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Economic Performance of Transplant Aman Rice under Different Methods of Land Preparation and Weeding Regime

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Abstract: An Experiment was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh to study the economic performance of transplant *aman* rice under different methods of land preparation and weeding regime. The treatments included three methods of land preparation and weeding regime. The treatments included three methods of land preparation-i). land preparation by country plough, ii). land preparation by power tiller, iii). land preparation by tractor and 10 weeding regime -i). no weeding, ii). one hand weeding at 21 DAT, iii). two hand weeding at 21 and 42 DAT, iv). three hand weeding at 21,42 and 63 DAT, v). Ronstar 25 EC @ 2.01 haG[1] at pre-emergence, vi). 2, 4-D amine @ 1.84 1 haG[1] at 42 DAT, vii). Ronstar 25 EC @ 2.0 1 haG[1] at pre-emergence +2,4-D amine @ 1.84 1 haG[1] at 42 DAT, viii). Ronstar 25 EC @ 2.01 haG[1] at pre-emergence + one hand weeding at 42 DAT, ix). one hand weeding at 21 DAT + 2,4-D amine @ 1.84 1haG[1] at 42 DAT and x) weed free. The experiment was laid out in a split -plot design with four replications. The size of the unit plot was 5m x 3m. In this experiment, net return and benefit -cost ratio were highest in crop raised in tractor prepared plots and weeds being controlled by Ronstar 25 EC @ 2.01 haG[1] + one hand weeding. One hand weeding recorded higher net return and benefit-cost ratio than two or three hand weeding. Between the single use of Ronstar 25 EC @ 2.0 1 haG[1] and 2, 4-D amine @ 1.84 1 haG[1], the former was more profitable than the later.

Key words: Weed management % Herbicides % Crop protection % Rice production

INTRODUCTION

Transplant aman rice is the most important rice crop of Bangladesh in terms of total coverage and output. It covers about 47.73% of total rice area and contributes to 33.40% of the total rice production [1]. But in this crop yield is much lower than that of transplanted rice in other rice growing countries of the world. Severe weed in infestation constitutes one of the reasons for such low yield [2]. The yield loss due to weed competition in transplant *aman* rice is 40% in Bangladesh [3]. The farmers of Bangladesh use different types of tillage implements for land preparation. Some of these usually plough deep and some plough shallow. Deep tillage decreases the bulk density and increases the soil porosity, infiltration rate and hydraulic conductivity and makes the soil to be permeable, aerated and of good physical conditions for crop production [4, 5]. Shallow tillage; on the contrary, increase the bulk density, soil resistance and mechanical impedance of soil resulting poor soil physical conditions. Thus different methods of land preparation would have differential effects on post planting weed infestation and crop performance. In Bangladesh weeds are being controlled manually by hand pulling or by using simple tools like *niranee*, Japanese rice weeder etc. Usually, two to three hand weddings are done for growing a transplant rice crop depending upon the nature of weeds and their intensity of infestation. But, this method is very laborious, time consuming and expensive. The use of herbicide can help controlling weeds more easily and cheaply. Weed competition at early growth stage can be eliminated through

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pre-emergence herbicides and weeds growing at later crop growth stage can be controlled by post-emergence herbicides. Pre-emergence herbicides, post-emergence herbicides or both if used in combination with hand weeding more efficient weed control may be achieved. It has been seen that combination of two methods are always better than single method, that is, only hand weeding or only chemical weeding. Moreover, repeated use of any single method makes an unimportant weed to establish as an important one. Efforts to suppress the weed infestation with simultaneous increase in crop production through improved cultivation require the introduction of improved farm implements as well as use of herbicide. The replacement of traditional implements and manual weeding respectively by mechanical implements and herbicides or herbicides in combination with hand weeding would help to obtain higher crop productivity with less efforts and cost. The present study was, therefore, undertaken to study the economic performance of transplant *aman* rice under different methods of land preparation and weeding regime.

MATERIALS AND METHODS

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University (BAU), Mymensingh to study the economic performance of transplant *aman* rice under different methods of land preparation and weeding regime. The experiment was laid out in a split-plot design with four replications. The treatments included three methods of land preparation- i) land preparation by country plough, ii) land preparation by power tiller, iii) land preparation by tractor and 10 weeding regime i) no weeding, ii) one hand weeding at 21, DAT, iii) two hand weeding at 21 and 42 DAT, iv) three hand weeding at 21,42 and 63 DAT, v) Ronstar 25 EC @ 2.01 haG^{1} at pre-emergence, vi) 2, 4-D amine @ 1.84 1 haG^{1} at 42 DAT, vii) Ronstar 25 EC @ 2.0 1 haG^{1} at pre-emergence +2,4-D amine @ 1.84 1 haG^{1} at 42 DAT, viii) Ronstar 25 EC @ 2.01 haG^{1} at pre-emergence + one hand weeding at 42 DAT, ix) one hand weeding at 21 DAT + 2,4-D amine @ 1.84 1haG^{1} at 42 DAT and x) weed free. The size of the main plot was 40m x 5m, Distance between replications was 1.5 m and that between the main plots was 1m. The unit plot size was 5 m x 3m and distance between the unit plots was 0.75 m. The land was prepared with country plough, power tiller and tractor drawn rotavator as per treatments and fertilized with 69, 18.86, 20, 10.8 and 3.6 kg of N, P, K.S and Zn haG^{1} through urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate, respectively. The whole amount of triple super phosphate, muriate of potash, gypsum and zinc sulphate were applied as basal dose at final land preparation and the whole amount of urea was top dressed in three equal installments at 10, 30 and 55 DAT. The seedlings were transplanted on the well puddled unit plots maintaining a spacing of 25 cm x 15 cm on 27 July 2010. Two seedlings were used per hill. Weeding was done as per the weeding regime. Irrigation was done when required. Proper preventive measures were taken to protect the crop from insect pests. The crop was harvested on 2 December 2010. Data on grain in straw yield were recorded at harvest of the crop and the cost of production calculated under different methods of land preparation and weeding regime was calculated for the studied crop. Collected data on different crop characters were statistically analyzed and the mean differences were adjudged by Duncan's Multiple Range Test. The human labor was obtained from adult male labor. Eight working hours of a labor was considered as a man-day. The animal labor was obtained from bullocks. A period of eight working hours of a pair of bullocks was considered as an animal-day. A tractor-day and a power- tiller day were considered as a period of eight working hours of a tractor and a power-tiller, respectively. The interest on input cost was calculated for 6 months @ Tk. 8% per year based on the interest rate of the Bangladesh Krishi Bank. The value of land was taken to be Tk.2, 00000 per hectare. The interest on the value of land was calculated @ 8% per year for 6 months. It was arbitrarily taken to be 5% of the total input cost.

