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COMPARATIVE PERFORMANCE OF DIRECT DRILLING AND CONVENTIONAL TILLAGE PRACTICES UNDER RICE-WHEAT ROTATION SYSTEM

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A field study was conducted to compare zero tillage sowing technique with the conventional sowing techniques. In zero tillage method wheat was sown directly in rice harvested plots, whereas in conventional tillage method, plots were prepared by 3 times and 6 times ploughing followed by planking. The difference of grain and straw yields was slightly higher in conventional tillage but was found statistically non-significant with zero tillage. Higher moisture retention and 13% higher income were calculated in case of zero tillage.

INTRODUCTION

No till, no tillage, zero tillage, or direct drilling describes drilling the seed directly into the such untilled ground where the weeds may have been presprayed to reduce competition, thus substituting chemical energy for mechanical energy hitherto widely used for tillage operations.

Stand establishment of crops by zero tillage is a function of efficiency of seed germination and seedling emergence and their interrelationship with the physical, chemical and biological micro-environment created in the soil by zero tillage techniques (Chaudhry, 1983).

Technique of direct drilling has been claimed to offer many advantages over conventional tillage. These include: increased trafficability; reduced soil erosion due to wind and water (Lal, 1978); improved moisture retention capacity (Lal, 1976); decreased water evaporation and increased infiltration into the soil (Triplett *et al.,* 1968); increased yield (Doren, 1964), reduced investment in farm power and equipment due to reduced energy requirement (Braunholtz, 1977); and improved timing of planting and harvesting operations (Gard and McKibben, 1973) and increased profit per hectare (Young, 1973). Larson (1970) observed that on crusting silt loamy soil the yields from no tillage with complete mulch cover were greater than from the ploughed plots.

Since little iaformation is available regarding effects of no till practices for growing wheat under rice-wheat rotation system, therefore, a demonstrational field study was carried out with the objective of determining comparative performance of direct drilling (no till) and conventional tillage practices to grow wheat under rice-wheat rotation system.

METHODOLOGY

A field study was carried out in the Water Management Research Project area, Shahkot, University of Agriculture, Faisal-

abad. Nine plots of 6 m X 64 m size were used for the comparison of zero tillage with two levels of conventional tillage (i.e. 3 and 6 ploughings). An improved wheat variety LV 26S was Sown with the help of an automatic rabi drill (Sccdamatic) both in zero and conventional tillage treatment plots. In zero tillage plot's soil was not disturbed after rice harvesting, while in conventional tillage treatment, plots were ploughed 3 and 6 times followed by plan king. All other management and agronomic practices were kept the same and carried out under farmer conditions.

Water use at first irrigation and moisture retention during the different growth periods and final grain yield were used to observe the effect of different sowing techniques. Cost analysis was also made on net benefit. The statistical analysis was applied to find the significance of different techniques.

RESULTS AN D DISCUSSION

Effect on grain yield: The grain yield as affected by different numbers of ploughing treatments is presented in Table 1, which indicates the comparative yield performance under zero tillage and conventional method of sowing under rice-wheat rotation system. The yield of 2.93 t ha! at zero tillage was 8% lesser compared to that of (conventional) 3 and 6 ploughings. These findings agreed with those of Doren (1964).

While the yield of straw was higher by 16% in 3 ploughings and 17% in 6 ploughings with conventional tillage system. However, the overall yield was depressed due to logging of the crop by heavy wind and rain during mid-growing season, but there was no significant difference among different sowing techniques.

From the wheat brain/straw yield data it can be concluded that yield performance of zero tillage and conventional method was almost similar. Less yield in zero tillage may be due to the fact that the direct drill crop may require more nitrogenous fertilizer to attain its maximum yield (Bakerman and deWit, 1970).

Table 1. Effects of no till and conventional tillage practices on grain and straw yield

Treatment	Grains (t ha-I)	Straw (t ha-I)
Zero tillage	2.93	4.64
3 ploughings	3.17	5,38
6 ploughings	3.17	5,43

Water use and soil moisture retention: The seeds were Sown directly after rice harvest in undisturbed soil with rice crop residual moisture, while in convcntionaltillage, fields were ploughed accordingly. At the first irrigation given 27 days after sowing, the irrigation water provided for each technique was measured with the cut-throat flume and depth of applied irrigation water was calculated by the formula Ot = 28 ad.

where

O = discharge in lit./sec; t = time in hr; a = area in ha; and d = depth of irrigation in cm.

