Impact of tillage and weed control practices on weed flora and yield of wheat in direct seeded rice-wheat cropping system

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ABSTRACT

A field experiment was conducted during *rabi* 2007-08 at NRC-Weed Science, Jabalpur (M.P.) to assess the effect of tillage and weed control practices on weed flora and yield of wheat in direct seeded rice-wheat cropping system. Yields were not influenced by any of the tillage packages adopted in wheat. But chemical weed control (clodinafop 0.060 *fb* 2,4-D 0.50 kg/ha) or integrated weed management practice (IWM) (clodinafop 0.060 *fb* 2,4-D 0.50 kg/ha + 1 HW at 40 DAS) after all the tillage packages increased grain and straw yields of wheat compared to weedy check plots. IWM practice (clodinafop 0.060 *fb* 2,4-D 0.50 kg/ha + 1 HW at 40 DAS) produced significantly higher grain yield of wheat than chemical control alone (clodinafop 0.060 *fb* 2,4-D 0.50 kg/ha). benefit per rupee of investment was higher in plots receiving clodinafop *fb* 2, 4-D in zero tilled wheat after conventional tillage in rice as well as IWM in wheat under zero tilled wheat after zero tillage in rice. Zero tilled wheat after zero tillage in rice had lower weed density and dry weight of weeds than other tillage (clodinafop 0.060 *fb* 2,4-D 0.50 kg/ha + 1 HW at 40 DAS) packages adopted in wheat after rice. Similarly post-emergence application of clodinafop 0.060 *fb* 2,4-D 0.50 kg/ha or integrated weed management in wheat, was found effective in curtailing the population including dry weight of dominant grassy and dicot weeds.

Key words : Tillage and weed, Rice-wheat, Clodinafop

Rice-wheat is one of the main cropping systems and occupies nearly 10.5 million hectares area in India. This cropping system is followed in irrigated eco-system of north and central India. In Madhya Pradesh, this system is followed mainly in Kymore plateau and Satpura hills zone and some part of the Vidhyan plateau, central Narmada valley and gird regions in about 1.064 million hectares, contributing nearly 10% to the total area under rice-wheat in the country (Annonymous 2007). Due to rising cost of labour and water crisis, the direct seeding of rice after conventional tillage through ferti-seed drill or zero till sowing through zero till seed drill are gaining importance in many parts of the country. Direct seeded rice matures around 7 -10 days earlier than transplanted rice, enabling timely sowing of subsequent wheat. Hence, it is of utmost importance to decide suitable tillage packages in wheat after direct seeded rice. Weeds are the major problem in irrigated wheat. Many research workers have reported the predominance of *Phalaris minor, Avena fatua* among the monocots, *Chenopodium album, Melilotus indica* among the dicot weeds in wheat field (Yadav *et al.* 2005 and Chahel *et al.* 2002). However, with the use of suitable herbicides or adoption of integrated approach of weed control, the weeds problem in wheat could be managed effectively and economically (Shrama *et al.* 2005) and cost of weed control in wheat could partially or completely be compensated by saving in the cost of tillage operations with zero till sowing of wheat.

A field experiment was carried out during *rabi* season of 2007-08 at the National Research Centre for Weed Science (NRCWS), Jabalpur. The soil of the experimental field was clayey in texture, neutral in reaction and normal in electrical conductivity. It was low in organic carbon (0.57%), and available nitrogen (110), medium in available phosphorus (12.58) and potassium (279). Variety of rice *Kranti* was grown in the experimental field with recommended package of practices during *kharif* season of 2007. After the harvest of direct seeded rice (DSR), twelve treatment combinations consisting of four tillage packages as main-plot treatments and three weed control practices as sub-plot treatments were laid out in split plot design with four replications. Main plot treatments were T_1 - Conventional tilled (direct seeded rice) zero tilled (wheat), T_2 - Zero tilled (direct seeded rice) conventional tilled (wheat), T_3 - Conventional tilled (direct seeded rice)- conventional tilled (wheat), T_4 - Zero tilled (direct seeded rice). Zero tilled (wheat) and sub plot treatments were W_1 -Weedy check, W_2 - Weed control (clodinafop 0.060 kg/ha followed by 2,4-D 0.50 kg/ha) and W_3 - Integrated weed management (clodinafop 0.060 kg/ha *fb* 2,4-D 0.50 kg/ha + 1 HW at 40 DAS). The variety