- Gross return was estimated in the following way:
- Gross return (Tk. haG^{1}) = Value of grain (Tk. haG^{1}) + Value of Straw (Tk .haG^{1}).
- Net return was estimated in the following way:
- Net return (Tk.haG^{1}) = Gross return (Tk. haG^{1}) - Total cost of production (Tk. haG^{1}).
- Benefit -cost ratio was calculated using the following formula:

$$\text{Benefit -cost ratio (BCR)} = \frac{\text{Gross return (Tk. ha}^{-1})}{\text{Cost of production (Tk. ha}^{-1})}$$

RESULTS AND DISCUSSION

The results of the present study have been presented in Tables 1-9. Cost of production hectareG^{1} and its distribution over different items of cost in relation to methods of hand preparation and weeding regime have been presented in Table 1, 2 and 3. From these tables it

Table 1: Total cost of production (Tk. haG^{1}) in country plough cultivation and its distribution over different heads of expenditure in transplant *aman* rice under different weeding regime

	Weeding regime									
	W_0		W_1		W_2		W_3		W_4	
Heads of expenditure	Actual cost	% of TCP	Actual Cost	% of TCP	Actual Cost	% of TCP	Actual cost	% of TCP	Actual cost	% of TCP
1. Input cost										
A.Non material input										
1. Labour										
a) Human	7500.00	33.14	9150.00	37.45	9950.00	39.32	10750.00	41.07	8400.00	33.16
b) Animal	1200.00	5.30	1200.00	4.91	1200.00	4.74	1200.00	4.58	1200.00	4.73
c) Mechanical	-	-	-	-	-	-	-	-	-	-
Non material input cost	8700.00	38.44	10350.00	42.36	11150.00	44.06	11950.00	45.65	9600.00	37.89
B. Material input										
2. Seed	220.00	0.97	220.00	0.90	220.00	0.87	220.00	0.84	220.00	0.87
3. Fertilizer	3210.00	14.18	3210.00	13.14	3210.00	12.69	3210.00	12.26	3210.00	12.67
4. Water for irrigation	600.00	2.65	600.00	2.46	600.00	2.37	600.00	2.29	600.00	2.37
5. Herbicide	-	-	-	-	-	-	-	-	1580.00	6.24
6. Insecticide	694.00	3.07	694.00	2.84	694.00	2.74	694.00	2.65	694.00	2.74
Material input out	4724.00	20.87	4724.00	19.34	4724.00	18.67	4724.00	18.05	6304.00	24.88
Total input cost	13424.00	59.31	15074.00	61.70	15874.00	62.73	16674.00	63.70	15904.00	21.77
II Overhead cost										
7. Interest on input cost @ 8.00% for 6 months	536.96	2.37	602.96	2.47	634.96	2.47	666.96	2.55	636.16	2.51
8. Interest on value of land @ 8.00% for 6 months	8000.00	35.35	8000.00	32.75	8000.00	31.65	8000.00	30.56	8000.00	31.58
9. Miscellaneous cost (5% of input cost)	671.20	2.97	753.70	3.08	793.70	3.15	833.70	3.19	795.20	3.14
Total overhead cost	9208.16	40.69	9356.66	38.30	9428.66	37.27	9500.66	36.30	9431.36	37.23
Total cost of production	22632.16	100.00	24430.66	100.00	25302.66	100.00	26174.66	100.00	25335.36	100.00
1. Input cost										
A.Non oratorical input										
1. Labour										
a) Human	8350.00	34.00	8550.00	32.26	9150.00	34.00	9100.00	35.86	14500.00	47.91
b) Animal	1200.00	4.88	1200.00	4.53	1200.00	4.59	1200.00	4.73	1200.00	3.97
c) Mechanical	-	-	-	-	-	-	-	-	-	-
Non material input cost	9550.00	38.88	9750.00	36.79	10350.00	39.58	10300.00	40.58	15700.00	51.88
B. Material input										
2. Seed	220.00	0.90	220.00	0.83	220.00	0.84	220.00	0.87	220.00	0.73
3. Fertilizer	3210.00	13.07	3210.00	12.11	3210.00	12.27	3210.00	12.65	3210.00	10.61
4. Water for irrigation	600.00	2.44	600.00	2.26	600.00	2.29	600.00	2.36	600.00	1.98
5. Herbicide	920.00	3.75	2500.00	9.43	1580.00	6.04	920.00	3.63	-	--
6. Insecticide	694.00	2.83	694.00	2.62	694.00	2.65	694.00	2..73	694.00	2.29
Material input cost	5644.00	22.98	7224.00	27.26	6304.00	24.10	5644.00	22.24	4724.00	15.61
Total input cost	15194.00	61.86	16974.00	64.05	16654.00	63.68	15944.00	62.82	20424.00	67.49
II Overhead cost										
7. Interest on input cost @ 8.00% for 6 months	607.76	2.47	678.96	2.56	666.16	2.55	637.76	2.51	816.96	2.70
8. Interest on value of land @ 8.00% for 6 months	8000.00	32.57	8000.00	30.19	8000.00	30.59	8000.00	31.52	8000.00	26.44
9. Miscellaneous cost (5% of input cost)	759.70	3.09	848.70	3.20	832.70	3.18	797.20	31.4	1021.20	3.37
Total overhead cost	9367.46	38.14	9527.66	35.95	9498.86	36.32	9434.96	37.17	9838.16	32.51
Total cost of production	24561.46	100.00	26501.66	100.00	26152.86	100.00	25378.96	100.00	30262.16	100.00

