Pak. J. Weed Sci. Res. 11(1-2): 49-53, 2005

INFLUENCE OF VARIOUS TILLAGE PRACTICES ON WEED CONTROL TO INCREASE MAIZE PRODUCTION UNDER IRRIGATED CONDITIONS

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ABSTRACT

Studies were conducted to find out the effect of various tillage practices on weed control to increase maize yield under irrigated conditions at NWFP Agricultural University Research Farm, during 1997-99. The experiment was laid out in randomized complete block design (RCBD). Tillage practices were managed with seven treatments and six replications. Cultivator two times (C_2), Cultivator four times (C_4), Cultivator six times (C_6), Moldboard plow and rotavator once (M_1R_1), Moldboard plow and disk harrow once (M_1H_1), Moldboard plow once and disk harrow two times (M_1H_2) and Disk plow once and cultivator two times (D_1C_2). In the deep tillage treatments, (M_1R_1), weed density was reduced and maize yield was increased by 15% as compared to shallow tillage treatment (C_2). Hence, to conserve moisture and effectively control weeds, deep tillage is recommended in irrigated conditions of Peshawar Valley.

Key words: *Zea mays*, deep tillage, weed control, cultivator, grain yield

INTRODUCTION

Maize is third important cereal after wheat and rice in Pakistan. It was grown on 0.51 million hectares under the irrigated and rainfed area of NWFP during 2003. The total production was 0.85 million tons with average yield of 1674 kg ha^{-1} (Agric. Stat. of Pak., 2002-2003).

Plant out of place in the field is called weed. A heavy annual loss occurs from weeds due to reduction in the quality and quantity of crops. Weed control is essential because weeds compete with the crops for water, nutrients, and light. The control of weeds without the use of chemical herbicides is an essential component of successful organic farming practices. Tillage alone or in combination with cropping pattern often is the most economical method for weed control. Herbicides are more effective method to control weeds, however, more expensive due to high cost (Charles, *et al.* 2004). Majid *et al.* (1986) and Katsvairo *et al.* (2002) reported maximum yield increase of maize by 95% over traditional method. The increase in grain yield by deep cultivation might be due to less weed competition (20 m^{-2}) as compared to more weeds (25 m^{-2}) in shallow

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cultivation. Hussain and Munir (1985) reported that the use of cultivator from 3 -- 6 times for controlling weed is not an economic practice. Zentner *et al.* (2002) reported a relatively poor economic performance of conservation tillage practices reflecting 13% higher cost for controlling weeds by using herbicides than the conventional tillage practices on silt loam and clay soils. Tillage plays an important role in the crop production. However, very little is known about the effect of various tillage implements on yield of maize. A heavy annual loss occurs from weeds due to a reduction in the quality and quantity of crops. Therefore, a three year research study was conducted to compare the effectiveness of various tillage treatments on weed control, yield components and yield of maize crop.

MATERIALS AND METHODS

Experiments were conducted at NWFP Agricultural University Research Farm, Peshawar, during 1997 -1999 to compare the performance of various tillage treatments on weed control to increase the maize production. The experiment was set up in randomized complete block design with six replications. Treatments combinations used were: Cultivator two times (C_2), Cultivator four times (C_4), and Cultivator six times (C_6) (conventional method of land preparation), Moldboard plow once and rotavator once (M_1R_1) (progressive farmers), Moldboard plow once and disk harrow once (M_1H_1), Moldboard plow once and disk harrow two times (M_1H_2), and Disk plow once and cultivator two times (D_1C_2). These tillage treatments were used for weed control before sowing of maize crop. Maize cv. Sarhad White was planted during 2nd week of July. Recommended doses of fertilizers (Urea 125 kg ha^{-1} and DAP 125 kg ha^{-1}), irrigation and other inputs were applied uniformly to all the treatments. The plot size for individual treatment was kept, as 90 x 9 m^2. For recording ear weight, cob weight, kernel weight ear^{-1}, number of kernels ear^{-1}, 9 ears were selected randomly from each plot of maize. Data on 1000 kernels weight was recorded, by counting 1000 kernels randomly sampled from individual plot of each treatment and weighted by electronic balance. Grain yield ha^{-1} of maize was determined after harvesting and threshing of each treatment.

RESULTS AND DISCUSSION

Weed Control

Mean number of weeds before and after tillage in all the tillage treatments during maize growing season 1997 - 99 are presented in Table-1. The analysis of variance showed significant differences in number of weeds for various tillage treatments. The minimum number of weeds (133 m^{-2}) were observed in M_1R_1. It was however, statistically comparable with all other treatments except C_4. The highest number of weeds (154 m^{-2}) was noted in C_2. It is clear from the results that deep tillage treatments effectively reduced the number of weeds (5% less) as compared to shallow tillage treatments. Conns (1987), reported that deep tillage had a significant effect on many species of grasses and total weed cover as compared to shallow tillage. It was further reported that tillage reduced the ground cover of foxtail which increased from 1.3% under maximum tillage to 23.4% under no-tillage.

Table-1. Effect of various tillage treatments on number of weeds during maize growing seasons 1997 - 99.

