.* 2013).

Furthermore, intensive ploughing results in decrease in soil organic matter due to acceleration of the oxidation and breakdown of organic matter and ultimately led to degradation of soil properties (Gathala *et al.* 2011). Zero tillage practice in wheat crop is beneficial to farmers because it saves preparation time which often delays the wheat sowing.

Lower productivity of wheat by and large can also be attributed to several other limiting factors and all but most important among these has been the poor weed management, which poses a major threat to crop productivity. Wheat crop is badly infested with grass as well as broad-leaf weeds. Crop losses due to weed competition throughout the world as a whole, are greater than those resulting from combined effects of insect-pests and diseases (Hassan *et al.* 2005). Therefore, timely weeding is most important to minimize the losses in crop yields especially during the critical crop-weed competition periods. Management of weeds through the use of herbicides has been found to be very effective and economical compared to that realized with manual or mechanical methods in various crops including wheat. Hence keeping the above facts in forefront there is greater need to evaluate tillage and weed control for wheat in irrigated maize-wheat cropping system.

***Corresponding author:** stanzen2015@gmail.com

MATERIALS AND METHODS

Experiment was carried out during *Rabi* season of 2013-14 and 2014-15. The experimental soil was sandy clay loam in texture with slightly alkaline in reaction (pH 7.87), medium in organic carbon (0.52 %), available phosphorus (12.32 kg/ha) and potassium (148.4 kg/ha) and low in available nitrogen (247.60 kg/ha). The experiment was conducted in split-plot design with three replications. The main plot comprised of four tillage treatments, *viz.* zero tillage in wheat preceded by zero tillage in maize (ZT pb ZT), conventional tillage in wheat preceded by zero tillage in maize (CT pb ZT), zero tillage in wheat preceded by conventional tillage in maize (ZT pb CT) and conventional tillage in wheat preceded by conventional tillage in maize (CT pb CT), whereas, sub-plot comprised of three weed management practices, *viz.* hand weedings (two), metribuzin at 200 g/ha and weedy check. Wheat variety '*RSP 561'* was sown on 15 November, 2013 and 18 November, 2014 with 100 kg seed/ha at row to row spacing of 20 cm. The crop was fertilized with 100 kg N, 50 kg P and 25 kg/ha K through urea, DAP and MOP, respectively. Full dose of P and K along with 1/3[rd] of N were applied as basal dose at the time of sowing and remaining N was applied in two equal splits at tillering stage and booting stage. Post-emergence application of herbicide was sprayed by knapsack sprayer fitted with flat fan nozzle using a spray volume of 500 l/ha. Weedy check plots remained infested with native population of weeds till harvest. Data on weed density and biomass were taken by quadrate method. The weed density and biomass were subjected to square root transformation $(\sqrt{x+1})$ to normalize their distribution. WCE was calculated by using the formulae suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Weed density, weed dry matter and WCE

The experimental field was infested with *Medicago denticulata, Anagallis arvensis, Cirsium arvensis, Chenopodium album* among broad-leaf weeds whereas, *Phalaris minor* and *Poa annua* among grasses. Tillage treatments failed to show any significant impact on total weed density and biomass (**Table 1**). The highest weed-control efficiency was recorded under CT pb CT which might be due to minimum biomass of weeds under conventional tillage over zero tillage which in turn increase weed control efficiency. These results corroborated with the findings of Jain *et al.* (2007). Different weed management treatments had significant effect on density and biomass of weeds in wheat. Among weed management treatments, lowest density and biomass of total weed at 90 DAS and at harvest were recorded with the post-emergence application of metribuzin at 200 g/ha which was found to be statistically at par with two hand weedings. Highest weed control efficiency was also recorded with application of metribuzin at 200 g/ha (**Table 1**). Chauhan *et al.* (2000) and Pandey *et al.* (2006) also recorded the best efficacy of metribuzin with respect of total density and biomass of both grass and non-grass weeds in wheat.

Nutrient uptake of crop

Tillage treatments failed to show any significant impact on N, P and K uptake of wheat. However, CT in wheat either preceded by CT or ZT recorded higher uptake of N, P and K of wheat crop during both the years of cropping than ZT in wheat (**Table 2**). There was a significant increase in nutrient (N, P and K) uptake of wheat due to different weed management treatments as compare to weedy check. Among weed management treatment, highest N, P and K uptake were recorded by metribuzin at 200 g/ha which was statistically at par with two hand weedings. Similar findings were noticed by Pandey *et al.* (2007) and Jat *et al.* (2004).

