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Effect of Tillage and Weed Management Practices on Weed Dynamics and Productivity in Maize (*Zea mays*)-Wheat (*Triticum aestivum*) System

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A B S T R A C T

An investigation was carried out at Sher-e-Kashmir University of Agriculture Science and Technology of Jammu during 2013-14 and 2014-15, to assess the influence of 4 tillage systems and 3 weed-control practices on weed dynamics and productivity in maize-wheat cropping sequence. In maize, grain yield of maize was statistically at par in continuous conventional tillage (CT-CT) in both maize and wheat and conventional tillage in maize and zero tillage in wheat (CT-ZT). Different tillage treatments did not influence on weed density, weed biomass, plant growth characters, grain and straw yields of wheat in maize-wheat cropping sequence. Amongst the weed-control practices, 2 hand weedings which was at par with atrazine (1 kg/ha) in maize and metribuzin (200 g/ha) at par with two hand weedings in wheat which was significantly reduced weed density, weed biomass and recorded significantly higher maize and wheat grain and straw yields than weedy check.

Introduction

Maize (*Zea mays* L.) and wheat (*Triticum aestivum* L.) are the two important staple food crops of India which provide food security to the country's population. These crops are grown in almost all the pockets of the country either in irrigated or *rainfed* conditions but the productivity is higher in irrigated ecosystems which are mainly situated in Indo-gangetic plains.

At present the soil, a natural resource is under great amount of stress owing to intensive cropping with a rising of more than two crops in a year without replenishing this resource as in 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 micro fauna (Malik *et al.*, 2006). Hence, zero tillage is one of the better options that reduce the problems associated to certain extent. However, a combination of zero and conventional options in sequence need to be standardized for each cropping, soil and microclimatic conditions in order to enhance the sustainability of systems and resource use efficiency. Zero tillage improves physic-chemical and biological properties of soil and reduces the cost of production (Bisen and Singh, 2008; Jha *et al.*, 2011). Hence, present

study was conducted to assess the effect of tillage and weed management practices on weed dynamics and productivity in maize (*Zea mays*)- wheat (*Triticum aestivum*) system.

Materials and Methods

A field experiment was carried out during *rabi* season of 2013-14 and 2014-15 at Sher-e-Kashmir University of Agriculture Science & Technology of Jammu. 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.* continuous zero tillage in maize-wheat (ZT-ZT), zero tillage in maize and conventional tillage in wheat (ZT pb CT), conventional tillage in maize and zero tillage in wheat (CT pb ZT) and continuous conventional tillage in maize-wheat sequence (CT pb CT), whereas, sub-plot comprised of three weed management practices, *viz.* hand weedings (two), weedy check and atrazine at 1 kg/ha in maize and metribuzin at 200 g/ha in wheat. Maize variety 'Kanchan 517' was sown on 16 June 2013 with seed rate 20 kg/ha at row to row spacing of 60 cm and plant to plant spacing of 20 cm and wheat variety '*RSP 561'* was sown on 15 November, 2013 with 100 kg seed/ha at row to row spacing of 20 cm. Post-emergence application of herbicide were sprayed by knap sack sprayer fitted with flat fan nozzle using a spray volume of 500 lt/ha. Weedy check plots remained infested with native population of weeds till harvest. The weeds removed from the selected areas were dried at 65^{o}C to obtain constant weight and the weight was expressed in g/m^{2}. 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 Mishra & Mishra (1997).

Results and Discussion

The predominant weed flora in maize comprised of *Cyperus rotundus* among sedges, *Cynodon dactylon, Echinochloa crusgalli, Setaria glauca* among grassy weeds, *Amaranthus viridis* and *Celosia argentea* were broad leaved weeds, whereas the dominant weed flora of the wheat experimental field was *Medicago denticulata, Anagallis arvensis, Cirsium arvense* and *Chenopodium album* amongst broad leaved weeds and grassy weeds included *Phalaris minor* and *Poa annua.*

Weed density and biomass

Results presented in table 1 clearly indicated that continuous zero tillage (ZT) in both the crops significantly increased the weed density and biomass in maize which is statistically at par with zero tillage in maize and conventional tillage in wheat (ZT-CT) in maize-wheat cropping and lowest weed density and biomass was observed in continuous conventional tillage (CT-CT). Whereas in wheat, different tillage systems under test did not differ significantly for their effect on weed density and biomass.

Among the different weed management treatments in maize, significantly lower number of total weed density and biomass was noted in treatment of two hand weedings but was at par with treatment atrazine 1 kg/ha. In wheat, among the weed managements treatments, significantly lowest weed density and biomass was recorded in metribuzin at 200 g/ha which was at par with two hand weeding.

