



Short communication

Conservation tillage practices on weed incidence in cereal fodder production in rice fallows

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Abstract

A field experiment was conducted to study the effect of various tillage practices like zero tillage, herbicide based zero tillage, minimum tillage and normal tillage on weed incidence and yield of fodder cereals in rice fallows. The population of grasses, sedges and broad leaved weeds as well as their dry weight was the highest in zero tillage. The highest forage yield was realized in herbicide based zero tillage followed by minimum tillage. The performance of maize and bajra were the best in herbicide based zero tillage, whereas performance of fodder sorghum in all the treatments except zero tillage was good.

Key words: Conservation tillage, Fodder cereals, Weed population, Forage yield.

Fodder crops have an important role in meeting the requirements of nutrients and roughage in livestock nutrition. Adequate availability of nutritive green fodder for livestock is vital for economizing milk production, as feed cost constitutes a major share of cost of livestock rearing. Cereal fodder crops like maize, sorghum and bajra are rich in energy and produce large quantities of quality herbage within a short growing period of 60-70 days and can be grown in rice fallows utilizing the residual moisture or with supplemental irrigation. Conservation tillage practices viz; minimum or zero tillage can save the cost of land preparation and weed control. Carter et al. (2002) reported that normal tillage may not be required for getting good crop yield in forage cereals. Lal (1989) also opined that no till farming systems are successful for production of row crops in the tropics.

Chauhan and Johnson (2009) reported that agronomic practices such as tillage have implications for weed competition and weed management strat-

egies. Chopra and Angiras (2008) found that seedling emergence of *Digitaria ciliaris*, *Echinochloa colona*, *Eleusine indica*, *Ageratum conyzoides*, *Eclipta prostrata* and *Portulaca oleracea* were greater in zero tillage compared with either conventional or minimum tillage where the seedling emergence was similar.

Changes in weed population and shift in weed flora under conservation tillage methods can influence crop performance. Hence the present study was aimed at testing the effect of tillage methods on weed intensity, weed spectrum and the herbage yield of different fodder cereals.

The study was conducted at the Department of Agronomy, College of Horticulture, Vellanikkara, Thrissur, Kerala, during the period from November 2009 to February 2010 in a rice fallow. Soil of the experimental site was sandy loam with a pH of 5.4, and containing available N, P and K in the order 209, 20 and 103 kg ha⁻¹, respectively.

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The experiment was laid out in split plot design with four replications. The main plots had tillage practices as treatments which included zero tillage with and without herbicide application (M1 and M2), minimum tillage (M3) and normal tillage (M4). The subplots had three treatments, viz., fodder cereals: maize (*Zea mays*) (S1), sorghum (*Sorghum bicolor*) (S2) and bajra (*Pennisetum typhoides*) (S3).

In zero tillage without herbicide application (M1), the land was kept undisturbed. In M2, glyphosate was applied at the rate of 0.8 kg ha⁻¹ and there was no soil disturbance. For M3 soil was dug in strips (width about 15cm) at a spacing of 30 cm. In the case of M4, the land was ploughed thoroughly twice and then ridges and furrows were taken. All the crops were dibbled at a spacing of 30 cm x 15 cm in all the treatments. Cowdung was applied basally @ 10 Mg ha⁻¹. N:P₂O₅:K₂O were applied @ 30:15:30 kg ha⁻¹ in two splits as basal and 30 days after sowing.

Species wise weed count was taken from 0.025m² area in each plot at 30 days after sowing (DAS) and at harvest. The weeds from the sampling area in each plot were uprooted, dried under shade and then in a hot air oven at 70°C and the weed dry weight was recorded in kg ha⁻¹. The green forage yield from

each plot was recorded leaving the border area. Data generated on various parameters were analyzed statistically by using the Analysis of Variance. In case the effects were found to be significant, Duncan’s Multiple Range Test was done for making logical comparisons between the treatment means (Panse and Sukhatme, 1978).