Yield and economics

Grain yield of wheat was statistically similar with respect to tillage treatments during both the years of cropping (**Table 2**). However, CT in wheat either preceded by CT or ZT recorded higher grain yield of wheat crop during both the years of cropping than ZT in wheat. Amongst the weed management treatments, application of metribuzin at 200 g/ha, recorded highest grain yield of wheat which was statistically at par with two hand weedings (**Table 2**). The highest grain yield might have been achieved due

Table 1. Effect of tillage and weed management practices on total weed density and biomass in wheat

Treatment	Total weed density (number/m²)				Total weed biomass (g/m²)				WCE at 90 DAS (%)
	90 DAS		At harvest		90 DAS		At harvest		
	2013	2014	2013	2014	2013	2014	2013	2014	Mean
Tillage									
ZT pb ZT	9.41(95)	9.31(94)	8.46(79)	8.37(77)	12.19(157)	12.00(153)	10.86(129)	10.69(127)	72.4
CT pb ZT	9.21(93)	9.06(91)	8.25(76)	8.13(76)	12.00(152)	11.83(149)	10.70(125)	10.58(124)	72.3
ZT pb CT	9.42(96)	9.26(94)	8.39(77)	8.29(77)	12.12(155)	11.94(152)	10.80(126)	10.69(125)	70.9
CT pb CT	9.18(92)	8.98(90)	8.23(76)	8.09(75)	11.87(149)	11.67(147)	10.45(121)	10.39(121)	74.6
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	-
Weed management									
Hand weeding (two)	7.38(54)	7.16(51)	6.38(40)	6.20(38)	10.14(102)	9.82(96)	8.51(72)	8.29(67)	71.1
Metribuzin at 200 g/ha	7.19(51)	6.87(47)	6.17(37)	5.88(34)	9.78(95)	9.36(87)	8.09(65)	7.84(61)	74.0
Weedy check	13.34(177)	13.41(179)	12.45(154)	12.57(157)	16.22(262)	16.40(268)	15.50(239)	15.63(243)	-
LSD (P=0.05)	0.21	0.29	0.21	0.33	0.51	0.60	0.43	0.45	-

Original data are given in parentheses; pd - Preceded by

Table 2. Effect of tillage and weed management practices on nutrient uptake by crop (grain + straw) yield and economics of wheat

Treatment	Nutrient uptake by crop (kg/ha)						Grain yield (t/ha)		Net returns (x10^3 `/ha)		B:C ratio	
	N		P		K							
	2013	2014	2013	2014	2013	2014	2013-14	2014-15	2013	2014	2013	2014
Tillage												
ZT pb ZT	80.9	84.8	18.3	19.2	105.1	115.6	3.14	3.16	45.5	50.6	2.25	2.45
CT pb ZT	86.8	90.9	19.8	20.4	110.7	122.4	3.32	3.35	44.8	50.3	1.84	2.02
ZT pb CT	81.9	85.7	18.6	19.2	106.3	116.9	3.15	3.18	45.7	50.9	2.26	2.46
CT pb CT	87.6	92.6	20.0	20.8	111.7	123.0	3.33	3.37	45.0	50.6	1.85	2.04
LSD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	-	-	-	-
Weed management												
Hand weeding (two)	99.0	104.2	22.8	23.1	123.5	136.2	3.85	3.90	51.3	57.5	1.87	2.04
Metribuzin at 200 g/ha	104.6	109.8	24.1	24.2	127.5	140.6	3.95	4.00	60.7	67.4	3.04	3.31
Weedy check	49.3	51.5	12.3	12.3	74.3	81.6	1.91	1.90	23.8	26.9	1.25	1.38
LSD (p=0.05)	6.4	7.1	1.9	2.4	8.2	9.8	2.04	2.20	-	-	-	-

pd - Preceded by

to better weed control, *i.e*. lowest weed density and weed biomass resulted in higher grain yield of wheat These results were in close conformity to those of Ashrafi *et al.* (2009).

