

Effect of tillage and weed management options on productivity and profitability of cotton - wheat system

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ABSTRACT

Three tillage options (zero, rotary and conventional tillage) and three weed management practices (metribuzin, sulfasulfuron and control) were evaluated under raised and flat bed planting systems at research farm of DWR Karnal. The seed cotton yield was at par under FIRB and flat bed planting systems. The Seed cotton yield was also at par among three tillage options i.e. Zero, rotary and conventional. Zero and rotary tillage practices save diesel and labour cost and more important time for field preparation. The wheat yield was similar in both the planting systems. The yield was numerically lower under zero tillage compared to rotary and conventional practice. The wheat yield was very poor in without herbicide plots due to more no. of weeds infestation whereas the yield was similar under both the herbicides. All the three tillage options (zero, rotary and conventional) were at par in profitability under FIRB system whereas under flat bed system, the highest profit was recorded for cotton-wheat system under rotary tillage followed by zero and conventional practice. The total cost of production was more in case of conventional sowing due to more no. of tractor operations for field preparation. Zero and rotary tillage is found to be beneficial for cotton sowing after wheat harvest which will reduce the cost of production without an adverse effect on seed cotton yield. Rotary tillage is superior to zero and conventional tillage for wheat sowing after cotton. Overall, the profitability of cotton-wheat system was higher under flat bed compared to raised bed and in rotary tillage compared to zero and conventional.

Key words: Tillage options, Weed management, Cotton -wheat system.

INTRODUCTION

Cotton-wheat system is the main cropping system after rice-wheat which occupies an area of 2.5 m ha in the Indo-Gangetic plains of India There are reports of yield stagnation and decline in soil productivity due to continuous adoption of exhaustive crops. These two crops took whole year to mature and even overlapping one maturity time to another sowing time, delaying the sowing of both crops but more delayed was noticed in case of wheat sowing due to late maturity of cotton. Therefore, a need was felt to evaluate different planting methods for cotton and wheat for their best performance under raised and flat bed conditions. There is shortage of time for wheat sowing under cotton-wheat system just like rice-wheat system as the cotton crop matures up to last week of November. The cotton crop is also sown just after wheat harvesting. Sowing of wheat or cotton by Zero and Rotary tillage where one tractor operation is required can save time and reduce cost of cultivation that ultimately increase net profit. So, the main objective behind this investigation was to evaluate productivity and profitability of cotton-wheat system under different tillage and weed management options.

MATERIALS AND METHODS

A field experiment was conducted at research farm of Directorate of Wheat Research, Karnal for three years, 2000-01 to 2002-03. The experimental soil was loam in texture (56 % sand, 30% silt and 14% clay), low in organic C (0.37%) and available N (139 kg/ha), medium in available P (17.6 kg/ha) and low in K (131 kg/ha) content. Three tillage options (zero, rotary and conventional tillage) and three weed management practices (metribuzin,

sulfasulfuron and control) were evaluated under raised and flat bed planting systems. The experiment was conducted in a split plot design with three replications. The fertilizers and other inputs were applied to different crops as per recommended practice. Irrigation was applied on the basis of critical physiological stages of different crops. Recommended pesticide spray schedule was adopted. The profitability and cost of production of the system was calculated on prevailing market price of produce and inputs.

RESULTS AND DISCUSSION

The seed cotton yield was at par under FIRB and flat bed planting systems (Table 1). On an average, the seed cotton yield was 20.67 and 21.64 q/ha in raised bed and flat sowing of cotton, respectively. The Seed cotton yield was also at par among three tillage options i.e. Zero, rotary and conventional. The mean seed cotton yield was 21.4, 21.6, 20.6 q/ha under zero, rotary and conventional practice of cotton sowing, respectively. Zero and rotary tillage practices save diesel and labour cost and more important time for field preparation.

