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# ENHANCEMENT OF WHEAT YIELD AND YIELD COMPONENTS BY CONTROLLING WEEDS WITH DEEP TILLAGE PRACTICES UNDER IRRIGATED CLAY LOAM SOIL CONDITIONS

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## ABSTRACT

*Experiments were conducted to enhance wheat yield and yield components by controlling weeds with deep tillage treatments under clay loam soil condition at NWFP Agricultural University Research Farm, during 1996-7 to 1998-99. The experiments were laid down in randomized complete block design (RCBD). Tillage practices were comprised of seven treatments; 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 ($D_1C_2$). Each treatment was replicated replicated 6 times. In the deep tillage treatments ($M_1R_1$), wheat yield was increased by 7% as compared to shallow tillage treatment ($C_2$). The deep tillage treatment ($M_1R_1$) appeared to have effectively controlled weeds hence, more soil moisture and nutrients were available for crop growth which ultimately led to higher wheat yield.*

**Key words:** Deep tillage, rotavator, cultivator, moldboard plough, weed control, *Triiticum aestivum*.

## INTRODUCTION

Wheat is a major staple food item in Pakistan in general and in NWFP in particular. Every effort is being made to meet the wheat requirements of the country as well as in NWFP. Wheat was grown on an area of 0.74 million ha in both irrigated and rainfed area of NWFP with a total production of 1.03 million tons with an average yield of 1382 kg $ha^{-1}$ during 2002 – 2003. Area under irrigated wheat was 0.32 million ha with a production 0.60 million tons and an average yield of 1906 kg $ha^{-1}$ (Agric. Stat. of Pak., 2003 -2004). The yield obtained from wheat in the developing countries is much lower as compared to developed countries. In Pakistan, the yield potential cannot be achieved due to many constraints, which include poor quality seed, imbalance or no use of fertilizer, poor tillage operations, inadequate weed control, small land holding and lack of modern technology. Hobbs *et al.* (1986) reported that 44% grain and 20% straw yield of wheat was increased when deep tillage with moldboard plow as compared to shallow tillage was practiced on silty clay soil. Majid *et al.* (1987) compared the

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effect of five tillage implements and recorded 28% more yield with moldboard plow than conventional method of land preparation in sandy loam soil. Khan and Duck, 1987, Maurya (1988) and Khan *et al.*,(1990) reported a heavy annual loss from weeds due to reduction in the quality and quantity of the produce.

Weed control is essential because weed compete with the crop for water, nutrients, and light. The control of weeds without the use of chemical herbicides is an essential component of successful organic farming. The produce from the organic farms can fetch a double price in developed countries. Tillage alone or in combination with cropping pattern often is the most economical method for weed control. No doubt, the herbicides are more effective method to manage weeds, however, it is more expensive due to high cost (Charles *et al* ., 2004).

Hussain *et al.* (1985) reported that the use of cultivator (3-6 times) for weed control is not an economical practice. Whereas Zenter *et al.* reported that relatively poor economic performance of conservation tillage practices reflects 13% higher cost for weed management by using herbicides than the conventional tillage on silty loam and clayey soils.

The control of weeds without the use of chemical herbicides and manual control of weeds as integrated with adequate tillage practices is an essential component of successful organic farming. The selection of suitable tillage practices for maintaining good tilth is the objective of this study. Although, to establish the relationship between a good tilth and weed management is difficult, yet the role of tillage in crop production is very clear. However, very little is known about the enhancement of wheat yield with controlling weeds by tillage practices. Therefore, a three year research study was conducted to compare the effectiveness of various tillage implements combination on controlling of weeds and its effect on yield and yield components of wheat crop.

