

EFFECT OF TILLAGE ON YIELD AND ECONOMIC RETURN OF WHEAT

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ABSTRACT

The present study was conducted at the Regional Agricultural Research Station, Jamalpur during the period from 1987-88 to 1990-91 to find out the suitable tillage method and number of passes for wheat cultivation under irrigated condition. Three tillage methods (Tractor, Power tiller and indigenous) each with 2, 4, 6 and 8 number of passes were tested. The effect of tillage methods on wheat yield were not significant. Four and six number of passes gave the higher yields over 2 and 8 passes. The highest benefit-cost ratio was obtained from the tractor method. The tractor and power tiller were found 14 and 4 times faster than the animal drawn country plough in land preparation, respectively. Considering the economic return, speed of work and timeliness of land preparation, 2 passes by tractor and 4 passes by power tiller were suitable for wheat cultivation under irrigated condition.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the second most important cereal crop in Bangladesh. It plays a vital role in the national economy to fill up the gap between food production and import. It has got great potential to increase its cultivated area as well as yield.

The purpose of tillage is to improve the physical, chemical and biological conditions of the soil and to enhance moisture retention of soil (Zhao *et al.*, 1986). About 80% farmers of Bangladesh use conventional bullock drawn plough for land preparation (Hossain *et al.*, 1995). There exists a shortage of draft power both in quality and quantity in Bangladesh (Bala *et al.*, 1995). To reduce this shortage, the use of tractor and power tiller is increasing gradually. Moniruzzaman and Baqui (1992) reported that a power tiller is normally 7-8

times faster than a pair of bullocks. On an average 4-5 passes are required for boro rice and 7-8 passes are required for aman rice and potato to prepare the land by conventional country plough while 3 passes are enough to prepare land by power tiller for the above crops. They also reported that power tiller increases the cropping intensity with a little reduction in yield compared to that by traditional plough. In Bangladesh wheat is generally sown after transplanted aman rice. Wheat growth and yield is very much sensitive to timeliness of planting (Mannaf, 1995). Zhao *et al.* (1986) reported that deep ploughing increased the yield of rainfed wheat. Khan *et al.* (1990) found 16% more grain yield of wheat by tractor operated moldboard plough than conventional cultivator in Pakistan in rainfed condition.

Optimum level of land preparation for wheat cultivation is very important to reduce timeliness loss

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and to increase yield. So this study was undertaken to know the effect of land preparation by tractor, power tiller and country plough and the optimum number of ploughing to have maximum yield as well as the highest economic return.

MATERIALS AND METHOD

The experiments were conducted on medium high land of Regional Agricultural Research Station, Jamalpur (24.56° N, 89.55° E) during the period from

1987-88 to 1990-91. The soil of the experimental site was of gray flood plain type and the texture was sandy

loam with P^H of 6.5. The experimental plots were laid out in split-plot design with three replications for each tillage method and the number of passes. Three tillage methods, described in Table 1, were employed. Each tillage method were used with 2, 4, 6 and 8 number of passes. The unit plot size was 8 m × 8 m.

Table 1 Tillage methods under study

Tillage Method	Description
Tractor method	Primary tillage with disk plow and secondary tillage with disk harrow
Power tiller method	Both the primary and the secondary tillage with rotary tiller
Indigenous method	Country plow pulled by a pair of bullocks

In case of tractor tillage method, the primary tillage operation was done by disk plough with field capacity of 0.35 ha/hr and secondary tillage operations were done by disk harrow with field capacity of 0.60 ha/hr. In power tiller method primary and secondary tillage operations were done by rotary tiller with field capacity of 0.11 and 0.16 ha/hr, respectively. In indigenous method country plough pulled by a pair of bullocks was used for both primary and secondary tillage operations with field capacities of 0.02 ha/hr and 0.025 ha/hr, respectively.

Continuous seeding was done in line at 20 cm spacing in mid-November. The variety of wheat was *Kanchan*. Uniform dose of fertilizers 80 kg N, 60 kg P₂O₅ and 40 kg K₂O per hectare were applied in the form of urea, triple super-phosphate and murate of potash. All fertilizers were applied as basal but 50% urea was top dressed at 45 DAS (days after sowing). One irrigation was applied before top dressing. The crop received precipitation of 73.1 mm at 62 DAS in 1990 and 113.5 mm at 74 DAS in 1990 and 1991, respectively. Ploughing and agronomic data were collected as and when necessary. Costs were calculated as per RNAM Test Code.

