

AGRO-ECONOMIC IMPACT OF DIFFERENT WEED CONTROL STRATEGIES IN WHEAT

Muhammad Bismillah Khan*, Muhammad Asif , Nazim Hussain and Muhammad Iqbal

Department of Agronomy, University College of Agriculture, Bahauddin Zakariya University, Multan

Abstract: This experiment was designed to study the impact of weed control methods on the productivity of wheat. Various weed control practices significantly affected the fertile tillers m^{-2} , grains spike $^{-1}$, grain yield (t ha^{-1}) and economic returns in wheat. Mechanical harrowing produced significantly maximum grain yield (2.8 t ha^{-1}). Hand hoeing and mechanical harrowing increased the 1000-grain weight significantly over control. Mechanical harrowing gave the maximum net returns (Rs. 7200 ha^{-1}) over control (Rs. 1060 ha^{-1}) where no weed control practice was adopted.

Keywords: Wheat; Hand hoeing; Mechanical harrowing; Yield and yield components; Economic analysis.

INTRODUCTION

Population of the world is increasing at an alarming rate. According to an estimate, it will become 8.2 billion by the year 2025¹. Feeding such fastly growing population is becoming a big problem. Wheat (*Triticum aestivum* L.) is the most important among food cereals in Pakistan. Due to dwindling land resources, the horizontal increase in productivity is becoming difficult day by day. In these circumstances, the only way to have more production is vertical i.e. increase per unit of land area. In Pakistan, wheat is grown on an area of 8355 thousand hectares with total production of 18694 thousand tons, making an average yield of 2238 kg ha^{-1} which is very low as compared to some other wheat producing countries such as 2578, 2907 and 3667 kg ha^{-1} in India, USA and China, respectively².

There are many factors responsible for low yield. One of the major causes of low yield is weed infestation. Weed competition in wheat crop has been reported to decrease yield by 42 % and 56% during 1994-95 and 1995-96, respectively³. However, Pandey⁴ reported a non-significant effect of different weed control methods on germination count per unit area in wheat. Tariful⁵ observed an increase in grain and straw yields, effective tillers plant $^{-1}$, panicle length and filled grains panicle $^{-1}$ of wheat by different weed control methods compared

with weedy check. Mechanical harrowing with spring tine weeder has been found to reduce effectively the weed dry weight compared with an unweeded control by Tillet⁶. Choubey⁷ reported a reduction in weed population and weed dry weight by hand weeding. Hand weeding has been reported to decrease the weed population m^{-2} of *Avena fatua* by 79.4% as compared to weedy check⁸. Mechanical weeding has been found to give the average yield of 3982 kg ha^{-1} as compared to 2809 kg ha^{-1} by no tillage practice⁹.

The present study was conducted to evaluate the harmful effects of weeds on wheat grain yield and to compare two different weed control methods (manual and mechanical).

MATERIAL AND METHODS

The study was conducted at the Experimental Farm, University College of Agriculture, Multan during 1998-99. The experiment was laid out in a randomized complete block design with four replications and having a net plot size of 5.0m x 2.25 m. Three treatments namely control, hand hoeing and mechanical harrowing were tested on wheat variety Parwaz-94. The crop was sown on a well-prepared moist seedbed with a single row hand drill in 22.50 cm apart rows using a seed rate of 150 kg ha^{-1} . A constant dose of NPK at the rate of 150:100:50 kg ha^{-1} was applied to all the treatments.

* Author to receive correspondence

Full dose of P_2O_5 and K_2O and one third of nitrogen was applied as a basal dose while remaining nitrogen was applied before first and second irrigation in two equal splits. In manual weed control, hoeing was done with kasola after first and second irrigation. In mechanical weed control, a manually operated bar harrow was used after first and second irrigation in criss-cross direction. All other agronomic practices were kept normal and uniform for all the treatments. Standard procedures were followed for recording data in various growth and yield parameters of wheat. Weed population was recorded randomly from three different locations from an area of 1.0 m^2 from each plot after the application of treatments. Weeds were cut from soil surface randomly from three different locations each having an area of 1.0 m^2 , dried in the sun for four days, weighed and averaged to record the air-dry weight of weeds. Economic analysis was carried out on the basis of cost of production using prevailing market prices. Data were analysed statistically using Fisher's analysis of variance technique and least significant difference test at 0.05 probability level was employed to compare the differences among the treatments means¹⁰.

