

EFFECT OF TILLAGE ON THE YIELD OF POTATO

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Key words : Potato, Tillage, Number of passes, Cost of ploughing

ABSTRACT

The experiment was conducted at the Regional Agricultural Research Station, Rahmatpur, Barishal during *rabi* season of 1992-1993 and 1993-1994. Three tillage implements such as country plough, BARI plough and power tiller were compared in loamy sand soil at 2, 3, 4, 5 and 6 number of ploughings. There was no significant effect of tillage implements on the yield of potato but the effect of number of ploughings were significant. The highest BCR values were found for 5 - 6 number of ploughings by country plough and BARI plough and that of 4 - 5 number of ploughings by power tiller. Considering yield, timeliness of land preparation and economic return, 4 ploughings by power tiller was found to be the best tillage system for potato cultivation in loamy sand soil.

INTRODUCTION

Potato (*Solanum tuberosum* L.) is the most abundantly cultivated non-cereal food crop in the world and is the third most important food crop of Bangladesh (Anon., 1987). About 1.38 million tons of potato are produced from an area of about 130 thousand hectares each year (BBS, 1994). The national average yield of potato is only 9.5 t/ha which is much lower than the world average yield of 14.0 t/ha (Sukumaran, 1990; Siddique, 1991). This low yield of potato is mainly due to degeneration of varieties, use of poor quality seeds and sub-optimal production practices (Ahmed and Kader, 1981).

The extent of tillage and number of tilling operations depend on soil type, nature of crop to be grown, availability of draft power and other agronomic practices.

Kouwenhoven (1978) reported that the yield of potato react positively to a fine aggregate soil. Soane (1972) found the reverse relationship between the clod size and the yield of potato. More tillage operation gives more root length but it does

not necessarily affect the yield of potato (Sarker, 1995).

Rouse and Stone (1980) revealed that deep cultivation increased the dry matter production of potato by 13% over that obtained by conventional ploughing.

Beukema and Zaag (1979) found a positive correlation between potato yield and depth of ploughing and they suggested to break dense layers to avoid soil compaction during tillage operations. The present study was undertaken to find out the effect of tillage operations on potato production.

MATERIALS AND METHODS

The experiment was conducted at the Regional Agricultural Research Station, Rahmatpur, Barishal (22.42° N, 90.22° E) during *rabi* season (November -February) 1992-93 and 1993-94. The land was medium high and the texture of soil was loamy sand. The p^H of soil ranged from 6.6 to 7.5 and bulk density was 1.42 g/cc.

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The experiment was laid out in a split-plot design with three replications. Ploughing implement was assigned to the main plot and number of ploughing to the sub-plot. Ploughing implements were country plough, BARI plough and power tiller. Number of ploughings were 2, 3, 4, 5 and 6. Each of the plot size was 6 m x 4.8 m. The variety of potato was *cardinal*. Seed size was 28.40 mm (average weight 30 g). Ploughing and laddering were done as per the design of the experiment. The whole tubers were planted on November 25, 1992 and November 29, 1993 for the first and second year respectively. The line spacing was 60 cm x 30 cm. Fertilizers used were Urea, TSP, MP, Gypsum and Zinc sulphate @ 300, 200, 300, 20 and 5 kg/ha, respectively. All fertilizers except half of the Urea were applied at the time of final land preparation and the rest Urea was top-dressed and mixed with

soil at 41 DAP (days after planting). Weeding and ridging were done at 30 and 41 DAP, respectively. Irrigation were applied at 31 and 44 DAP. Fungicide (Dithane M-45) was sprayed against early blight at 50 DAP. The crop was harvested at 100 DAP.

RESULTS AND DISCUSSION

The effect of tillage implements on the yield and yield contributing factors are presented in Table 1. It was found that tillage implements had no significant effect on yield and yield attributes, but heaviest weight of tuber per hill was found from BARI plough in 1993-94 and from BARI plough and country plough in 1992-93.

Table 1 Effect of plough type on yield and yield attributes of potato

Plough type	Plant height, cm		No. of stem per hill		No. of tuber per hill		Weight of tuber per hill, kg		Yield, t/ha	
	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94
Country plough	45.21	43.96	3.11	4.33	8.36	7.45	0.34	0.28	17.51	15.96
BARI plough	41.58	43.19	2.96	4.97	7.92	8.17	0.33	0.38	17.46	16.11
Power tiller	42.67	34.53	2.95	4.25	7.80	6.47	0.27	0.26	20.02	14.65
F-test	ns	ns	ns	ns	ns	ns	*	*	ns	ns
CV %	12.84	21.78	14.22	19.73	10.65	18.62	10.72	9.24	13.80	12.43

* Significant at 5% level, ns not significant.