GW-273 of wheat was taken as test crop. Fertilizers were given uniformly to all the plots through urea, single super phosphate and muriate of potash at the rate of 120 kg N, 60 kg P_5 and 30 kg K/ha respectively. The quantities of different herbicides for the respective plots were determined according to the active ingredient present in the commercial products. The spraying of herbicides was done by mixing the exact quantity of herbicides in measured quantity of water at the rate of 500 liters/ha. Herbicides were applied in the plots by Knapsack sprayer using flat fan nozzle. In zero tilled plots, parquat was applied seven day before sowing of wheat crop to kill the emerged weeds and to make the field weed free. The 2,4-D at 0.50 kg/ha and clodinafop at 0.06 kg/ha are antagonistic to each other, therefore, the 2,4-D was applied 10 days after application of clodinafop.

Among the different weeds infesting wheat crop, the monocot weed *Avena ludoviciana* was most rampant, constituting major share (94%) of the relative density of weeds at 60 days after sowing (DAS). Whereas, dicot weeds like *Medicago hispida* (3%), *Chenopodium album* (1%), and monocot weed *Phalaris minor* (2%) were present in lesser numbers (Fig. 1). Similar weed flora in wheat in rice-wheat system was also reported by Yadav *et al.* (2001).

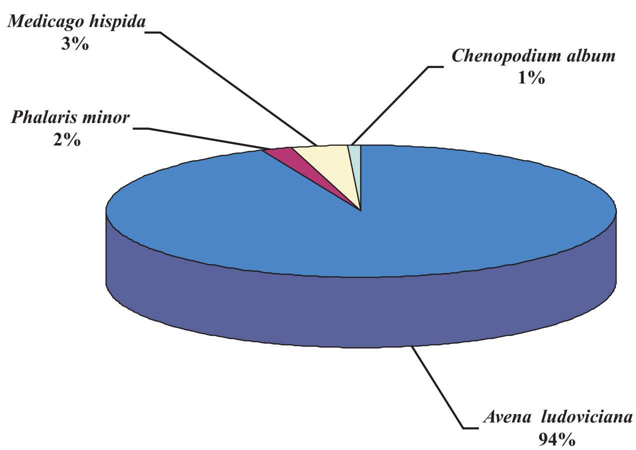

Fig. 1 Relative density of weeds in weedy check plot at 60 DAS

Tillage packages had marked influence only on the density and dry weight of *Avena ludoviciana* but not on *Phalaris minor*. Among the various tillage packages, zero tilled wheat after zero tillage in rice had significantly the minimum weed density and dry weight of *A. ludoviciana* (12.28/m^2 and 8.83/gm^2) as compared to zero tilled wheat after conventional tillage in rice (15.58/m^2 and 9.51/gm^2), conventional tilled wheat after zero tillage in rice (16.28/m^2 and 10.14/gm^2) and conventionally tilled wheat after conventional tillage wheat in rice (16.28/m^2 and 10.22/gm^2) (Table 1). No soil disturbance coupled with continuous check as buildup of seed bank of *A. ludoviciana* due to application of non selective herbicide (Glyphosate 1%) before seeding of wheat seed of zero tilled wheat after zero tillage in rice could be assigned the reason for minimal density of *A. ludoviciana*, while the reverse was true for other tillage packages.

Weed control treatments also caused significant variation on density and dry weight of *A. ludoviciana* and *Phalaris minor* in wheat crop. The density and dry weight of *A. ludoviciana* (26.79/m^2 and 16.75/gm^2) and *Phalaris minor* (3.87/m^2 and 0.97/gm^2) were the maximum in weedy check plots, where weeds were allowed to grow through-out the crop season. But the density and dry weight of both the weeds were reduced when weeds were controlled chemically or through integrated weed management. The density and dry weight of *Avena ludoviciana* and *Phalaris minor* were lesser in plots receiving chemical weed control measures (11.76/m^2, 7.70/gm^2 and 0.70/m^2, 0.70/gm^2) and these values were reached to (6./76m^2, 4.58/gm^2 and 0.70/m^2, 0.70/gm^2) minimal levels when weeds were controlled by integrated weed management (clodinafop 0.060 kg/ha *fb* 2,4-D 0.5 kg/ha + 1 HW at 40 DAS) (Table 1). The elimination of weeds to the greater extent under IWM and chemical weed control is attributed to lower density and dry weight of weeds. Jain *et al.* (2007) also made similar observations.