Weed spectrum of the experimental field indicated that broad leaved weeds constituted the major population followed by grasses. The dicots included *Ludwigia parviflora*, *Melochia corchorifolia*, *Mollugo pentaphylla*, *Cleome viscosa*, *Alternanthera bettzickiana*, and monocots included *Digitaria ciliaris*, *Echinochloa colona* as well as *Isachne miliacea* and sedges *Cyperus rotundus* and *Fimbristylis miliacea*. Between tillage methods, significant variation in the population of grass weeds could be noticed only at the initial stage (30 DAS) (Table 1) The lowest number of grassy weeds was observed in normal tillage. The highest number of grass weeds was observed in zero tillage followed by minimum and herbicide based zero tillage, the latter two being statistically at par. Among the weeds present in the field, the population of sedges was the lowest and the variation between main plots also was found to be non significant at both the stages of observation.

Table 1. Population of grasses and sedges [number m⁻²] as influenced by tillage methods

Treatments	Grasses		Sedges	
	30 DAS	Harvest	30 DAS	Harvest
Tillage methods				
Zero tillage	11.08	9.32	**2.37 (5.12)*	1.90 (3.12)
Herbicide based zero tillage	7.56	8.20	1.35 (1.33)	1.12 (0.75)
Minimum tillage	8.24	7.88	2.02 (3.58)	1.89 (3.08)
Normal tillage	5.44	6.88	0.71 (0.00)	0.71 (0.00)
CD(p=0.05)	1.96	NS	NS	NS
Fodder cereals				
Maize	7.36	7.04	1.66 (2.25)	1.39 (1.44)
Sorghum	8.92	8.40	1.58 (2.00)	1.41 (1.50)
Bajra	8.48	8.24	1.95 (3.31)	1.63 (2.30)
CD(p=0.05)	NS	NS	NS	NS

* values given in parenthesis are original values; * $\sqrt{x+0.5}$ transformed values.

In zero tilled plots as there was no disturbance of soil, the weed population was high during all stages of growth. This is in accordance with the findings of Singh et al. (2009) and Bisen and Singh (2008). According to them, the highest weed population and weed dry weight was observed in zero tillage and the lowest weed dry weight and population in conventional tillage.

There was no significant variation among fodder crops with respect to population of grasses and sedges both at 30 DAS and at harvest probably due to their similar growth habits and spacing. The interaction between tillage methods and fodder crops was also found to be non significant at 30 DAS but significant at harvest stage.

The population of broad leaved weeds showed a decreasing trend in zero and minimum tillage from 30 DAS to harvest stage (Table 2). But the population of broad leaved weeds in normal tillage showed a considerable increase from 30 DAS to harvest stage of the fodder crops. This might have resulted from the favourable soil conditions for emergence of weed seedlings from the soil seed bank. However, the population showed a marginal increase from 10.83 kg ha⁻¹ to 11.52 kg ha⁻¹ in herbicide based zero tillage, where better vegetative growth of the fodder crops was observed due to less weed competition.

Weed dry weight varied with tillage as well as with fodder crops at 30 DAS and at harvest, as in the case of weed count (Table 3). The highest weed dry weight of 1545 kg ha⁻¹ was in zero tilled plots compared to the minimum value of 193.33 kg ha⁻¹ in normal tillage plots at 30 DAS. The normal as well as herbicide based zero tillage recorded statistically comparable values, whereas minimum tillage recorded intermediary values of weed dry weight. A similar trend was there at harvest stage also. However, the weed dry weight in herbicide based zero tillage was almost double, whereas it showed about three times increase in normal tillage.

The response of all the crops to different tillage methods was the same at 30 DAS and at harvest. This might be due to the similarity in growth habit of the three cereal crops and absence of crop bound or crop associated weeds. The highest weed dry weight in all crops was recorded at zero tillage and lowest in normal tillage whereas, by harvest the lowest weed dry matter was observed in maize in herbicide based zero tillage and in bajra in normal tillage. In sorghum, both herbicide based zero tillage and normal tillage were comparable with respect to weed dry weight at this stage.