W_0 = No weeding; W_1 = One hand weeding at 21 DAT; W_2 = Two hand weeding at 21 and 42 DAT; W_3 = Three hand weeding at 21, 42 and 63 DAT; W_4= Ronstar 25 EC @ 2.01 haG^{1} at pre-emergence; W_5 = 2, 4-D amine @ 1.84 1haG^{1} at 42 DAT; W_6 = Ronstar 25 EC @ 2.0 1haG^{1} at pre-emergence + 2, 4-D amine @ 1.84 1haG^{1} at 42 DAT; W_7 = Ronstar 25 EC @ 2.0 1haG^{1} at pre-emergence + One hand weeding at 42 DAT ;W_8 = One hand weeding at 21 DAT + 2, 4-amine @ 1.84 1haG^{1} at 42 DAT and W_9 = Weed free.

Table 2: Total cost of production (Tk.haG^{1}) in power tiller cultivation and its distribution over different heads of expenditure in transplant *aman* rice under different weeding regime

	Weeding regime									
	W_0		W_1		W_2		W_3		W_4	
Heads of expenditure	Actual cost	% of TCP	Actual Cost	% of TCP	Actual Cost	% of TCP	Actual cost	% of TCP	Actual cost	% of TCP
1. Input cost										
A.Non material input										
1. Labor										
a) Human	6300.00	28.01	7300.00	30.95	8150.00	33.25	8900.00	35.14	6700.00	27.18
b) Animal (for laddering)	350.00	1.56	350.00	1.48	350.00	1.43	350.00	1.38	350.00	1.42
c) Mechanical (power tiller)	1925.00	8.56	1925.00	8.16	1925.00	7.85	1925.00	7.60	1925.00	7.80
Non material input cost	8575.00	38.12	9575.00	40.60	10425.00	42.43	11175.00	44.12	8975.00	36.40

Table 2: Continuee

	Weeding regime									
	W_0		W_1		W_2		W_3		W_4	
Heads of expenditure	Actual cost	% of TCP	Actual Cost	% of TCP	Actual Cost	% of TCP	Actual cost	% of TCP	Actual cost	% of TCP
B. Material input										
2. Seed	220.00	0.98	220.00	0.93	220.00	0.90	220.00	0.87	220.00	0.89
3. Fertilizer	3210.00	14.27	3210.00	13.61	3210.00	13.10	3210.00	12.67	3210.00	13.02
4. Water for irrigation	600.00	2.67	600.00	2.54	600.00	2.45	600.00	2.37	600.00	2.43
5. Herbicide	---	--	---	---	--	--	--	--	1580.00	6.41
6. Insecticide	694.00	3.09	694.00	2.94	694.00	2.83	694.00	2.74	694.00	2.81
Material input cost	4724.00	21.00	4724.00	20.03	4724.00	19.27	4724.00	18.65	6304.00	25.57
Total input cost	13299.00	59.12	14299.00	60.63	15149.00	61.80	15899.00	62.77	15279.09	61.97
II Overhead cost										
7. Interest on input cost										
@ 8.00% for 6 months	531.90	2.36	571.96	2.43	60596.00	2.47	635.96	2.51	611.16	2.48
8. Interest on value of land										
@ 8.00% for 6 months	8000.00	35.56	8000.00	33.92	8000.00	32.64	8000.00	31.58	8000.00	32.45
9. Miscellaneous cost (5% of										
input cost)	664.95	2.93	714.95	3.03	757.45	3.09	794.95	3.14	763.95	3.10
Total overhead cost	9196.91	40.88	9286.91	39.37	9363.41	38.20	9430.91	37.23	9375.11	38.03
Total cost of production	22495.91	100.00	23585.91	100.00	24512.41	100.00	25329.91	100.00	24654.11	100.00
1. Input cost										
A.Non material input										
1. Labor										
a) Human	6600.00	27.70	6750.00	26.25	7350.00	28.98	7300.00	29.69	13000.00	43.63
b) Animal (for laddering)	350.00	1.87	350.00	1.36	350.00	1.38	350.00	1.40	350.00	1.17
c) Mechanical (Power tiller)	1925.00	8.08	1925.00	7.49	1925.00	7.59	1925.00	7.83	1925.00	6.46
Non material input cost	8875.00	37.25	9025.00	35.10	9625.00	37.95	9575.00	38.94	15275.00	51.26
B. Material input										
2. Seed	220.00	0.92	220.00	0.86	220.00	0.87	220.00	0.89	220.00	0.74
3. Fertilizer	3210.00	13.47	3210.00	12.48	3210.00	12.66	3210.00	13.05	3210.00	10.77
4. Water for irrigation	600.00	2.52	600.00	2.33	600.00	2.37	600.00	2.44	600.00	2.01
5. Herbicide	920.00	3.86	2500.00	9.72	1580.00	6.23	920.00	3.74	--	--
6. Insecticide	694.00	2.91	694.00	2.70	694.00	2.74	694.00	2.82	694.00	2.33
Material input cost	5644.00	23.69	7224.00	28.10	6304.00	24.86	5644.00	22.95	4724.00	15.85
Total input cost	14519.00	60.94	16249.00	63.20	15929.00	62.81	15219.00	61.89	19999.00	67.11
II Overhead cost										
7. Interest on input cost										
@ 8.00% for 6 months	580.76	2.44	649.96	2.53	637.16	2.51	608.76	2.48	799.96	2.35
8. Interest on value of land										
@ 8.00% for 6 months	8000.00	33.58	8000.00	31.11	8000.00	31.54	8000.00	32.54	8000.00	26.85
9. Miscellaneous cost (5% of										
input cost)	725.95	3.05	812.45	3.16	796.45	3.14	760.95	3.09	999.95	3.36
Total overhead cost	9306.71	39.06	9462.41	36.80	9433.61	37.19	9369.71	38.11	9799.91	32.89
Total cost of production	23825.71	100.00	25711.41	100.00	25362.61	100.00	24588.71	100.00	29798.91	100.00