Variations in tillage packages did not affect the grain and straw yields of wheat perhaps due to alike crop stand and proper growth and development of crop plants. However, weed control treatments caused identical variations on grain and straw yields of wheat. The grain and straw yields were significantly maximum (4769 kg/ha and 8928 kg/ha) in plots receiving IWM , followed by chemical weed control and both proved significantly superior over weedy check plots which attained the lowest values of gain and straw yields (2540 kg/ha and 5630 kg/ha). Better growth and development including superior values of yield attributes of wheat in both the former treatments are the reasons for higher yields.

Cost of cultivation of wheat under different tillage packages varied from Rs 11524 to 13924/ha depending upon the tillage packages adopted. The cost of cultivation was the highest (Rs 13924/ha) under conventionally tilled wheat after zero tillage in rice and conventionally tilled wheat after conventional tillage in rice due to more numbers of tillage operations for seed bed preparation as compared to zero tilled wheat after conventional tillage in rice and zero tilled wheat after zero tillage in rice (Rs 11524/ha). Among weed control practices, the cost of cultivation was the highest (Rs14650/ha) under

Table 1. Weed density, weed dry weight and yield of wheat as influenced by different tillage and weed control treatments

Treatment	Density/m^2		Dry matter (g/m^2)		Grain yield (kg/ha)	Straw yield (kg/ha)	Cost of cultiva-tion (Rs.)	B:C ratio
	Avena ludoviciana	*Phalaris minor*	*Avena ludoviciana*	*Phalaris minor*				
T_1 - CT (rice) - ZT (wheat)	15.6 (242.2)	1.7 (2.4)	9.51 (89.94)	0.78 (0.10)	3982	7830	11524	(3.75)
T_2 - ZT (rice) - CT(wheat)	16.3 (264.5)	1.8 (2.7)	10.14 (102.3)	0.78 (0.10)	3924	7576	13924	(3.04)
T_3 - CT (rice) - CT (wheat)	16.3 (264.5)	1.9 (3.1)	10.22 (103 .09)	0.78 (0.10)	3798	7035	13924	(2.93)
T_4 - ZT (rice) - ZT (wheat)	12.3 (150.3)	1.7 (2.2)	8.83 (77.46)	0.78 (0.10)	3719	7802	11524	(3.50)
LSD (P=0.05)	0.51	NS	0.63	NS	NS	NS	-	-
W_1 - Weedy check	26.8 (717.2)	3.9 (14.5)	16.75 (280.00)	0.97 (0.44)	2540	5630	10899	(2.62)
W_2 - Chemical control	11.8 (134.8)	0.7 (0.0)	7.70 (58.79)	0.70 (0.01)	4257	8125	12625	(3.72)
W_3 - IWM	6.8 (45.2)	0.7 (0.0)	4.58 (20.47)	0.70 (0.01)	4769	8928	14650	(3.58)
LSD (P=0.05)	0.50	0.18	0.62	0.01	195.06	496.02	-	-

CT - Conventional tillage, ZT - Zero tillage, IWM - Integrated weed management, B:C - Benefit cost, Value in paranthesis are original values.

Integraged weed management (IWM) (clodinafop 0.060 kg/ha *fb* 2,4-D 0.5 kg/ha + 1 HW at 40 DAS) followed by chemical control (Rs.12625/ha) due to more expenditure on herbicides and manual labour for weed control in IWM and on herbicides in chemical control (clodinafop 0.060 kg/ha *fb* 2,4-D 0.5 kg/ha) as compared to weedy check (Rs 10899/ha). The monetary gain per rupee of investment was higher in zero tilled wheat after conventional tillage or zero tillage in rice due to lower cost of cultivation as compared to conventionally tilled wheat after zero or conventional tillage in rice, which required more expenditure on seed bed preparation.

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