RESEARCH PAPER Asian Journal of Bio Science, Vol. 4 Issue 2 : 254-257 (October, 2009 to March, 2010)

Effect of tillage systems and weed control methods on weeds, yields and economics of wheat (*Triticum aestivum*)

SANJAI CHAUDHRY, J.P.S. RATHI, OM PAL SINGH AND D.KUMAR
Department of Agronomy, C.S. Azad University of Agriculture and Technology, KANPUR (U.P.) INDIA

(Accepted : August, 2009)

A field experiment was conducted during the winter season of 2006-07 to study the effect of tillage practices (Zero and conventional tillage) and six weed control methods against weedy check on yield, weed dynamics and economics of wheat grown in rice-wheat sequence. Zero tillage increased the weed intensity by 20.3% reduced the grain yield by 4.2% net profit by 2.8% compared to conventional tillage. Among weed control methods, Pendimethalin @ 500 g.a.i./ha + one hand weeding being at par with 2, 4-D@ 500 g a.i./ha + Isoproturon @ 500 g a.i./ha produced significantly higher grain and straw yield than other weed control methods. These yields were attributed to higher growth and yield attributes in above weed control methods. The application of pendimethalin @ 500 g a.i./ha + one hand weeding showed highest weed control efficiency of 76.89% and gross income of Rs. 58864/ha. However, net profit was maximum of Rs. 35675/ha under application of 2,4-D @ 500 g a.i./ha + Isoproturon @ 500 g a.i./ha closely followed by pendimethalin @ 500 g a.i./ha + one hand weeding with Rs. 35130/ha. Single application of 2,4-D or Isoproturon or Pendimethalin at recommended doses reduced the yields and profit than combined application of any two herbicides at half of the recommended dose.

Key words : Tillage, Wheat, Herbicides, Weeds, Yield, Economics

INTRODUCTION

Rice-wheat cropping system is predominant in Indo-gangetic plains covering an area of 10.5 million ha. In this system, sowing of wheat is some times delayed because of late harvest of rice crop due to one or the another reason. It caused reduction in yield of wheat. To advance the sowing of wheat under such condition zero till ferti-seed drill has been advised by some of the research workers. Zero tillage is suitable for economizing time and energy that is needed for sowing wheat following the rice crop. In this method of wheat sowing, intensity of weeds in wheat crop may increase compared to conventional tillage which reduces the weeds infestation upto some extent. Generally, wheat fields are infested with both grassy and broad leaved weeds, thus weed control is basic requirement for optimum utilization of essential inputs. In view of the above, the present study was undertaken on tillage systems and weed control methods in wheat grown after rice in sequence.

MATERIALS AND METHODS

A field experiment was conducted at Students' Instructional Farm of C.S.Azad University of Agriculture and Technology, Kanpur during *rabi* 2006-07 on sandy loam soil having 0.43% organic carbon, 13.5 kg/ha available P_2O_5, 190 Kg/ ha available K_2O and 9.2 soil pH. The treatments comprised of two tillage systems (T_1-zero tillage, T_2-conventional tillage) and 7 methods of weed control (Mo - weedy check, M_1 - Isoproturon @ 1Kg a.i./ha, M_2 - 2,4-D @ 800 g a.i./ha, M_3 - 2, 4-D @ 500 g a.i./ha + Isoproturon @ 500 g a.i./ha, M_4 - Pendimethalin @ 1 litre a.i./ha, M_5 - Pendimethalin @ 500 g a.i./ha + one hand weeding, M_6 - Hand weeding at 30 DAS). Split plot design was used with tillage systems in main plots and weed control methods in sub-plots, all replicated 4 times. An uniform dose of 150 Kg N + 60 Kg P_2O_5 + 40 Kg K_20/ha was applied in all treatment plots. In the plots of zero tillage, direct seeding was done while in conventional tillage one ploughing with tractor harrow followed by two cross ploughing with tractor tillars were done for field preparation. Wheat variety 'Halan' was sown with 125kg seed/ha on 6.12.2006 at 22.5 cm row spacing using zero till machine. Herbicides were applied through sprayer as per emergence (pendimethalin) and post-emergence (Isoproturon and 2,4-D) in different cases. Experimental crop was raised under irrigated condition with recommended package of practices. Crop was harvested on 26-4-2007 at full maturity.