W_0 = No weeding; W_1 = One hand weeding at 21 DAT; W_2 = Two hand weeding at 21 and 42 DAT; W_3 = Three hand weeding at 21, 42 and 63 DAT; W_4 = Ronstar 25 EC @ 2.01 haG^{-1} at pre-emergence; W_5 = 2, 4-D amine @ 1.84 1 haG^{-1} at 42 DAT; W_6 = Ronstar 25 EC @ 2.01 haG^{-1} at pre-emergence + 2, 4-D amine @ 1.84 1 haG^{-1} at 42 DAT; W_7= Ronstar 25 EC @ 2.01 haG^{-1} at pre-emergence + One hand weeding at 42 DAT; W_8 = One hand weeding at 21 DAT + 2, 4-amine @ 1.84 1 haG^{-1} at 42 DAT and W_9 = Weed free.

Table 3: Total cost of production (Tk. haG^{-1}) in tractor cultivation and its distribution over different heads of expenditures in transplant *aman* rice under different weeding regime.

	Weeding regime									
	W_0		W_1		W_2		W_3		W_4	
Heads of expenditure	Actual cost	% of TCP	Actual Cost	% of TCP	Actual Cost	% of TCP	Actual cost	% of TCP	Actual cost	% of TCP
1. Input cost										
A.Non material input										
1. Labour										
a) Human	6600.00	30.15	7450.00	32.66	8350.00	35.09	9100.00	36.97	6950.00	28.97
b) Animal (for laddering)	350.00	1.60	350.00	1.53	350.00	1.48	350.00	1.42	350.00	1.46
c) Mechanical (tractor)	1067.00	4.87	1067.00	4.68	1067.00	4.48	1067.00	4.34	1067.00	4.45
Non material input cost	8017.00	36.63	88.67.00	38.87	9767.00	41.05	10517.00	42.73	8367.00	34.88
B. Material input										
2. Seed	220.00	1.01	220.00	0.96	220.00	0.92	220.00	0.89	220.00	0.92
3. Fertilizer	3210.00	14.67	3210.00	14.07	3210.00	13.49	3210.00	13.04	3210.00	13.38
4. Water for irrigation	600.00	2.74	600.00	2.63	600.00	2.52	600.00	2.44	600.00	2.50
5. Herbicide	-		--	--	--	--	--	--	1580.00	6.59
6. Insecticide	694.00	3.17	694.00	4.23	694.00	2.92	694.00	2.82	694.00	2.89
Material input out	4724.00	21.58	4724.00	20.70	4724.00	19.85	4724.00	19.19	6304.00	26.28
Total input cost	12741.00	58.21	13591.00	59.57	14491.00	60.90	15241.00	61.92	14671.00	61.15