It could also be seen that though weed count decreased in zero tilled plots from 30 DAS to harvest, weed dry matter showed an increase. This

Table 2. Population of broad leaved weeds (number m⁻²) as influenced by tillage methods at 30 days after harvest (DAS) and at harvest.

	Subplots							
	Maize		Sorghum		Bajra		Main plot mean	
	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest
Main plots								
Zero tillage	24.80	18.88	23.92	15.44	20.92	15.28	23.21	16.52
Herbicide based zero tillage	11.20	9.52	11.28	10.80	10.00	14.28	10.83	11.52
Minimum tillage	16.68	15.52	16.44	12.40	16.72	15.24	16.61	14.36
Normal tillage	5.44	8.88	8.76	12.76	6.60	11.60	6.93	11.08
Sub plot mean	14.53	13.20	15.10	12.84	13.56	14.12		
CD (p=0.05)	Main plot		Sub plot		Main plot x sub plot interaction			
	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest		
	0.73	0.43	NS	NS	2.28	2.88		

Table 3. Effect of tillage on weed dry weight at 30 DAS and at harvest (kg ha⁻¹)

	Maize		Sorghum		Bajra		Main plot mean	
	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest
Zero tillage	1570	1690	1625	1745	1440	1563	1545	1666
Herbicide based zero tillage	307	539	357	682	327	650	330	624
Minimum Tillage	525	1047	601	1116	545	1070	557	1078
Normal tillage	190	620	200	650	190	490	193	587
Sub plot mean	648	974	696	1048	626	943		
	Main plot		Sub plot		Main plot x sub plot interaction			
	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest
CD (p=0.05)	48.52	42.56	33.52	33.88	67.04		67.80	

is due to more vegetative growth of the weeds present, especially the weeds like *Digitaria ciliaris* which produced numerous tillers. Increase in weed dry weight with decrease in weed count is also reported by Channappagoudar and Biradar (2007).

Tillage treatments had significant influence on herbage yield of fodder cereals. The highest yield of 20.72 kg ha⁻¹ was recorded in herbicide based zero tillage which was statistically comparable to minimum and normal tillage (Table 4). Zero tilled

cereals indicated that crops do differ with respect to tillage requirements when raised in rice fallows. Fodder maize performed better in herbicide based zero tillage as well as in minimum tillage. Many workers have previously reported better performance of maize under minimum tillage or chemical tillage practices than under conventional tillage (Shenk and Saunders, 1981) or mechanical weeding (Sharma et al., 2010). In the case of bajra, herbicide based zero tillage was the best treatment (20.84 kg ha⁻¹) whereas for fodder sorghum various

Table 4. Effect of tillage methods on green forage yield of cereal fodder crops (Mg ha⁻¹)

	Maize		Sorghum		Bajra		Main plot mean	
	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest
Zero tillage	16.50		9.00		9.56		11.69	
Herbicide based zero tillage	22.94		18.39		20.84		20.72	
Minimum tillage	22.31		17.69		16.16		18.72	
Normal tillage	19.00		18.56		16.68		18.08	
Sub plot mean	20.19		15.91		15.81			
	Main plot		Sub plot		Main plot x sub plot interaction			
	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest	30 DAS	Harvest
CD (p=0.05)	2.49		1.10		2.20			

plots recorded the lowest herbage yield. The yield increase over zero tillage was to the tune of 77 per cent and 60 per cent in herbicide based zero tillage and minimum tillage and 55 per cent in normal tillage. This indicated the possibility of reduction in cost and energy for tillage practices in rice fallow cereal production.

The interaction between tillage methods and fodder

tillage practices resulted in comparable herbage yield.

The findings of the study indicate that for rice fallow fodder cereal production, herbicide based zero tillage or minimum tillage can be resorted to and weed flora as well as weed density in crop field are influenced by tillage method. Normal tillage resulted in good control of weeds but it favoured

broad leaved weed population towards later stage of crop growth. There was no significant variation among fodder maize, sorghum or bajra with respect to weed density or dry matter production of the weeds. Fodder maize and fodder bajra were found to be good cereal fodder crops for rice fallows under conservation tillage.

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