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Effect of Tillage and Herbicides on Weed Seed Bank Dynamics in Wheat (*Triticum aestivum*) under Transplanted Rice-Wheat System

Namrata Jain, J. S. Mishra[1], M. L. Kewat and Vinamarta Jain[2]
Department of Agronomy
Jawaharlal Nehru Krishi Vishva Vidyalaya, Jabalpur (M. P.), India

ABSTRACT

Tillage operations significantly influenced the vertical distribution of winter weeds in the wheat field. Significantly higher number of seeds of *Avena ludoviciana, Medicago hispida* and *Chenopodium album* was recorded in the upper 0-5 cm layer under zero tillage treatments than conventional and deep tillage. But at higher depths of 5-10 and 10-15 cm, the number of seeds of *A. ludoviciana* was significantly higher under deep tillage followed by conventional and zero tillage. Continuous use of clodinafop fb 2, 4-D and isoproturon+2, 4-D for control of weeds in wheat field significantly reduced the number of weed seeds over weedy check.

INTRODUCTION

Species composition of any soil seed bank is the result of seed production, germination and mortality. The crop management practices such as tillage and herbicide use are the important factors which contribute to seed bank composition. Tillage practices also alter distribution of weed seeds vertically within the soil profile (Buhler, 1995). Application of herbicide was found to reduce weed seed numbers (Schreiber, 1992). As the top 5 cm of soil is the active layer in terms of germination of small seeded species (Hoffman *et al.*, 1998), the persistence of many troublesome annual weeds requires knowledge of seed density and distribution in the soil. Keeping these points in view, the present study was carried out to study the effect of tillage packages and herbicides on weed seed bank in wheat crop under transplanted rice-wheat system.

MATERIALS AND METHODS

A study was conducted at National Research Centre for Weed Science, Jabalpur (23° 90'N, 79° 58'E, 412 m above mean sea level) during the winter seasons of 2003-04 and 2004-05. The soil was clayey in nature, medium in organic carbon (0.66%), low in available nitrogen (239 kg ha^{-1}), medium in available phosphorus (17 kg ha^{-1}) and potassium (298 kg ha^{-1}) with neutral in reaction (pH 7.2). After the harvest of transplanted rice, 12 treatment combinations consisting of four tillage packages viz., zero tillage (ZT) immediately after rice, ZT with chemical stale seed bed using glyphosate, conventional tillage (CT) and deep tillage (DT) as a main-plot treatments and three weed control practices viz., weedy check, isoproturon at 1.0 kg ha^{-1}+2, 4-D at 0.5 kg ha^{-1} and clodinafop at 0.06 kg ha^{-1} fb 2, 4-D at 0.5 kg ha^{-1} as sub-plot treatments were laid out in split plot design replicated four times. DT consisted of disc ploughing once+cultivator twice+rotavator and sowing, CT with cultivator twice+rotavator and sowing and ZT comprised sowing directly with zero-till seed drill in the presence of anchored rice stubbles. In ZT with chemical stale seed bed, emerged weeds were killed using glyphosate at 1.0 kg ha^{-1} before sowing of crop. Field was irrigated through sprinkler immediately after sowing to ensure proper seed germination.

Soil samples were collected from a long

[1]National Research Centre for Weed Science, Jabalpur (M. P.), India.
[2]Krishi Vigyan Kendra, Bilaspur (C. G.), India.

term trial of transplanted rice-wheat system, after the harvest of 3rd and 4th year and sowing of the 4th and 5th season wheat crop. The samples were taken with core auger at depths 0-5, 5-10 and 10-15 cm. Soil samples were dried in the shade and ground gently in the small pieces. Thereafter 0.5 kg of soil for each depth was weighed and kept in the petriplate (diameter 15 cm, depth 2.5 cm) and replicated thrice to study the emerged weeds present in the soil. However, no study was made for the dormant weed seeds. The petriplates were given water manually as and when needed to maintain adequate moisture. After germination, the seedlings were identified, counted and removed, and again soil was thoroughly stirred and given water regularly for another flush of weeds. The cycle of operation was repeated after every flush of germination, identification and removal of seedlings till the exhaust of all emerged weeds.

RESULTS AND DISCUSSION

The number of weed seeds was higher in the upper 0-5 cm layer and decreased with increase in the depth of the soil. At surface layer (0-5 cm), weed seeds were significantly higher under both zero tillage than conventional and deep tillage (Table 1). However, at deeper layer (5-10 and 10-15 cm) significantly higher weed seeds were recorded under deep tillage (13.3 and 9.4 seeds kg^{-1} soil) followed by conventional tillage and zero tillage packages. In conventional and deep tillage the weed seeds, which remained in the upper surface must have gone into the deeper layer owing to tillage operations and consequently there were more seeds at 10-15 cm depth.

Tillage packages also influenced the species-wise distribution of weed seeds. Seeds of *A. ludoviciana* were more in the upper layer of 0-5 cm under zero tillage packages than conventional and deep tillage (Fig. 1). However, it was higher in deeper layer of 5-10 and 10-15 cm in conventional and deep tillage than both the zero tillage packages. Similar trend was recorded in case of *Medicago hispida* and *Chenopodium album* but the difference in distribution of the weed seeds from the upper layer to deeper layer was less than *A. ludoviciana*. This might be due to the lighter weight and greater surface area of *A. ludoviciana* as compared to other dominant weeds, helping weed seeds to float on the soil surface.