Table 3: Continue

	Weeding regime									
	W_0		W_1		W_2		W_3		W_4	
Heads of expenditure	Actual cost	% of TCP	Actual Cost	% of TCP	Actual Cost	% of TCP	Actual cost	% of TCP	Actual cost	% of TCP
II Overhead cost										
7. Interest on input cost @ 8.00% for 6 months	509.64	2.33	543.64	2.38	579.64	2.44	609.64	2.48	586.84	2.45
8. Interest on value of land @ 8.00% for 6 months	8000.00	36.55	8000.00	35.07	8000.00	33.62	8000.00	32.50	8000.00	33.35
9. Miscellaneous cost (5% of input cost)	637.05	2.91	679.55	2.98	724.55	3.04	762.05	3.10	733.55	3.06
Total overhead cost	9146.69	41.79	9223.19	40.43	9304.19	39.10	9371.69	38.08	9320.39	38.85
Total cost of production	21887.69	100.00	22814.19	100.00	23795.19	100.00	24612.69	100.00	23991.39	100.00
1. Input cost										
A.Non material input										
1. Labour										
a) Human	6800.00	29.43	6950.00	27.81	7550.00	30.63	7500.00	31.42	13200.00	45.39
b) Animal (for laddering)	350.00	1.51	350.00	1.40	350.00	1.42	350.00	1.47	350.00	1.20
c) Mechanical (Tractor)	1067.00	4.62	1067.00	4.27	1067.00	4.33	1067.00	4.47	1067.00	3.67
Non material input cost	8217.00	35.56	8367.00	33.48	8967.00	36.38	8917.00	37.36	14617.00	50.26
B. Material input										
2. Seed	220.00	0.95	220.00	0.88	220.00	0.89	220.00	0.92	220.00	0.76
3. Fertilizer	3210.00	13.89	3210.00	12.84	3210.00	13.02	3210.00	13.45	3210.00	11.04
4. Water for irrigation	600.00	2.60	600.00	2.40	600.00	2.43	600.00	2.51	600.00	2.06
5. Herbicide	920.00	3.98	2500.00	10.00	1580.00	6.41	920.00	3.85	-	-
6. Insecticide	694.00	3.00	694.00	2.78	694.00	2.82	694.00	2.91	694.00	2.39
Material input cost	5644.00	24.42	7224.00	28.90	6304.00	25.58	5644.00	23.64	4724.00	16.24
Total input cost	13861.00	59.98	15591.00	62.38	15271.00	61.96	14561.00	61.00	19341.00	66.56
II Overhead cost										
7. Interest on input cost @ 8.00% for 6 months	554.44	2.40	623.64	2.50	610.84	2.48	582.44	2.44	773.64	2.66
8. Interest on value of land @ 8.00% for 6 months	8000.00	34.62	8000.00	32.01	8000.00	32.46	8000.00	33.51	8000.00	27.51
9. Miscellaneous cost (5% of input cost)	693.05	30.00	779.55	3.12	763.55	3.10	728.05	3.05	967.05	3.33
Total overhead cost	9247.49	40.02	9403.19	37.62	9374.39	38.04	9310.49	39.00	9740.69	33.50
Total cost of production	23108.49	100.00	24994.19	100.00	24645.39	100.00	23871.49	100.00	29081.69	100.00

W_0 = No weeding ; W_1 = One hand weeding at 21 DAT; W_2 = Two hand weeding at 21 and 42 DAT; W_3 = Three hand weeding at 21, 42 and 63 DAT; W_4 = Ronstar 25 EC @ 2.0 1 ha^{-1} at pre-emergence; W_5 = 2, 4-D amine @ 1.84 1 ha^{-1} at 42 DAT; W_6 = Ronstar 25 EC @ 2.0 1 ha^{-1} at pre-emergence + 2, 4-D amine @ 1.84 1 ha^{-1} at 42 DAT; W_7 = Ronstar 25 EC @ 2.01 ha^{-1} at pre-emergence + One hand weeding at 42 DAT; W_8 = One hand weeding at 21 DAT + 2, 4-amine @ 1.84 1 ha^{-1} at 42 DAT and W_9 = Weed free.

Table 4: Interaction effect of methods of land preparation and weeding regime on the crop characters of transplant *aman* rice (BR11)

Land preparation method	Plant height (cm)	Total tillers hill G^{-1} (no.)	Ear bearing tillers $hillG^{-1}$ (no)	Non-ear bearing tillers hill G^{-1}	Panicle length (cm)	Grains $panicleG^{-1}$ (no.)	Sterile spike lets lets Panicle G^{-1} (no)	1000 grain weight (g)	Grains yield (t haG^{-1})	Straw yield (t haG^{-1})	Biological yield (t haG^{-1})	Harvest index (%)
CW0	102.20	10.79 f	5.28j	5.5la	21.05	74.58	30.63	22.11	2.00 l	4.05	6.05j	33.09k
CW1	113.48	10.96f	7.06i	3.90bc	22.15	79.75	27.09	21.38	3.44jk	6.11	9.55i	35.97hij
CW2	115.63	12.21 abcde	7.60ghi	4.61ab	22.44	82.62	26.23	22.16	3.51ijk	6.22	9.73hi	36.12hij
CW3	115.48	12.46abcde	7.79ghi	4.67ab	22.51	83.74	25.75	22.22	3.56ijk	6.38	9.94ghi	35.74ij
CW4	113.65	11.85 cdef	8.59fg	3.26bcd	22.93	86.25	25.80	22.02	3.61ijk	6.38	9.99ghi	36.07hij
CW5	115.20	10.85f	8.48fgh	2.38cde	21.81	84.25	27.85	22.05	3.31k	6.50	9.81hi	33.70jk
CW6	115.40	12.13bcde	8.69fg	3.44bcd	22.85	88.08	25.25	22.42	3.89ghij	6.45	10.34fghi	37.56fghi
CW7	115.38	12.81abc	9.00def	3.81bc	22.95	88.86	23.46	22.26	4.09fgh	6.67	10.76defg	38.02efghi
CW8	115.00	10.85f	7.43hi	3.43bcd	22.91	88.19	23.66	22.90	3.71hijk	5.91	9.62i	38.61cdefgh
CW9	116.39	12.85abc	9.05def	3.81bc	22.82	91.69	22.48	22.16	4.29cdefg	6.89	11.18cbef	38.18defghi
PW0	105.70	11.55def	8.41fhg	3.14bcd	22.55	78.32	28.63	22.11	2.15 l	4.25	6.40j	33.59jk
PW1	117.38	12.13bcde	9.03def	3.10bcd	23.56	80.75	27.46	22.38	4.25defg	6.22	10.47fghi	40.59abcde
PW2	117.88	12.63abcd	9.26bcdef	3.36bcd	22.87	82.59	22.93	22.51	4.27defg	6.53	10.80defg	39.54bcdefg
PW3	118.03	12.55abcde	9.46bcdef	3.09bcd	22.52	83.04	21.36	22.58	4.33cdefg	6.67	11.00cdef	39.36bcdefg
PW4	118.33	11.82cdef	9.41bcdef	2.42cde	21.86	82.99	24.43	22.47	4.19defg	6.62	10.81defg	38.72cdefgh
PW5	117.08	12.42abcde	9.15cdef	3.28bcd	21.22	84.24	26.54	22.54	3.97ghi	6.62	10.59efgh	37.53ghi
PW6	118.00	11.43ef	9.46bcdef	1.98de	22.71	86.15	24.48	22.66	3.96ghi	6.00	9.96ghi	39.78bcdefg
PW7	118.30	12.66abcd	10.01bcde	2.66cde	23.72	91.24	22.37	22.42	4.67bcd	6.90	11.57bcd	40.36abcdefg
PW8	117.20	11.85cdef	8.96ef	2.89cde	23.42	88.99	23.28	22.91	4.16efgh	6.44	10.60efgh	39.27bcdefg
PW9	119.73	13.08ab	10.15bcde	2.93cde	23.66	93.67	21.20	22.49	4.76bc	7.01	11.77bc	40.42abcdef
TW0	107.10	12.39abcde	9.28bcdef	3.12bcd	23.01	85.75	26.03	22.24	2.35 l	4.50	6.85j	34.32jk

