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**EFFECTS OF TILLAGE METHODS
ON BARLEY YIELDS¹**

A.H. Hakimi and S.M. Chakrabarti²

ABSTRACT

An experiment was conducted to investigate different tillage methods for barley seedbed preparation using mouldboard plow, disk plow and field cultivator at three depths of cultivation (5, 15, and 25 cm). The feasibility of a no-tillage method was also studied.

Results strongly favored the combination of the field cultivator and disking over any other implement used, since it produced the highest yield. The no-tillage method resulted in the lowest yield. In addition, with increased depths of cultivation the yield of barley was significantly decreased.

INTRODUCTION

With the advent of new tillage machinery, an effort has been made to adopt tillage systems to meet the needs of crop, soil and climatic conditions present on any one farm. Because tillage operations represent a large proportion of the machine costs, considerable effort has been directed towards reducing tillage (1,2,5,8). However, the success of this method depends on a number of soil, climatic and cultural requirements (7). The productive potential of such a method under particular local conditions remains to be investigated.

Tillage requirements for crop production vary not only from crop to crop but also

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1. Contribution from Department of Farm Machinery, College of Agriculture, Pahlavi University, Shiraz, Iran.
 2. Associate Professor and Assistant Professor of Farm Machinery, respectively.

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with differences in soil moisture conditions. Numerous studies (3,4,6,7,9) have been reported on the effects of tillage practices on the growth and yield of corn. Little information, however, is available on the effects of tillage methods on barley yield. The objectives of this study were to evaluate the effects of five tillage treatments, ranging from conventional tillage to no-tillage, on the yield of barley and to determine the most suitable method of seedbed preparation for barley production.

MATERIALS AND METHODS

The field experiment was conducted during 1973 and 1974 on a calcareous silty clay soil (pH = 7.6 and bulk density = 1.22 gm/cm³ within 15cm depth) at the Kooshkak Agriculture Experiment Station located 80 km North West of Shiraz. The soil is classified as an aridosol with good drainage and a slope of 0.2 to 0.3%. Total N, P, and K in the soil were 0.16%, 15 ppm and 350 ppm, respectively. Ground water table fluctuated in the range of 120 to 200 cm.

Wheat was grown in the test field in 1970. Following harvesting, the land was plowed and levelled and the field was left fallow for the next two years. Experimental plots of 8.5 x 4m were selected and the experiment was conducted in a randomized block design with four replications. The tillage methods were: mouldboard plowing and disking (T₁), disking (T₂), field cultivator (T₃), field cultivator and disking (T₄), and no-tillage (T₅). Three depths of cultivation, 5, 15, and 25 cm, were used. A six-row barley variety (Zarjo) was planted on September 6, 1973 with a row spacing of 20 cm and a rate of planting of 120 kg/ha. Fertilizer at the rates of 150 kg/ha ammonium phosphate and 50 kg/ha urea was applied at the time of planting. An additional 50 kg/ha of urea was applied broadcast following planting and irrigation.

Since soil moisture stress was significant during the germination period, two emergency irrigations were made, one immediately after planting and another on November 15, 1973. No irrigation was required during the rainy season (January-April). The total rainfall during this period was 218.5 mm. To ensure proper maturity of the crop, three further irrigations were applied on May 3, 14 and 24. The crop was hand harvested from each plot on June 25, 1974 and grain was air dried for yield determinations.

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RESULTS AND DISCUSSION

The effects of tillage treatments on barley grain yield are summarized in Table 1 where it can be seen that tillage methods produced wide variation in yield. The statistical analysis of the data indicated that the only significant difference in yield was the result of tillage with field cultivator and disk (T_4) as compared to disk plowing (T_2). The data indicated no significant difference in yield among treatments T_1 , T_2 , and T_3 . Several factors could have caused the higher yield in T_4 . The most likely explanation is better infiltration of water into the soil and more extensive root growth in T_4 treatment, as compared to other treatments (T_5). The lowest yield occurred under the no-tillage treatment. Since no herbicide was used in the experiment, considerable weed growth in T_5 plots caused slow emergence of the crop and poor stands, with an average yield of 1.76 tons/ha as compared to the highest yield of 3.24 tons/ha under treatment T_4 . Thus, the no-tillage method was not feasible under the conditions which prevailed in the experiment. Since treatment T_1 is the conventional method of seedbed preparation, from the experimental data it appears that optimum tillage requirement for barley can be fulfilled with less expensive field cultivator (T_3).

The influence of depth of cultivation on the yield is also summarized in Table 1. In general, increased depths of plowing or cultivation reduced the yield. The statistical analysis of the data indicated no significant yield difference between depths of cultivation of 15 cm and 25 cm, and between 5 cm and 15 cm. However, barley yield for depth of cultivation of 5 cm was significantly higher than that of 25 cm. This may be attributed to better conservation of sub-surface moisture which resulted in more extensive root development under 5 cm depth, as compared to other depths of cultivation. Thus, it implies that increasing the depth of cultivation beyond the minimum need for seedbed preparation did not improve yield. Since increased depths markedly increase tillage costs, a careful consideration of cost/benefit relationships is recommended.

LITERATURE CITED

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Table 1. Effect of various tillage methods and depths on barley yield, tons/ha.

Tillage treatments	Plowing depth			Mean
	5 cm	15 cm	25 cm	
Mouldboard Ploughing + disking (T ₁)	3.09	2.72	2.64	2.82ab*
Desking (T ₂)	3.03	2.50	2.48	2.67b
Field cultivator (T ₃)	3.54	2.86	2.73	3.04ab
Field cultivator + disking (T ₄)	3.34	3.33	3.05	3.24a
No-tillage (T ₅)	—	—	—	1.76**
Mean	3.25b	2.85ab	2.73a	

* Means followed by same letter are not significantly different at 5% level of probability (Duncan's test).

** No-tillage treatment was not considered in statistical analysis because the effect of depth was absent.

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