The effect of number of ploughing on the yield and yield contributing parameters are shown in Table 2. Plant height, number of stem per hill and number of tuber per hill were found statistically similar both in 1992-93 and 1993-94. Significant difference in weight of tuber per hill and the yield of potato were found for different number of tilling operations in 1992-93 and 1993-94. 2 and 3 tilling operations gave significantly lower yield than 4, 5 and 6 number of ploughings but they are statistically similar by DMRT. Ploughing numbers 4, 5 and 6

were also statistically similar by DMRT. Hence the weight of tuber per hill directly affected the yield of potato.

The combined effect of tillage implements and number of ploughings are presented in Table 3. No significant effect of tillage implements and number of tilling operations on yield of potato were found. Some yield contributing factors were significantly different but did not affect the yield.

Table 2 Effect of number of ploughing on yield and yield attributes of potato

Number of ploughing	Plant height, cm		No. of stem per hill		No. of tuber per hill		Weight of tuber per hill, kg		Yield, t/ha	
	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94
2	40.24	37.88	2.88	4.82	8.16	7.51	0.18	0.23	14.18	12.85
3	45.80	41.27	3.16	4.33	7.90	7.35	0.24	0.25	15.35	14.10
4	40.08	40.07	2.80	4.27	7.42	6.96	0.33	0.30	17.43	16.18
5	43.88	41.91	3.08	4.64	7.19	7.62	0.29	0.28	17.64	16.39
6	42.87	40.62	2.99	4.51	8.49	7.48	0.31	0.29	17.66	16.41
F-test	ns	ns	ns	ns	ns	ns	**	**	**	*
CV %	9.38	7.56	14.22	13.64	14.22	16.46	7.18	6.05	8.21	6.29

* Significant at 5% level, ** Significant at 1% level, ns not significant.

Table 3 Combined effect of tillage implements and number of ploughing on yield and yield attributes of potato

Expt. No.	Plant height, cm		No. of stem per hill		No. of tuber per hill		Weight of tuber per hill, kg		Yield, t/ha	
	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94
C ₂	42.33	41.19	2.83	4.46	6.79	7.07	0.22	0.23	14.62	12.68
C ₃	45.87	42.87	3.40	4.13	7.52	8.47	0.25	0.26	17.43	13.96
C ₄	38.97	42.81	3.03	4.06	7.43	7.33	0.31	0.30	15.79	16.04
C ₅	44.43	45.64	2.77	4.93	6.93	6.93	0.28	0.33	18.12	17.17
C ₆	51.57	44.39	3.23	4.18	8.17	7.28	0.32	0.34	21.50	16.92
F-test	ns	ns	*	ns	ns	**	*	*	*	ns
B ₂	43.19	40.01	2.59	4.87	7.36	8.13	0.22	0.25	15.35	13.55
B ₃	44.23	43.27	3.17	5.13	8.09	6.73	0.25	0.28	18.32	15.13
B ₄	41.43	45.16	2.73	5.40	8.33	8.07	0.30	0.33	15.32	17.44
B ₅	42.27	44.13	3.10	5.06	7.44	9.73	0.33	0.34	17.86	18.30
B ₆	38.40	44.24	2.83	5.20	7.65	9.62	0.32	0.33	17.89	17.68
F-test	*	ns	*	ns	*	**	*	*	ns	ns
P ₂	39.63	32.42	2.72	3.60	8.20	6.33	0.21	0.20	12.91	12.31
P ₃	47.30	37.67	2.90	4.00	6.39	6.87	0.24	0.23	13.66	13.21
P ₄	39.83	32.24	2.63	5.06	7.14	5.46	0.29	0.28	21.25	15.06
P ₅	44.93	35.78	3.37	4.33	7.42	6.20	0.30	0.31	19.05	16.39
P ₆	38.63	36.32	2.90	4.39	7.35	6.51	0.31	0.32	16.10	15.90
F-test	*	ns	*	ns	*	**	*	*	*	ns

* Significant at 5% level, ** Significant at 1% level, ns not significant.