Table 4: Continue

Land preparation method	Plant height (cm)	Total tillers hill G^{1} (no.)	Ear bearing tillers hillG^{1} (no)	Non-ear bearing tillers hill G^{1}	Panicle length (cm)	Grains panicleG^{1} (no.)	Sterile spike lets lets Panicle G^{1} (no)	1000 grain weight (g)	Grains yield (t haG^{1})	Straw yield (t haG^{1})	Biological yield (t haG^{1})	Harvest index (%)
TW1	119.62	12.86abc	9.52bcdef	3.35bcd	22.83	88.72	25.39	22.73	4.47bcdef	6.67	11.14cdef	40.13abcdefg
TW2	120.38	12.48abcde	10.01bcde	2.46cde	23.49	91.93	24.39	22.76	4.49bcdef	6.75	11.24cdef	39.95 abcdefg
TW3	121.93	12.58abcde	10.31bc	2.35cde	22.87	94.08	24.03	22.79	4.51bcdef	6.77	11.28cdef	39.98 abcdefg
TW4	121.55	13.25ab	10.38b	2.88cde	23.44	91.57	23.39	22.40	4.85ab	6.93	11.78bc	41.22abc
TW5	119.20	13.06ab	10.14bcde	2.84cde	23.71	89.36	25.15	23.00	4.63bcde	6.87	11.50bcde	40.26abcdefg
TW6	119.70	12.41abcde	10.14bcde	2.27cde	22.79	88.89	24.10	22.12	4.89ab	6.83	11.72bcd	41.71ab
TW7	121.80	13.20ab	10.46b	2.74cde	23.63	96.06	20.46	22.65	5.26a	7.03	12.29ab	42.76a
TW8	120.00	12.77abc	10.21bcd	2.56cde	23.22	93.84	22.25	22.40	4.59bcde	6.66	11.25cdef	40.79abcde
TW9	122.68	13.40a	12.05a	1.35e	24.37	97.53	20.36	22.71	5.28a	7.60	12.88a	40.99abcd
Sx	-	0.345	0.355	0.364	-	-	-	-	0.112	-	0.221	0.842
CV(%)	3.12	5.63	7.76	6.19	6.10	9.06	10.18	3.14	5.55	5.52	4.24	4.38
level of Significance	NS	0.05	0.05	0.01	NS	NS	NS	NS	0.01	NS	0.01	0.05

In a column, figures having a common letter(s) do not differ significantly. NS = Not significant; C= Land preparation by country plough ; P= Land preparation by power tiller, T= Land preparation by tractor; W_0 = No weeding; W_1 =One hand weeding at 21 DAT; W_2 = Two hand weeding at 21 and 42 DAT; W_3 = Three hand weeding at 21, 42 and 63 DAT; W_4 = Ronstar 25 EC@ 2.0 1 haG^{1} at pre-emergence; W_5 =2, 4-D amine @ 1.84 $lhaG^{1}$ at 42 DAT; W_6 = Ronstar 25EC @ 2.0 $1haG^{1}$ at pre-emergence + 2,4-D amine @ 1.84 $1haG^{1}$ at 42 DAT; W_7 = Ronstar 25 EC@ 2.0 $1haG^{1}$ at pre-emergence + one hand weeding at 42 DAT; W_8 = One hand weeding at 21 DAT + 2, 4 amine @ 1.84 $1haG^{1}$ at 42 DAT and W_9 = Weed free.