Among weed control practices, more number of seeds was noted in weedy check followed by isoproturon+2, 4-D and clodinafop fb 2, 4-D. The reduction in weed seed bank under herbicidal treatments was the result of continuous reduction in weed population due to effective control of weeds. However, the accumulation of weed seeds was

Table 1. Effect of tillage packages and weed control practices on total weed seed bank (No. kg^{-1} soil) (Pooled data for 2003-04 and 2004-05)

Treatment	0-5 cm	5-10 cm	10-15 cm
Tillage package			
ZT immediately after rice	23.6	7.5	4.9
ZT with chemical stale seed bed	22.9	7.4	5.2
Conventional tillage	15.9	11.2	7.6
Deep tillage	15.5	13.3	9.4
LSD (P=0.05)	1.9	1.7	1.2
Weed control			
Weedy	21.5	10.8	7.3
Isoproturon+2, 4-D	18.7	9.6	6.6
Clodinafop fb 2, 4-D	18.2	9.3	6.4
LSD (P=0.05)	1.6	1.0	1.2

fb–followed by.

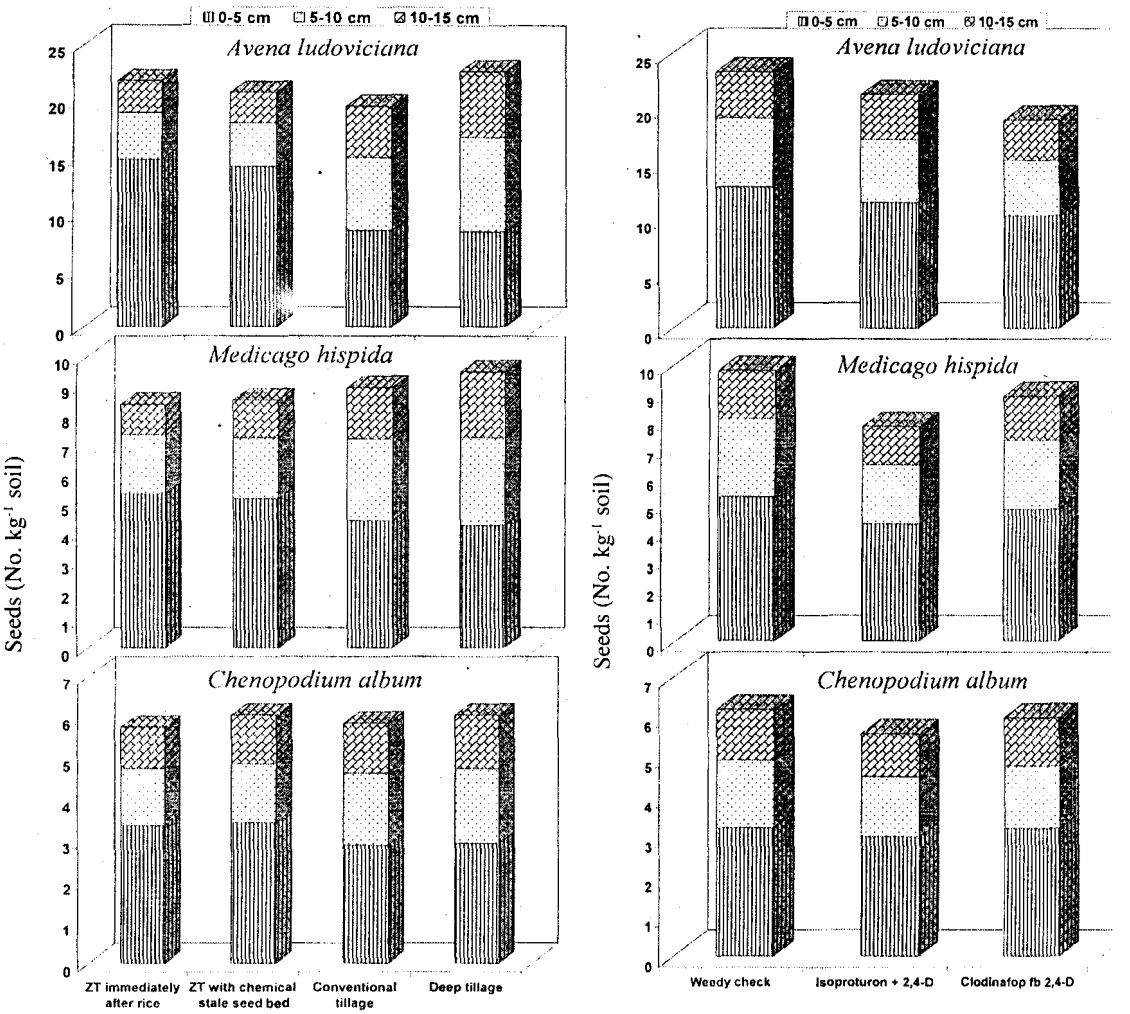

Fig. 1. Effect of tillage packages and herbicides on weed seed bank distribution in soil profile.

higher in the upper layer of both the zero tillage packages than conventional and deep tillage.

REFERENCES

Buhler, D. D. 1995. Influence of tillage systems on weed population dynamics and management in corn and soybean in the central USA. *Crop Sci.* **35** : 1247-1258.

Hoffman, Melinda, L. Micheal, D. K. Owen and Douglas D. Buhler, 1998. Effects of crop and weed management on density and vertical distribution of weed seeds in soil. *Agron. J.* **90** : 793-799.

Schreiber, M. M. 1992. Influence of tillage, crop rotation and weed management on giant foxtail (*Setaria faberi*) population dynamics and corn yield. *Weed Sci.* **40** : 645-653.