Table.1 Influence of different tillage and weed management on weed density and weed biomass at harvest in maize-wheat cropping sequence of 2013-14

Treatments	Weed density (No./m^2)		Weed biomass (g/m^2)		Weed control efficiency (%)	
	Maize	Wheat	Maize	Wheat	Maize	Wheat
	At harvest	120 DAS	At harvest	120 DAS	At harvest	120 DAS
Tillage						
ZT-ZT	9.43 (93.56)	9.16 (90.22)	12.40 (166.44)	11.56 (142.67)	44.48	43.35
ZT-CT	9.14 (88.22)	9.06 (88.78)	12.21 (162.78)	11.50 (140.33)	45.71	44.27
CT-ZT	8.31 (75.44)	8.87 (86.44)	11.43 (146.11)	11.36 (138.56)	51.27	44.98
CT-CT	8.14 (72.67)	8.89 (86.56)	11.23 (141.67)	11.22 (136.11)	52.74	45.95
SEm±	0.09	0.09	0.06	0.11	-	-
CD (p=0.05)	0.31	NS	0.21	NS	-	-
Weed management						
2 hand weeding	6.83 (46.33)	7.11 (49.83)	8.92 (79.08)	9.32 (86.17)	73.62	65.78
Atrazine (1 kg/ha)*/ Metribuzin (200 g/ha)**	7.12 (50.25)	6.89 (46.58)	9.19 (83.83)	9.01 (80.25)	72.04	68.13
Weedy check	12.32 (150.83)	12.98 (167.58)	17.34 (299.83)	15.90 (251.83)	-	-
SEm±	0.10	0.08	0.09	0.12	-	-
CD (p=0.05)	0.30	0.25	0.28	0.36	-	-

Table.2 Influence of different tillage and weed management on growth character of maize and wheat crop in maize-wheat cropping sequence of 2013-14

Treatments	Growth and yield attributes of maize at harvest			Growth and yield attributes of wheat at 120 DAS		
	Plant height (cm)	Leaf Area Index	No. of cobs/plant	Plant height (cm)	Leaf Area Index	No. of earheads/m^2
Tillage						
ZT-ZT	185.89	2.83	1.35	96.44	2.56	285.67
ZT-CT	186.44	2.93	1.36	97.22	2.67	285.78
CT-ZT	188.89	3.43	1.47	99.78	2.89	287.67
CT-CT	189.78	3.48	1.48	101.00	3.00	288.22
SEm±	0.76	0.03	0.17	1.14	0.17	2.75
CD (p=0.05)	2.64	0.10	NS	NS	NS	NS
Weed management						
2 hand weeding	190.33	3.33	1.54	98.92	2.83	285.67
Atrazine (1 kg/ha)*/ Metribuzin (200 g/ha)**	189.33	3.29	1.47	101.50	3.25	287.92
Weedy check	183.58	2.88	1.28	95.42	2.25	286.92
SEm±	0.59	0.02	0.16	0.89	0.23	4.69
CD (p=0.05)	1.75	0.06	NS	2.66	0.69	NS

Maize*, Wheat **

Table.3 In Influence of different tillage and weed management on yield and harvest index of maize and wheat in maize-wheat cropping system 2013-14

Treatments	Yield (kg/ha)				Harvest Index	
	Maize		Wheat		Maize	Wheat
	Grain	Stover	Grain	Straw		
Tillage						
ZT-ZT	3145	8830	3147	5803	26.09	34.54
ZT-CT	3267	9073	3157	5811	26.32	34.61
CT-ZT	3640	9813	3325	5996	26.92	34.95
CT-CT	3851	10237	3336	6017	27.20	34.96
SEm±	61.19	129.24	64.54	138.16	0.10	0.75
CD (p=0.05)	211.74	447.22	NS	NS	0.34	NS
Weed management						
2 hand weeding	4010	10624	3850	6607	27.36	36.88
Atrazine (1 kg/ha)*/ Metribuzin (200 g/ha)**	3899	10479	3958	6699	27.10	37.15
Weedy check	2519	7362	1916	4414	25.45	30.28
SEm±	93.67	218.69	68.27	155.95	0.20	0.63
CD (p=0.05)	280.83	655.62	204.67	467.55	0.61	1.90

Maize*, Wheat **

The improvement in density of grassy weeds might be due to higher deposition of seed in upper layer of soil (0-10 cm) with no disturbance of the top soil. However, under continuous conventional tillage and rotated tillage lower grassy weed density could be ascribe to comparatively less number of seeds of this category on top 0-10 cm layer of soil due to burying of seed into deeper layer and killing of newly emerged weeds with repeated tillage operation, viz. ploughing, harrowing and cross cultivator (Mahajan *et al*., 2002). Among the different tillage treatments CT-CT recorded highest weed control efficiency in both maize and wheat crop followed by CT-ZT treatment and among the weed control treatments in maize two hand weeding recorded highest weed control efficiency followed by Atrazine at 1 kg/ha. Shah and Koul (1990) and Thakur (1994) also observed higher WCE under twice hand weeding. Whereas, in wheat, highest weed control efficiency was observed in Metribuzin @ 200 g /ha followed by two hand weedings.