Table 5: Labor cost in country plough cultivation of transplant aman rice under different weeding regime

	Labor (human, animal) cost (Tk. haG^{1})									
Production activities	W_0	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9
1. Seedbed preparation and seeding	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00
2. Land preparation	320.00	3200.00	3200.00	3200.00	3200.00	3200.00	3200.00	3200.00	3200.00	3200.00
3.Uprooting of seedling	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00
4.Fertilizar application	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00
5. Transplanting	1700.00	1700.00	1700.00	1700.00	1700.00	1700.00	1700.00	1700.00	1700.00	1700.00
6. Weed control	-	1000.00	1750.00	2500.00	150.00	150.00	300.00	650.00	850.00	6000.00
7. Irrigation	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
8. Insect control	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
9. Guard against birds, animals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
10. Harvesting	1500.00	1750.00	1800.00	1850.00	1850.00	1800.00	1850.00	1900.00	1850.00	1900.00
11. Post harvest operation	1100.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1700.00	1500.00	1700.00
Total labor cost (haG^{1})	8700.00	10350.00	11150.00	11950.00	9600.00	9550.00	9750.00	10350.00	10300.00	15700.00

W_0 = No weeding; W_1 =One hand weeding at 21 DAT; W_2 = Two hand weeding at 21 and 42 DAT, W_3 = Three hand weeding at 21, 42 and 63 DAT; W_4 = Ronstar 25 EC@ 2.0 $1haG^{1}$ at pre-emergence; W_5 =2, 4-D amine @ 1.84 $lhaG^{1}$ at 42 DAT; W_6 = Ronstar 25EC @ 2.0 $lhaG^{1}$ at pre-emergence + 2,4-D amine @ 1.84 $1haG^{1}$ at 42 DAT; W_7 = Ronstar 25 EC@ 2.0 $lhaG^{1}$ at pre-emergence + one hand weeding at 42 DAT; W_8 = One hand weeding at 21 DAT + 2, 4 amine @ 1.84 $1haG^{1}$ at 42 DAT and W_9 = Weed free.

Table 6: Labor cost in tractor cultivation of transplant *aman* rice under different weeding regime

	Labor (human, animal, mechanical) cost (Tk. haG^{1})									
Production activities	W_0	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9
1. Seedbed preparation and seeding	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00
2. Land preparation	1617.00	1617.00	1617.00	1617.00	1617.00	1617.00	1617.00	1617.00	1617.00	1617.00
3.Uprooting of seedling	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00
4.Fertilizar application	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00	250.00
5. Transplanting	1700.00	1700.00	1700.00	1700.00	1700.00	1700.00	1700.00	1700.00	1700.00	1700.00
6. Weed control	-	800.00	1550.00	2300.00	150.00	150.00	300.00	500.00	700.00	5850.00
7. Irrigation	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
8. Insect control	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
9. Guard against birds, animals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
10. Harvesting	1800.00	1850.00	1900.00	1900.00	1900.00	1850.00	1850.00	1950.00	1900.00	2050.00
11. Post harvest operation	1700.00	1700.00	1800.00	1800.00	1800.00	1700.00	1700.00	2000.00	1800.00	2200.00
Total labor cost (haG^{1})	8017.00	8867.00	9767.00	10517.00	8367.00	8217.00	8367.00	8967.00	8917.00	14617.00

W_0 = No weeding; W_1 =One hand weeding at 21 DAT; W_2 = Two hand weeding at 21 and 42 DAT; W_3 = Three hand weeding at 21, 42 and 63 DAT; W_4 = Ronstar 25 EC@ 2.0 $1haG^{1}$ at pre-emergence; W_5 =2, 4-D amine @ 1.84 $lhaG^{1}$ at 42 DAT; W_6 = Ronstar 25EC @ 2.0 $1haG^{1}$ at pre-emergence + 2,4-D amine @ 1.84 $1haG^{1}$ at 42 DAT; W_7 = Ronstar 25 EC@ 2.0 $1haG^{1}$ at pre-emergence + one hand weeding at 42 DAT; W_8 = One hand weeding at 21 DAT + 2, 4 amine @ 1.84 $1haG^{1}$ at 42 DAT and W_9 = Weed free.

Table 7: Net return (+) or loss (-) and benefit-cost ratio in transplant *aman* rice in relation to different weeding regime under country plough cultivation.

	Weeding regime									
Particulars	W_0	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9
1.Total cost of production (Tk. haG^1)	22632.16	24430.66	25302.66	26174.66	25335.36	24561.46	26501.66	26152.86	25378.96	30262.16
2. Total cost for weed control	-	1000.00	1750.00	2500.00	1730.00	1070.00	2800.00	2230.00	1770.00	6000.00
3.Out put (Yield) (t haG^1)										
a) Product (grain)	2.00	3.44	3.51	3.56	3.61	3.31	3.89	4.09	3.71	4.29
b) By -product (straw)	4.05	6.11	6.22	6.38	6.38	6.50	6.45	6.67	591	6.89
4. Gross return (Tk. haG^1)	18787.50	31672.50	32306.25	32820.00	33213.75	309.41.25	35471.25	37211.25	33648.75	38951.25
a) Product (grain)	15750.00	27090.00	27641.25	28035.00	28428.75	26066.25	30633.75	322 08.75	29216.25	33783.75
b)By -product (straw)	3037.50	4582.50	4665.00	4785.00	4785.00	4875.00	4837.50	5002.50	4432.50	5167.50
5. Net return (+) loss (-) (Tk.haG^1)	-3844.66	+7241.84	+7003.59	+6645.34	+7878.39	+6379.79	+8969.59	+11058.39	+8269.79	+8689.09
6. Benefit-cost ratio	0.83	1.30	1.28	1.25	1.31	1.26	1.34	1.42	1.33	1.29

Price of unhusked grain = Tk. 7.875 kgG^1; Price of straw = Tk. 0.75 kgG^1; W_0 = No weeding; W_1 =One hand weeding at 21 DAT; W_2 = Two hand weeding at 21 and 42 DAT; W_3 = Three hand weeding at 21, 42 and 63 DAT; W_4 = Ronstar 25 EC@ 2.0 1haG^1 at pre-emergence; W_5 =2, 4-D amine @ 1.84 l haG^1 at 42 DAT; W_6 = Ronstar 25EC @ 2.0 1haG^1 at pre-emergence + 2,4-D amine @ 1.84 1 haG^1 at 42 DAT; W_7 = Ronstar 25 EC@ 2.0 1haG^1 at pre-emergence + one hand weeding at 42 DAT; W_8= One hand weeding at 21 DAT + 2, 4 amine @ 1.84 1haG^1 at 42 DAT and W_9 = Weed free.