It was clearly observed that the zero tillage plot at first irrigation required less time to fill the field, hence less irrigation water was consumed as compared to conventional tillage. It amounted to 3.52, 4.17 and 4.54 cm respectivcly in zero, 3 and 6 ploughing techniques. The 6-ploughing technique used 29% more water than zero

tillage at first irrigation In the absence of 'Rauni' irrigation.

cm depth with the interval of 10 cm. The moisture contents were determined by

Table 2. Net return and lield operatlou cost

Cosl ha·l (Rs.)	Zero tillage	3 ploughings	6 ploughings
Rent ha'! /crop	1200	1200	1200
Fertilizer and seed	1694	1694	1694
Land preparation	-	441	735
Sowing	147	147	147
Weeding	773	1740	1740
Harvesting/threshing	620	620	620
Tolal cost Rs. ha'!	4434	5842	6136
Grain yield Rs. ha'!	8204	8876	8876
Straw yield Rs, ha·l	2076	2427	2444
Net income Rs. ha·l	5840	5461	5184
Cost benefit ratio	1:2.31	1:1.93	1:1.84

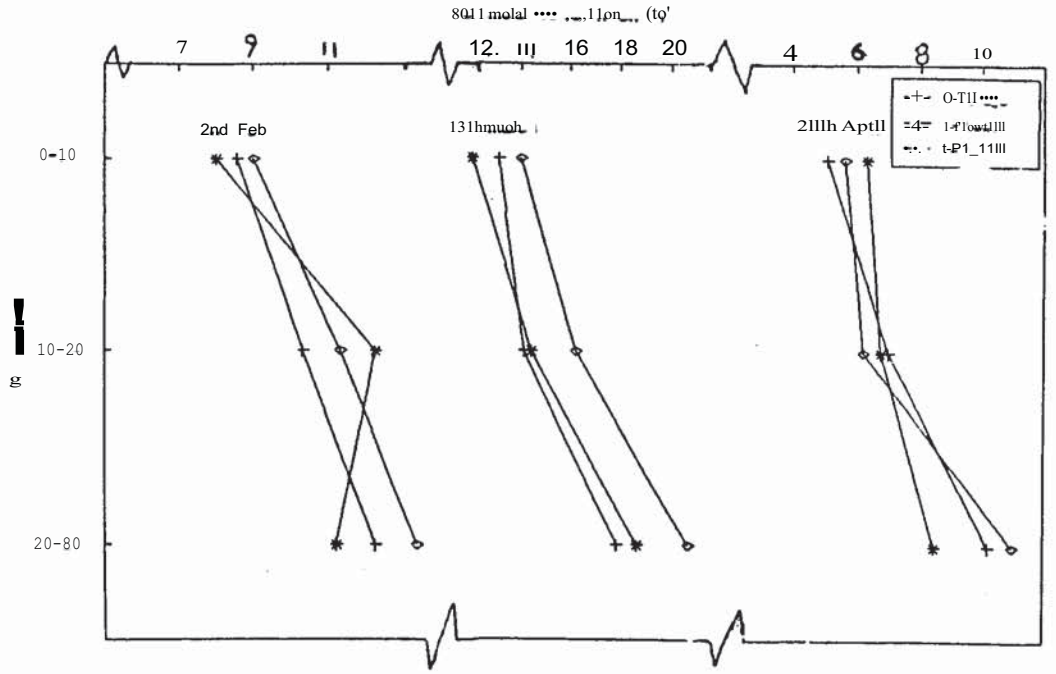

Fig. 1. Effect of different ploughing techniques on soil moisture retention.

The soil moisture retention was also measured al diffcrenl growth stages up to 30

gravimetric method and observed high moisture holding capacity in case of zero

tillage plots as shown in Fig. 1. Lal (1976) found increased soil moisture to 30 cm depth, while Blevins *et al.* (1971) to 60 cm.

Economic analysis: Total cost ha^{-1} for wheat crop for different tillage systems varied in terms of additional cost on ploughing and weeding. Ploughing operation cost with 3 and 6 ploughings was higher by Rs. 441 and Rs. 735 than with zero tillage sowing technique, whereas the overall difference in total cost was only 32% higher with 3 ploughings and 38% higher with 6 ploughings.

Net income was higher with zero tillage sowing technique by 7% and 13% than with 3 and 6 ploughing techniques. The cost benefit ratio of zero tillage has been determined as 1:2.31, as compared to conventional 3 and 6 ploughings method which has cost benefit ratio as 1:1.93 and 1:1.84 respectively. It suggests that the zero tillage technique under rice-wheat rotation system is beneficial in terms of net return and field operation costs (Table 2).

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