## MATERIALS AND METHODS

A research study was conducted at Malkandher Research Farm, NWFP Agricultural University Research Farm, Peshawar, during 1996-7 -1998-9, to compare the performance of various tillage treatments on yield and yield components of wheat. The tillage implements included moldboard plow, disk plow, cultivator, disk harrow and rotavator. The experiment was set up in randomized complete block design with six replications. Treatment combinations used were: Cultivator two times ($C_2$), Cultivator four times ($C_4$), Cultivator six times ($C_6$) (conventional method of land preparation), Moldboard plow and rotavator once ($M_1R_1$) (progressive farmers), 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 ($D_1C_2$). These tillage treatments were used for soil tilth before sowing of wheat crop. Every year wheat cv. Bakhtawar was sown during the 1st week of November. Recommended doses of fertilizers (Urea 125 kg/ha and DAP 125 kg/ha), irrigation and other inputs were applied uniformly to all the treatments. The plot size for individual treatment was kept at 90 x 9 $m^2$, and the total experimental area was 3.78 hectares. Data were recorded on weed density $m^{-2}$, spike weight (g), number of grains $spike^{-1}$, grain weight $spike^{-1}$, 1000 grain weight (g), and straw and grain yield (kg $ha^{-1}$). The data for the individual parameters were subjected to the appropriate statistical analyses (Steel and Torrie, 1980).

## RESULTS AND DISCUSSIONS

### Weed density ($m^{-2}$)

Average number of weeds before tillage were 242 $m^{-2}$, while the density of weeds after tillage practices was variable are shown significantly as presented in Table-1. The least number of weeds (112 $m^{-2}$) were observed in deep tillage (moldboard plow and rotavator once, $M_1R_1$), while the highest number of weeds (126 $m^{-2}$) were recorded in shallow tillage (cultivator 2 times, $C_2$). It seems that deep tillage treatments effectively lowered the weed density (6% lesser), as compared to the shallow tillage treatments. Hussain and Munir (1986), Khan et al. (1986) and Khan et al. (1990) also reported that deep tillage was the most suitable practice to control weeds and increase wheat yield as compared to the shallow tillage. Our results are also in the close conformity with that of Conns (1987) who reported that deep tillage had a significant effect on controlling grassy and broadleaf weeds as compared to shallow tillage. The use of tillage in managing weeds is an economical and environment friendly when integrated with the manual control of weeds.

**Table-1. Effect of various tillage treatments on number of weeds during wheat growing seasons 1996 - 99.**

| Treatments | Number of weeds $m^{-2}$ | | | | |
|---|---|---|---|---|---|
| | Before tillage practices | 1996 - 97 | 1997 – 98 | 1998 - 99 | Means |
| $C_2$ | 242 | 149 | 110 | 119 | 126 a |
| $C_4$ | 242 | 140 | 106 | 114 | 120 ab |
| $C_6$ | 242 | 145 | 111 | 121 | 122 ab |
| $M_1R_1$ | 242 | 122 | 95 | 121 | 113 b |
| $M_1H_1$ | 242 | 129 | 102 | 117 | 116 ab |
| $M_1H_2$ | 242 | 135 | 104 | 116 | 118 ab |
| $D_1C_2$ | 242 | 133 | 102 | 120 | 118 ab |
| $LSD_{0.05}$ | | | | | 11.13 |

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

### Wheat yield components

Data on spike and straw weight were non-significant statistically among the various tillage treatments, while the data on number of grains per spike, grain weight per spike and 1000 grain weight showed significant differences (Table-2). The average number of grains ranged from 43 - 51 per spike. The highest (51) number of grains per spike were found in $M_1R_1$ and the lowest (43) grains per spike were observed in $C_2$. Similarly, highest grain weight per spike of 2.1 g was also found in $M_1R_1$ and the lowest grain weight per spike of 1.9 g was observed in $C_4$ and $C_2$ (Table-2). Mean values for 1000 grain weight ranged from 38 – 41 g as

shown in Table-2. The heaviest 1000 grain weight of 41 g was obtained in $M_1R_1$ and the lowest 1000 grain weight (38 g) in $C_4$. These results are in conformity with Majid *et al.*, (1987) and Rehman *et al.*, (1995) who reported more number of grains per spike, grain weight per spike and 1000 grain weight in the treatments to which deep tillage was applied.

**Table-2. Effect of various tillage treatments on the spike weight, number of grains per spike, grain weight per spike, 1000 grain weight and straw weight of wheat.**

| Treatments | Spike weight, (g) | Straw weight, (g) | Number of grains /spike | Grains weight/ spike, (g) | 1000 grains weight, (g) |
|---|---|---|---|---|---|
| $C_2$ | 2.3 | 0.39 | 43 c | 1.9 b | 37.8 bc |
| $C_2$ | 2.2 | 0.31 | 45 bc | 1.9 b | 37.5 c |
| $C_2$ | 2.2 | 0.32 | 45 bc | 1.9 b | 38.0 bc |
| $M_1R_1$ | 2.5 | 0.37 | 51 a | 2.1 a | 40.9 a |
| $M_1H_1$ | 2.3 | 0.38 | 48 ab | 1.9 b | 39.6 ab |
| $M_1H_2$ | 2.4 | 0.37 | 48 ab | 2.0 ab | 39.4 ab |
| $D_1C_2$ | 2.3 | 0.37 | 47 abc | 2.0 ab | 39.1 bc |
| LSD: | | | 4.69 | 0.12 | 1.86 |