The field performances of different types of tillage implements at different levels of tilling operation are presented in Table 4. Power required by country plough were significantly higher (in t-test) than that of BARI plough at different number of tilling operations. This finding agreed with that of Hossain *et al.* (1995). The depth of ploughing of country plough and BARI plough were statistically similar but the depth of ploughing of power tiller was found lower than those of country plough and BARI

plough. Furrow width of BARI plough was higher than that of country plough. Power tiller attained a fixed furrow width 62 cm) due to its design. Hossain *et al.* (1995) presented similar results of depth of tillage by country plough and BARI plough at different locations of Bangladesh and Sarker (1995) presented similar depth of tillage by power tiller for potato cultivation in Modhupur Thana under Tangail district.

Table 4 Field performance of different types of plough

Plough type	Number of Ploughing	Pulling force, kg	Depth of ploughing, cm	Furrow width, cm	Soil moisture, %	Field capacity, ha/hr	Ploughing time, ha/hr
Country	1	55.0	9.5	13.5	24.4	0.013	76.92
	2	48.5	10.3	14.0	24.4	0.014	71.43
	3	46.5	11.8	14.8	22.3	0.018	55.56
	4	42.5	11.9	15.6	22.3	0.017	58.82
	5	36.5	13.5	16.8	22.3	0.021	47.62
	6	32.5	14.3	17.5	22.3	0.023	43.48
BARI	1	45.0	10.0	15.2	24.5	0.015	66.67
	2	41.5	11.7	16.4	24.5	0.016	62.50
	3	33.0	12.3	16.8	20.2	0.019	52.63
	4	32.5	12.2	17.6	20.2	0.024	41.67
	5	28.0	13.4	18.8	20.2	0.025	40.00
	6	26.0	13.8	19.5	20.2	0.025	40.00
Power tiller	1	-	7.0	62.0	25.3	0.058	17.24
	2	-	9.5	62.0	25.3	0.062	16.13
	3	-	11.0	62.0	19.6	0.063	15.87
	4	-	12.2	62.0	19.6	0.063	15.87
	5	-	12.4	62.0	19.6	0.064	15.63
	6	-	12.6	62.0	19.6	0.063	15.87

In preparing the land, power tiller was found 3.0 and 3.5 times faster than BARI plough and country plough respectively. The cost of ploughing by country plough were higher followed by BARI plough and power tiller (Table 5). The lowest cost of ploughing was obtained for power tiller, though its initial cost was higher. For country plough, BCR values increased with the increase in number of ploughings while BCR values corresponding to BARI plough and power tiller reduced after 5 and 4 number of ploughings respectively. The highest BCR value was obtained from 6 ploughings by country plough followed by 5 and 4 ploughings by

BARI plough and power tiller respectively. The lowest BCR values were found for 2 ploughings by all the three implements.

CONCLUSION

From the above discussion it may be concluded that there is no significant difference among country plough, BARI plough and power tiller on the yield of potato. Number of tilling operations increases yield up to 4 number of ploughings. Ploughing cost by power tiller was found lowest.

Table 5 Economic analysis of different tillage methods

Tillage Implement	Number of ploughing	Ploughing cost, Tk/ha	Other cost*, Tk/ha	Total cost, Tk/ha	Average yield, t/ha	price of potato, Tk/ha	BCR value
Country plough	2	1302	41470	42772	13.65	68250	1.60
	3	2300	41470	43770	15.69	78450	1.79
	4	2750	41470	44220	15.90	79500	1.80
	5	3173	41470	44643	17.65	88250	1.97
	6	3559	41470	45029	19.92	99600	2.21
BARI plough	2	1148	41470	42618	14.45	72250	1.69
	3	1616	41470	43086	16.73	83625	1.94
	4	1987	41470	43457	16.38	81900	1.88
	5	2343	41470	43813	18.08	90400	2.06
	6	2698	41470	44168	17.79	88925	2.01
Power	2	668	41470	42138	12.61	63050	1.50
	3	987	41470	42457	13.44	67175	1.58
	4	1320	41470	42790	18.15	90775	2.12
	5	1634	41470	43104	17.72	88600	2.06
	6	1968	41470	43438	16.00	80000	1.84

Price of country plough = Tk. 250/-, BARI plough = Tk. 350/- and power tiller Tk. 50,000/-.

* Other cost includes the cost of labour, seeds, fertilizer, irrigation and pesticide.

In preparing the land, up to 5-6 ploughings by power tiller were found economic. Six ploughings by country plough, 5 ploughings by BARI plough and 4 ploughings by power tiller are optimum for potato cultivation in loamy sand soil.

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