Among the tillage treatments, ZT pb CT recorded highest net returns and benefit: cost ratio followed by ZT pb ZT during both the years of cropping (**Table 2**). This might have happened due to reduction in cost of cultivation under zero tillage treatments while producing similar grain yield as that obtained under conventional tillage. These results were in close conformity with the findings of Shekhar *et al.* (2014). Among weed management treatments, highest net returns and B:C ratio were obtained with application of metribuzin at 200 g/ha in wheat crop, which was closely followed by two hand weeding (**Table 2**). This might have happened due to the fact that all treatments associated with weed control increased the grain yield of wheat than weedy check with regard to net monetary returns. Similar findings have been reported by Shekhar *et al.* (2014). On the basis of two year study, it was concluded that ZT in wheat either preceded by CT or ZT in maize was more beneficial as it recorded higher net returns and benefit: cost ratio than CT in wheat. Among the weed management treatments, post emergence application of metribuzin at 200 g/ha in wheat was found to be most economical for weed management.

REFERENCES

Ashrafi ZY. 2009. Study of integrate methods chemical and cultural control of weeds to wheat (*Triticum aestivum* L.). *Journal of Agricultural Science* **1**(2): 113-119.

Chauhan DS, Sharma RK, Chhokar RS, Kharub AS and Natrajan S. 2000. Management of *Phalaris minor* in wheat. *Indian Farming* **50**: 7-8.

Gathala M, Ladha JK, Kumar V, Saharawat YS, Kumar V, Sharma PK, Sharma S and Pathak H. 2011. Tillage and crop establishment affects sustainability of South Asian rice-wheat system. *Agronomy Journal* **103**: 961-971.

Gomez KA and Gomez AA. 1984. *Statistical Procedures for Agricultural Research* (2nd Ed.), John Willey and Sons Inc. New York, USA.

Hassan I, Hussain Z and Akbar G. 2005. Effect of permanent raised beds on water productivity for irrigated maize–wheat cropping system. Evaluation and performance of permanent raised bed cropping systems in Asia, Australia and Mexico, *ACIAR, Griffith, Australia*. **121**: 59-65.

Jain Namrata, Mishra JS, Kewat ML and Jain Vinamarta. 2007. Effect of tillage and herbicides on grain yield and nutrient uptake by wheat (*Triticum aestivum*) and weeds. *Indian Journal of Agronomy* **52**(2): 131-134.

Jat RS, Nepalia V, Shivran DR and Chalka M. 2004. Relative NPK uptake by wheat and associated weeds as affected by weed control and sowing methods. *Haryana Journal of Agronomy* **20**: 13-15.

Kumar V, Saharawat YS, Gathala MK, Jat AS, Singh SK, Chaudhary N and Jat ML. 2013. Effect of different tillage and seeding methods on energy use efficiency and productivity of wheat in Indo-Gangetic plains. *Field Crops Research* **142**: 1-8.

Malik RK, Yadav A. and Kamboj BR. 2006. Conservation tillage and crop establishment techniques. pp: 11-16. In: *Golden Jubilee National Symposium on Conservation Agriculture and Environment*, 26-28, October 2006, Banaras Hindu University.

Pandey AK, Gopinath KA and Gupta HS. 2006. Evaluation of sulfosulfuron and metribuzin for weed control in irrigated wheat. *Indian Journal of Agronomy* **51**: 135-138.

Pandey IB, Dwidedi DK and Pandey RK. 2007. Efficacy of herbicides and fertilizer management on weed dynamics in wheat and yield of wheat (*Triticum aestivum*). *Indian Journal of Agronomy* **52**(1) 49-52.

Saharawat YS, Singh B, Malik RK, Ladha JK, Gathala M, Jat ML and Kumar V. 2010. Evaluation of alternative tillage and crop establishment methods in a rice–wheat rotation in North Western IGP, *Field Crops Research* **116**: 260-267.

Shekhar C, Singh D, Singh AK, Nepalia V and Choudhary J. 2014. Weed dynamics, productivity and soil health under different tillage and weed-control practices in wheat (*Triticum aestivum*)-maize (*Zea mays*) cropping sequence. *Indian Journal of Agronomy* **59** (4): 561-567.