Means with the same letter (s) are not significantly different by LSD test at 0.05 level of probability

**Wheat grain yield**

Mean value for various tillage treatments revealed that the highest grain yield of 4422 kg ha$^{-1}$ was recorded in $M_1R_1$ and lowest 3806 kg ha$^{-1}$ grain yield in $C_2$ (Fig.-1). Deep tillage was effective in loosening the sub-surface plow pan and resulted in better grain weight and maximum grain yield (7% more) as compared to shallow tillage treatments. These results are supported by Khan *et al* (1986), who reported that primary tillage with the moldboard plow gave significantly higher grain yields per hectare. Similar results were also found by Khan *et al* (1990) who observed that deep tillage by moldboard plow gave higher wheat yields ranging from 15 - 52% with an average yield increase of 25% over the cultivator. Jankee *et al* (1991) also reported an increase in wheat grain yield to the extent of 41% by deep tillage practices in NWFP and Balochistan. Maurya (1986), reported that wheat yield, was significantly higher in the tilled plots as compared to no-tilled plots. Majid *et al* (1987) recorded that highest grain yield of 5.58 t ha$^{-1}$ in moldboard plow plots with 28% yield increase over the conventionally prepared plots. Similar results were also reported by Rehman *et al* (1995) who observed the highest grain yield of 4470 kg ha$^{-1}$ in moldboard plow plus disk harrow as compared to the cultivator (3680 kg ha$^{-1}$). It is concluded that deep tillage effectively decreased the weed infestation, which ultimately provided a conducive environment for the vegetative and reproductive growth of wheat crop.

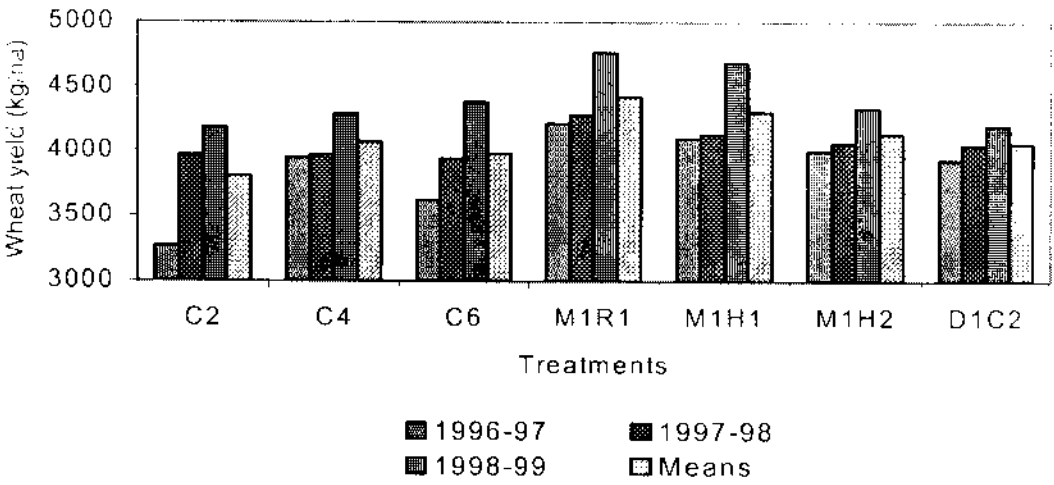


**Fig.-1. Effect of various tillage treatments on grain yield during wheat growing seasons 1996-7 to 1998- 9.**

## CONCLUSIONS

It is concluded that tillage treatments significantly affected yield components and yield of wheat. On average, field prepared by moldboard plow and rotavator once ($M_1R_1$) gave 7% higher yield as compared to shallow tillage treatments through better management of weeds. For maximum wheat yield, soil should be tilled with deep tillage treatment (Moldboard plow and rotavator once) under irrigated clay loam soil conditions.

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