RESULTS AND DISCUSSION

Major weed species recorded were *Phalaris minor*, *Avena fatua*, *Cyperus rotundus*, *Anagallis arvensis* and *Chenopodium album*.

Weed population was significantly reduced by different weed control methods over control (Table 1). Mechanical harrowing and hand hoeing gave 84.68 % & 65.55% decrease in weed population over control, respectively. Choubey⁷ also reported suppression in weed population due to weed control.

Dry weight of weeds (g) was affected significantly by different weed control methods (Table 1). Mechanical weed control produced significantly the lowest weed dry weight (4.15 g), followed by manual hand hoeing with 7.96 (g). Reduced dry weight of weeds by the application of manual and mechanical methods of weed control have also been reported by Choubey⁷ and Tillet⁶. Weed control treatments had no effect on germination count (Table 2). Non-significant effect

of different weed control methods on germination count has also been reported by Pandey⁴.

Number of fertile tillers m^{-2} and grains spike⁻¹ increased significantly in different weed control treatments over control (Table 2). Mechanical harrowing produced significantly the highest number of fertile tillers m^{-2} (297.7) and number of grains spike⁻¹ (36.1). Control gave the lowest number of fertile tillers m^{-2} (197.7). Mechanical harrowing effectively reduced the weed population, which resulted in efficient utilization of available resources by the crop and ultimately produced the maximum number of grains spike⁻¹. Control gave the lowest number of grains spike⁻¹ (28.3). These results are in line with those of Tariful⁵.

Both manual and mechanical weed control methods increased the 1000-grain weight significantly over control (Table 2). Mechanical harrowing significantly produced the maximum 1000-grain weight (30.78 g) but it was statistically at par with manual hand hoeing with 1000-grain weight of 29.60 g. It is argued that both manual and mechanical methods of weed control effectively reduced the weed population which led to better utilization of available resources during photosynthesis and resulted in storage of maximum amount of photosynthates in grains, thus giving maximum 1000-grain weight. Control gave the lowest 1000-grain weight (27.12 g).

Weed control exerted a positive influence on grain yield of wheat (Table 2). Mechanical harrowing produced significantly the maximum grain yield (2.8 t ha^{-1}) as against the minimum (1.7 t ha^{-1}) recorded in control. Mechanical harrowing produced significantly the maximum number of fertile tillers m^{-2} , number of grains spike⁻¹, 1000-grain weight (g) and ultimately resulted into maximum grain yield per unit area. Significant effect of mechanical harrowing on grain yield of wheat has also been reported by Barberi⁹.

Different weed control methods varied significantly as regards the net returns (Table 1). Mechanical harrowing gave the maximum net returns (7200 Rs. ha^{-1}), followed by hand hoeing (3100 Rs. ha^{-1}). Control produced the lowest net returns (1060 Rs. ha^{-1}). Better control of weeds in mechanical method resulted in maximum number of fertile tillers m^{-2} , number of grains spike⁻¹,

1000- grain weight, grain yield and hence maximum net returns.

Table 1. Weed growth in different weed control strategies in wheat crop

Treatments	Weed density m ⁻²	Weed dry weight g m ⁻²
Control	52.2 c	25.5 c
Hand hoeing	18.0 b	8.0 b
Mechanical harrowing	8.0 a	4.1 a
LSD	9.4	2.38

Table 2. Agro-economic impact of different weed control strategies in wheat.

Treatments	Germination counts m ⁻²	Number of fertile tillers m ⁻²	Number of grains spike ⁻¹	1000-grain weight (g)	Grain yield (t ha ⁻¹)	Net returns (Rs.ha ⁻¹)
Control	205.7 NS	197.7 c	28.3 c	27.1 b	1.7 c	1060
Hand hoeing	206.0	247.5 b	32.5 b	29.6 a	2.2 b	3100
Mechanical harrowing	204.2	297.7 a	36.1 a	30.8 a	2.8 a	7200
LSD		26.2	2.2	1.94	0.27	

* Means sharing same letters are statistically non-significant at 5% probability level; NS= Non-significant

CONCLUSION

Mechanical weed control may be preferred as it

produced maximum grain yield and net returns compared with hand hoeing

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