RESULTS AND DISCUSSION

Effect of Tillage Method

The yield and yield attributes of wheat as affected by tillage methods are presented in Table 2. Highest grain yield was obtained from tractor ploughing followed by country plough and power tiller but the differences were not statistically significant. The variation of yield contributing characters such as plant population, plant height, length of spike and number of grains per spike due to tillage methods were also insignificant. 1000 grain weight of all the tillage methods were found statistically insignificant.

Effect of Number of Passes

Grain yield, plant height, length of spike and number of grain per spike were significantly influenced by the number of passes (Table 3). The differences in plant populations and 1000 grain weights were statistically insignificant in all number of passes. The higher yields were obtained from 4 and 6 number of ploughings and the differences in yields were

Table 2 Effect of tillage methods on the yield and yield attributes of wheat

Tillage methods	Plant height (cm)	Plant population per line.m	Length of spike (cm)	No. of grains per spike	1000 grain weight (g)	Grain yield (kg/ha)
Tractor	83	76	8.84	29	44	2837
Power tiller	82	73	8.50	30	43	2538
Indigenous	83	76	8.80	30	42	2564
LSD _{0.05}	ns	ns	ns	ns	ns	ns

Table 3. Effect of number of passes on the yield and yield attributes of wheat

Number of passes	Plant height (cm)	Plant Population per line.m	Length of spike (cm)	No. of grains per spike	1000 grain weight (g)	Grain yield (kg/ha)
2	87	76	8.2	28.8	42.9	2534
4	88	74	8.9	31.1	42.3	2744
6	88	75	8.9	31.4	42.8	2725
8	87	73	8.6	29.6	42.2	2580
LSD ₀₅	ns	ns	ns	ns	ns	ns

statistically insignificant. The yields obtained from 2 and 8 number of ploughings were lower than those from 4 and 6 number of ploughings. In case of 8 ploughings, the causes of yield reduction might be due to breaking down of soil structures into finer soil particles resulting in more soil compaction by flood irrigation and rain that retarded the physiological growth of the plants. This result is agreed with Karim *et al.*, (1983). The results revealed that 2 ploughings by all methods are suitable for seed germination but not sufficient for physiological growth of wheat plants.

Combined Effect of Tillage Method and Number of Passes

The combined effect of tillage method and number of passes are shown in Table 4. The differences in grain yields were statistically insignificant. The higher grain yields were found from 4 and 6 number of

ploughings followed by 8 number of ploughings by all tillage methods. Two number of ploughings by all methods produced the lowest grain yields. The length of spikes were almost similar in all cases. Other yield attributes were insignificant.

Work Potential of Different Tillage Methods

For tillage operation a power tiller is 1.5 to 5.5 times faster than a pair of animal and a tractor is 11 to 18 times faster than bullocks and 3.3 to 7 times faster than power tiller (Table 5).

Economic analysis

Ploughing cost per ha by a tractor is 24 and 4.29 times higher than that by animal and a power tiller respectively (Table 5).

Table 6 Economic analysis of wheat cultivation using different tillage methods with different number of passes

Ploughing system	No. of passes	Ploughing time (hr/ha)	Land preparation cost (Tk/ha)	Total cost Tk/ha	Yield (kg/ha)	Price of grain (Tk/ha)	BCR
Tractor method	2	8	1920	10866	2747	13735	1.264
	4	14	3360	12306	2969	14845	1.206
	6	20	4800	13746	2952	14760	1.074
	8	26	6240	15186	2894	14470	0.953
Power tiller method	2	46	2576	11522	2412	12060	1.047
	4	66	3696	12642	2737	13685	1.083
	6	86	4816	13762	2638	13190	0.958
	8	106	5936	14882	2437	12185	0.819
Indigenous Method	2	110	1100	10046	2443	12215	1.216
	4	220	2200	11146	2699	13495	1.211
	6	330	3300	12246	2637	13185	1.077
	8	440	4400	13346	2576	12880	0.965

Labor* cost (Tk/ha) = 4800; Cost of seed (Tk/ha) = 960; Cost of fertilizer (Tk/ha) = 1986;

Irrigation cost, (Tk/ha) = 1200; Price of grain (Tk/kg) = 5.00

* labour from sowing to harvest; 160 man-days)

CONCLUSION

The effect of tillage method and the number of passes on the yield and yield attributes of wheat are found insignificant. Cost of land preparation by country plough is less than that of tractor and power tiller. Considering timeliness, speed of work and BCR values 2 ploughings by tractor and 4 ploughings by power tiller are good for wheat cultivation under irrigated condition.

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