Growth parameters and Yield attributes

In maize, the highest plant height and leaf area under continuous conventional tillage (CT-CT) which was at par with rotated conventional tillage in maize and zero tillage in wheat (CT-ZT) (Table 2). However, different tillage systems under test did not differ significantly for their effect on number of cobs/plant in maize and plant height, leaf area and number of ears head/m^2 in wheat crop. The improvement in plant height and leaf area of maize under continuous conventional tillage (CT-CT) and rotated conventional tillage in maize and zero tillage in wheat (CT-ZT) in maize-wheat system seems to be due to better tilth, aeration, improved water-holding capacity of soil, better root growth and its proliferation, which might have promoted growth of leaves by virtue of enhanced cell-division and increased better interception, absorption and utilization of radiant energy, thereby resulting in higher photosynthesis and finally growth parameters (Bisen and Singh, 2008.)

Among the different weed management treatments highest plant height and leaf area in maize found under two hand weedings, were at par with atrazine at 1 kg/ha and both of these proved significantly superior to the weedy check. Whereas in wheat highest plant height and leaf area recorded under metribuzin at 200 g/ha were at par with two hand weedings. The better growth parameters were owing to significant reduction in weed density and dry matter of weeds under treatments of hand weedings and recommended herbicides in both crops, indirectly it might be on account of results of better plant growth, greater penetration of solar radiation in the crop canopy, which can be reason for greater rate of photosynthesis and more accumulation of dry matter and crop growth rate (Singh *et al.*, 2010).

Yields

The highest grain yield and stover yield of maize was recorded under continuous conventional tillage (CT-CT), which was at par with rotated (CT-ZT) in maize-wheat cropping sequence, but was significantly higher over zero tillage in maize and conventional tillage in wheat (ZT-CT) and continuous zero tillage (ZT-ZT). But in wheat different tillage systems failed to recorded perceptible variation in grain yield and straw yield. But maximum harvest index was recorded under (CT-CT) followed by (CT-ZT) in both crops. The weed-control treatments recorded significantly higher grain yield, stover yields and harvest index than unweeded check. Two hand weeding at 15 and 30 days after sowing produced significantly higher maize grain yield, stover yield and harvest index and statistically on a

par with Atrazine at 1 kg/ha. In wheat metribuzin at 200 g/ha recorded significantly higher grain, straw yield and harvest index and statistically on a par with two hand weedings at 30 and 60 days after sowing. These findings are in line with the results of Sharma *et al.*, (1998) for atrazine 1.5 kg/ha (Table 3).

References

Bisen, P.K. and Singh, R. 2008. Effect of tillage and weed control practices on weed growth and yield of wheat (*Triticum aestivum*) - rice (*Oryza sativa*) system. *Indian J. Agri. Sci.*, 78(4): 347-50.

Jha, A.K., Kawat, M.L., Upadhyay, V.B. and Vishwakarma, S.K. 2011. Effect of tillage and sowing methods on productivity, economics and energetic of rice (*Oryza Sativa*)-wheat (*Triticum aestivum*) cropping system. *Indian J. Agronomy*, 56(1): 35-40.

Mahaja, G., Brar, L.S. and Walia, U.S. 2002. Phalaris mino response in wheat in relation to planting dates, tillage and herbicides. *Indian J. Weeds Sci.*, 34(1 and 2): 114-15.

Malik, R.K., Yadav, A. And Kamboj, B.R. 2006. Conservation tillage and crop establishment techniques. (In:) Abstract Golden Jubilee National Symposium on Conservation Agriculture and Environment, held during October 26-28, Banaras Hindu University, p. 11-16.

Mishra, M. and Mishra, A. 1997. Estimation of integrated pest management index in Jute-A new approach. *Indian J. Weed Sci.*, 29(1&2): 39-42.

Shah, M.H. and P.K. Kour. 1990. Fertilizer and herbicide compatibility to control weeds in maize under moisture stress conditions. *Annals Agri. Res*., 11: 21.

Sharma, A.R., Toor, A.S. and Sur, H.S.2000. Effect of interculture operations and scheduling of atrazine application on weed control and productivity of rainfed maize (*Zea mays*) in Shivalik foothills of Punjab. *Indian J. Agri. Sci.*, 70: 757-761.

Singh, G., Singh, O.P., Singh, S. and Prasad, K. 2010. Weed management in late sown wheat (*Triticum aestivum*) after rice (Oryza sativa) in rice-wheat system in rainfed lowland. *Indian J. Agronomy*, 55(2): 88.

Thakur, D.R. 1994. Weed management in intercropping systems based on maize under rainfed mid Hill condition. *Indian J. Agronomy*, 39: 203.

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