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below:

Weed infestation:

The major weeds observed in the experimental field were *Chenopodium album* (28.77%), *Coronepus didimum* (22.58%) and *Phallaris minor* (14.30%). The other weeds present in the field (34.32%) were *Cyperus rotundus, Cynodon dactylon, Anagallis arvensis, Malilotus* spp. and *Convolvulus arvensis.*

Weeds intensity and dry weight of weeds both were significantly influenced by tillage systems and weed control methods (Table 1). Conventional tillage reduced the weeds intensity by 16.9% and dry weight of weed by 17.0% compared to zero tillage. This may be attributed to burying of weed seeds through ploughing in conventional tillage plots which reduced the germination of weeds seeds compared to zero tillage plots. The result confirms the findings of Pandey *et al.* (2001). Among the weed control methods, treatment M_5 recorded significantly minimum weeds intensity and dry weight of weeds followed by treatment M_3. The rates of reduction in weeds intensity were 76.9 and 62.%, and in dry weight of weeds 77.0 and 62.2% in the plots of treatment M_5 and M_3, respectively compared to weedy check. The best performance of M_5 treatment might be attributed to reduction in germination of weed seeds because of pre-emergence application of pendimethalin while the second flush of weeds was controlled by hand weeding. In case of treatment M_3, the application of 2,4-D controlled broad leaved weeds whereas, grassy weeds were controlled by Isoproturon spray. Thus, combined application of both herbicides could control weeds more efficiently than application of one single herbicide. Similar results were reported by Jain *et al.* (2007). One thing is clear from Table 1 that only one hand weeding 30 DAS (M_6) showed better control of weeds than application of any herbicide alone (M_1, M_2 or M_4). Weed control efficiency was recorded higher in conventional than zero tillage confirming the findings of Jain *et al.* (2007).

Table 1 : Effect of tillage and weed control methods on weeds dynamics in wheat field

Treatment	Total no. of weeds/m^2 at		Dry weight of weed/m^2 g at 120 DAS	Weed control efficiency (%)
	60 DAS	120 DAS		
Tillage systems				
T_1	62.09	69.72	1.42	40.34
T_2	51.71	57.94	1.18	50.42
S.E. ±	1.16	2.06	0.05	-
C.D. (P =0.05)	3.69	6.55	0.17	-
Weed control methods				
M_0	103.36	116.53	2.38	-
M_1	77.11	86.95	1.78	25.21
M_2	52.01	57.26	1.17	50.80
M_3	39.66	44.26	0.90	62.18
M_4	58.23	64.93	1.33	44.11
M_5	24.02	26.90	0.55	76.89
M_6	44.63	49.99	1.02	57.14
S.E. ±	3.26	4.97	0.12	-
C.D. (P=0.05)	6.62	10.09	0.24	-

Growth and yield attributes:

Tillage systems could influenced significantly only the plant stand and ear length when conventional tillage recorded significantly higher values over zero tillage (Table 2) by the margins of 5.32, 10.22 and 1.95% in plant stand at germination, number of shoots at harvest and ear length, respectively. In conventional tillage, field operations resulted in proper seed and soil contact, which caused better germination and tillering of wheat crop (Kumar, 2000). Non- significant effect between zero and conventional tillage in regard of yield attributes of wheat has also been reported by Gupta *et al.* (2007).

Weed control methods recorded all the growth and yield attributes except germination significantly higher over weed free check (Table 2). Among weed control methods M_5 closely followed by M_3 method gave significantly highest values of almost all growth and yield attributes. These methods M_5 and M_3 registered 46.0 and 36.6% more shoots/M^2, 17.2 and 15.3% more plant height, 19.0 and 16.9% more ear length, 19.8 and 18.2% more ear weight, 19.7 and 17.8 more number of grains/ear, 21.4 and 19.5% more grain weight/ear and 5.3 and 5.4% more 1000 grain weight, respectively over weedy check. These are attributed to better weed control as indicated by weed control efficiency of M_5 and M_3 methods (Table 1). These results support the findings of Kussahun *et al.* (2004). The interaction effect of tillage × weed control methods was not found significant on any of the growth or yield attributes of wheat.

Yield and economics:

Grain as well as straw yields were produced significantly higher under conventional tillage than zero tillage system by the margin of 4.41 and 4.57%, respectively. Different methods of weed control yielded significantly higher over weedy check with the margin ranging from 6.7 to 18.0 per cent (Table 3). Among methods, M_5 being at par with M_3 produced significant higher grains and straw yields compared to remaining methods of weed control. Weed control methods M_5

Table 2 : Effect of tillage and weed control methods on growth and yield attributes of wheat

Treatment	No. of plants/ m^2 at germination	No. of shoots / m^2 at harvest	Plant height at harvest (cm)	Ear length (cm)	Ear weight (g)	No. of grains / ear	Grain wt./ear (g)	1000 - grains weight (g)
Tillage systems								
T_1	118.22	398.61	73.02	7.70	2.15	51.23	1.74	37.21
T_2	124.51	439.33	74.40	7.85	2.20	52.18	1.78	37.83
S.E. ±	1.17	3.60	0.61	0.03	0.02	0.37	0.02	0.27
C.D. (P =0.05)	3.90	11.47	N.S.	0.09	N.S.	N.S.	N.S.	N.S.
Weed control methods								
M_0	118.00	331.07	66.35	6.91	1.92	45.68	1.54	36.35
M_1	121.29	426.64	74.55	7.89	2.21	52.43	1.79	37.5
M_2	118.18	376.12	72.04	7.61	2.14	50.68	1.74	37.25
M_3	123.45	452.27	76.52	8.08	2.27	53.80	1.84	38.31
M_4	121.75	424.20	73.35	7.75	2.18	51.61	1.76	37.31
M_5	124.87	483.39	77.73	8.22	2.30	54.70	1.87	38.28
M_6	122.01	439.10	75.47	7.97	2.23	53.06	1.81	37.82
S.E. ±	3.86	6.56	1.16	0.06	0.03	0.71	0.03	0.36
C.D. (P=0.05)	NS	13.30	2.36	0.11	0.06	1.44	0.05	0.74