The wheat yield was similar in both the planting systems. Raised bed and flat sowing produced 43.0 and 42.3 q/ha, respectively. The yield was slightly lower under zero tillage compared to rotary and conventional practice (Table 2). On an average, the rotary tillage produced highest wheat yield (43.9 q/ha) followed by conventional (42.9q/ha) and zero (42.6 q/ha). The wheat yield was very poor in without herbicide plots (35.3 q/ha) due to more no. of weeds infestation whereas the yield was similar under both the herbicides. Although under raised bed system without herbicide plot also produce similar to herbicide plot because the weed population were in the furrows and the competition

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Table 1: Seed cotton yield (q/ha) as affected by planting methods and tillage options

Planting method/ varieties	2001-02	2002-03	Mean
FIRBS/raised beds	22.92	18.42	20.67
Flat bed	24.33	18.99	21.64
Mean	23.6	18.7	21.1
CD (0.05)	NS	NS	
Zero	23.7	19.0	21.4
Rotary	24.3	19.0	21.6
Conventional	22.9	18.2	20.6
Mean	23.6	18.7	21.2
CD (0.05)	NS	NS	

Table 2 : Wheat yield (q/ha) as affected by planting methods and tillage options

Planting method	2000-01	2001-02	2002-03	Mean
FIRBS/raised beds	50.6	38.6	39.7	43.0
Flat bed	49.6	37.4	39.9	42.3
Mean	50.1	38.0	38.6	42.6
CD (0.05)	NS	NS	NS	
Zero	49.4	35.2	38.6	41.1
Rotary	51.0	40.0	40.8	43.9
Conventional	49.8	38.9	40.0	42.9
Mean	50.1	38.0	39.8	42.6
CD (0.05)	NS	1.89	1.37	
Sulfasulfuron	50.6	43.0	48.8	47.5
Metribuzin	51.5	42.0	43.1	45.5
Control	48.2	30.7	27.1	35.3
Mean	50.1	38.5	39.7	42.8
CD (0.05)	NS	2.05	2.57	

Table 3: Net Return of cotton- wheat system as affected by tillage options (Average of 3 years)

Planting method	Cotton				Wheat				Net Return C+W
	Total cost	Yield, q/ha	Total Return	Profit	Total cost	Yield, q/ha	Total Return	Profit	
FIRBS/raised beds	27220	20.7	34296	7073	17337	42.9	21475	9978	17051
Flat bed	28391	21.6	36101	7710	17583	42.6	21648	10667	18377
Mean	27805	21.1	35198	7392	17460	42.7	21561	1032	17714
Zero	28050	21.3	35015	6965	16975	41.1	21611	10240	17205
Rotary	28395	21.6	35690	7295	17075	43.9	22519	11270	18565
Conventional	29006	21.2	34911	5905	18325	42.9	20704	9459	15364
Mean	28484	21.4	35205	6722	17458	42.6	21611	10323	17045

was less with the main crop. Constable et al (1992) reported that tillage with soil disturbance decreased soil nitrate, increased soil bulk density and reduced root growth. Soil preparation under wet conditions compacted the soil under SD. Apparent recovery of applied N was highest with minimum tillage and concluded that MT is a viable option for soil preparation on this soil type, particularly under wet conditions. Raper et al (1994) experimented in a sandy loam and reported that strip-till treatment decreased cone index directly beneath the row, decreased surface bulk density, increased surface moisture content, decreased energy usage, and increased yields.

All the three tillage options (zero, rotary and conventional) were at par in profitability under FIRB system whereas under flat bed system, the highest profit was recorded for cotton-wheat system under rotary tillage followed by zero and conventional practice. The total cost of production was more in case of conventional sowing due to more no. of tractor operations for field preparation. Zero and rotary tillage is found to be beneficial for cotton sowing after wheat harvest which will reduce the cost of production without an adverse effect on seed cotton yield. Rotary tillage is superior to zero and conventional tillage for wheat sowing after cotton. Overall, the profitability of cotton-wheat system was higher under flat bed compared to raised bed and The profitability was highest in rotary tillage (Rs 18565) and compared to zero (Rs 17205) and conventional system (Rs 15364) because of more production and less cost (Table 3). Lacewell et al. (1989) resulted that greater crop yields for cotton and sorghum in reduced tillage operation. A rotation of cotton-wheat was associated with an increase in cotton yield, but a decline in wheat yield, when compared

to growing the two crops continuously. Baliyan et al (1984) reported that wheat plants in zero tillage treatment had plant height, DM/plant, number of effective tillers and grain yields similar to those in conventional tillage. Increase in N rate from 60 to 120 kg/ha significantly increased growth and yield during both years.

It can be concluded that practising rotary and zero tillage in cotton as well as in wheat reduced cost of production and increase the profit margin of the farmer. Rotary tillage produced higher wheat yield compared to zero and conventional practice.

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