Treatments	Number of weeds m^{-2}			
	1997	1998	1999	Means
C_1	157	159	105	140 ab
C_2	153	187	123	154 a
C_3	152	154	102	136 b
M_1R_1	138	149	111	133 b
M_1H_1	141	152	108	134 b
M_1H_2	146	167	107	140 ab
D_1C_1	147	167	100	138 b
LSD = 15.13				

Means with the same letter are not significantly different at 0.05 level of probability

Maize Yield Components

Data regarding ear weight, number of kernels ear^{-1}, kernel weight ear^{-1}, cob weight ear^{-1} and 1000-kernel weight during 1997-99 (Table-2) showed significant differences among various tillage treatments. Maximum ear weight of 131.2 g, number of kernels ear^{-1} of 477.2, and kernel weight ear^{-1} of 104 g were recorded in tillage treatment M_1R_1 and the lowest ear weight of 104.2 g, number of kernels ear^{-1} of 423.3 and kernel weight ear^{-1} of 80 g were recorded in treatment C_1. Highest (17.5 g) cob weight ear^{-1} was found in the treatment M_1R_1 and the lowest (15.2 g each) cob weight ear^{-1} was observed in the treatments C_1 and C_3 respectively. Similarly, the highest (215 g) 1000 kernel weight was obtained in the treatment M_1R_1 while the lowest (191 g) 1000 kernel weight was obtained in the treatment C_1.

Table-2. Effect of various tillage treatments on ear weight, number of kernels ear^{-1}, kernels weight ear^{-1}, cob weight ear^{-1} and thousand kernels weight during maize growing seasons 1997 - 99.

Treatments	Ear weight (g)	Number of kernels/ear	Kernels weight/ ear (g)	Cob weight/ ear. (g)	1000 kernels weight. (g)
C_1	104.2 c	423.3 c	80 c	15.2 c	191 c
C_2	107.7 c	442.5 b	82 c	15.7 bc	197 b
C_3	106.5 c	435.8 bc	82 c	15.2 c	196 b
M_1R_1	131.2 a	477.2 a	104 ab	17.5 a	215 a
M_1H_1	126.3 ab	468.3 a	99 ab	17.0 ab	210 a
M_1H_2	121.7 b	462.5 a	94 b	16.8 abc	208 a
D_1C_1	123.5 b	468.2 a	96 b	17.3 ab	211 a
LSD	6.61	17.66	6.26	1.61	8.76

Means with same letter are not significantly different at 0.05 level of probability

Maize grain Yield

Data pertaining to the maize yield of various tillage treatments of maize crop during 1997 - 99 are shown in Figure-1. Mean yield of maize varied from 3966 to 4827 kg ha^{-1}. The highest (4827 kg ha^{-1}) grain yield was recorded in the treatment M_1R_1 and the lowest (3966 kg ha^{-1}) grain yield was recorded in the treatment C_2. Deep tillage treatments had higher grain yield (15% more) as compared to shallow tillage treatments. Similar results were recorded by Khan *et al.* (1990), who observed that deep tillage by moldboard plow gave higher wheat yields in the range of 15 - 52% with an average yield increase of 25% over the cultivator. These results are also in agreement with those reported by Ahmad *et al.* (1990), who found that the average grain yield of 2903 kg ha^{-1} was obtained by moldboard plow and was significantly higher than the grain yield of 2512 kg ha^{-1} was recorded in cultivator treatment. The results showed that by deep tillage practices increase moisture absorption and effectively controlled weeds, which ultimately provided favorable environment for plant growth, better root development, and plant population than shallow tillage practices, ultimately increasing the grain yield.

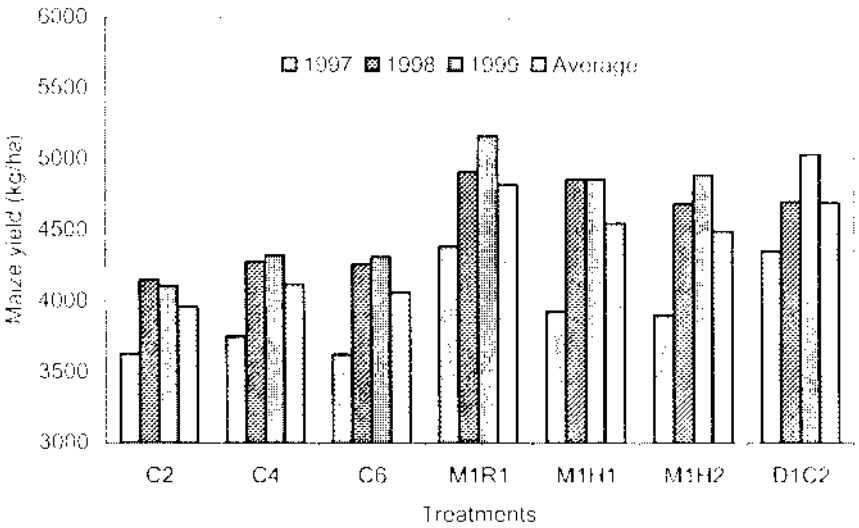

Fig.1. Effect of various tillage treatments on maize yield during 1997 – 99 growing seasons.

CONCLUSION

It is concluded that tillage treatments significantly affected yield components and yield of maize by controlling weeds. On average, field prepared by moldboard plow and rotavator once (M_1R_1) gave 15% higher yield as compared to shallow tillage treatments. For maximum maize yield, soil should be tilled with deep tillage treatment (Moldboard plow and rotavator once) for controlling weeds, improving physical properties and harvesting higher yield under irrigated clay loam soil condition.

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