N.S. = Non significant

Table 3 : Effect of tillage and weed control methods on yield (q/ha) and economics of wheat (Rs./ha)

Treatments	Wheat yields (q/ha)			Economics (Rs./ha)		
	Grain	Straw	Harvest index (%)	Gross income	Net profit	B:C ratio
Tillage systems						
T_1	38.94	58.13	40.05	53654	31899	1.46
T_2	40.66	60.79	40.02	56037	32825	1.41
S.E. ±	0.48	0.62	0.12	73	73	0.004
C.D. (P =0.05)	1.53	1.98	N.S.	231	231	0.01
Weed control methods						
M_0	36.15	53.49	39.88	50772	29543	1.39
M_1	40.14	59.39	40.33	54993	33201	1.51
M_2	38.58	57.24	40.26	52896	312264	1.44
M_3	41.70	62.82	39.89	57412	35675	1.63
M_4	38.99	58.47	40.00	53602	30749	1.34
M_5	42.67	64.78	39.71	58864	35130	1.47
M_6	40.37	60.05	40.20	55378	30970	1.26
S.E. ±	0.97	1.25	0.24	997	997	0.05
C.D. (P=0.05)	1.96	2.53	N.S.	2022	2022	0.09

N.S.-Non significant

produced highest of 42.67 q/ha grain yield which was found 0.97, 2.30, 2.53, 3.68, 4.09 and 6.52 q/ha or 2.3, 5.7, 6.3, 9.4, 10.6 and 18.0 per cent higher over the grain yields under M_3, M_6 M_1, M_4, M_2 and M_0 methods, respectively. These yields are attributed to growth and yield attributes which also behaved in a similar manner under different treatments. These results are in accordance to those of Kussahun *et al.* (2004).

Economics of wheat cultivation was found better under conventional tillage as it gave significantly higher gross income and earned more net profit than zero tillage by the margin of Rs. 2383 (4.44%) and Rs. 926 (2.9%) per ha, respectively. It is attributed to higher grain and straw yields under conventional tillage. All weed control measures earned significantly more gross income than weedy check (Table 3). In case of net profit, weed control

methods M_1, M_3 and M_5 methods could earn significantly more over weedy check. The methods M_3 and M_5 being at par earned significantly more net profit than all other weed control treatments with the nearest margin of 7.5 and 5.8 per cent over M_1 and largest margin of 20.8 and 18.9 per cent over weedy check, respectively. The variable effects of weed control methods on economics are associated with crop yields and cost of treatments application. Benefit: Cost ratio was computed maximum of 1.63 in M_3method followed by M_1 method with 1.51 ratio. These results are supported by the findings of Martin *et al.* (1991).

REFERENCES

Gupta, M., Bali, A.S., Sharma, B.C., Kachroo, D. and Bharat, R. (2007). Productivity, nutrient uptake and economics of wheat under various tillage and fertilizer management practices. *Indian J. Agron.*, 5**2** (2) : 127 - 130.

Jain, N., Mishra, J.S., Kewat, M.L. and Jain, V. (2007). Effect of tillage and herbicides on grain yield and nutrient uptake by wheat and weeds. *Indian J. Agron.*, **52** (2) : 131 - 134.

Kumar, A. (2000). Effect of different tillage systems on wheat (*Triticum aestivum*) crop. *Indian J. Agron.*, **45** (1) : 114 - 117.

Kussahun, E., Suwanketrikom, R., Chinawong, S., Suwarnarat, C., Juntakook, S. and Vichukit, V. (2004). Weed population dynamics as influenced by tillage, fertilizer and weed management in wheat cropping system. *J. Natural Sci.*, **38** (3) : 290 - 304.

Martin, M.A., Scheiber, M.M., Riepe, J.R. and Bahr, J.R. (1991). The economics of alternative tillage systems, crop rotations and herbicides use in three representative east central cum belt farms. *J. Weed Sci.*, **39** (2) : 299 - 307.

Pandey, I.B., Sharma, S.L., Tiwari, S. and Bharti, V. (2001). Effect of tillage and weed management on grain yield and nutrient removal by wheat and weeds. I*ndian J. Weed Sci.*, **33** (3-4) : 107 - 111.