Table 8: Net return (+) or loss (-) and benefit cost ratio in transplant aman rice in relation to different weeding regime under country plough cultivation.

	Weeding regime									
Particulars	W_0	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9
1.Total cost of production (Tk. haG^1)	22495.91	23585.91	24512.41	25329.91	24654.11	23825.71	25711.41	25362.61	24588.71	29798.91
2. Total cost for weed control	-	850.00	1600.00	2350.00	1730.00	1070.00	2800.00	2130.00	1670.00	5900.00
3.Output (Yield) (t ha$^{-1)}$	2.15	4.25	4.27	4.33	4.19	3.97	3.96	4.67	4.16	4.76
a) Product (grain)	4.25	6.22	6.53	6.67	6.62	6.62	6.00	6.90	6.44	7.01
b) By -product (straw)	20118.75	38133.75	38523.75	39101.25	37961.25	36228.75	35685.00	41951.25	37590.00	42742.50
4. Gross return (Tk. haG^1)	16931.25	33468.75	33626.25	34098.75	32996.25	31263.75	31185.00	36776.25	32760.00	37485.00
a) Product (grain)	3187.50	4665.00	4897.50	5002.50	4965.00	4965.00	4500.00	5175.00	4830.00	5257.50
b)By -product (straw)	-2377.16	+14547.84	+14011.34	+13571.34	+13307.14	+12403.04	+9973.59	+16588.64	+13001.29	+12943.59
5. Net return or (+) loss (-) (Tk.haG^1)	0.89	1.62	1.57	1.54	1.54	1.52	1.39	1.65	1.53	1.43
6. Benefit-cost ratio										

Price of unhusked grain = Tk. 7.875 kgG^1; Price of straw = Tk. 0.75 kgG^1; W_0 = No weeding; W_1 =One hand weeding at 21 DAT; W_2= Two hand weeding at 21 and 42 DAT; W_3= Three hand weeding at 21, 42 and 63 DAT; W_4 = Ronstar 25 EC@ 2.0 1haG^1 at pre-emergence; W_5 =2, 4-D amine @ 1.84 lhaG^1 at 42 DAT; W_6 = Ronstar 25EC @ 2.0 1haG^1 at pre-emergence + 2,4-D amine @ 1.84 1haG^1 at 42 DAT; W_7 = Ronstar 25 EC@ 2.0 1haG^1 at pre-emergence + one hand weeding at 42 DAT; W_8 = One hand weeding at 21 DAT + 2, 4 amine @ 1.84 1haG^1 at 42 DAT and W_9 = Weed free.

Table 9: Net return (+) or loss (-) and benefit cost ratio in transplant *aman* rice in relation to different weeding regime under tractor cultivation.

	Weeding regime									
Particulars	W_0	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9
1.Total cost of production (Tk. haG^1)	21887.69	22814.19	23795.19	24612.69	23991.39	23108.49	24994.19	24645.39	23871.49	29081.69
2. Total cost for weed control	-	800.00	1550.00	2300.00	1730.00	1070.00	2800.00	2080.00	1620.00	5850.00
3.Out put (Yield) (t haG^1)										
a) Product (grain)	2.35	4.47	4.49	4.51	4.85	4.63	4.89	5.26	4.59	5.28
b) By -product (straw)	4.50	6.67	6.75	6.77	6.93	6.87	6.83	7.03	6.66	7.60
4. Gross return (Tk. haG^1)	21881.25	40203.75	40421.25	40593.75	43391.25	41613.75	43631.25	46695.00	41141.25	47280.00
a) Product (grain)	18506.25	35201.25	35358.75	35516.25	38193.75	36461.25	38508.75	41422.50	36146.25	41580.00
b)By -product (straw)	3375.00	5002.50	5062.50	50 77.50	5197.50	5152.50	5122.50	5272.50	4995.00	5700.00
5. Net return (+) loss (-) (Tk.haG^1)	- 6.44	+17389.56	+16626.06	+15981.06	+19399.86	18505.26	+ 18637.06	+22049.61	+17269.76	+18198.31
6. Benefit-cost ratio	0.999	1.76	1.70	1.65	1.81	1.87	1.75	1.89	1.72	1.63

Price of unhusked grain = Tk. 7.875 kgG^1; Price of straw = Tk. 0.75 kgG^1; W_0 = No weeding; W_1 =One hand weeding at 21 DAT; W_2 = Two hand weeding at 21 and 42 DAT; W_3 = Three hand weeding at 21, 42 and 63 DAT; W_4 = Ronstar 25 EC@ 2.0 1 haG^1 at pre emergence; W_5 =2, 4-D amine @ 1.84 haG^1 at 42 DAT; W_6 = Ronstar 25EC @ 2.01 haG^1 at pre-emergence + 2,4-D amine @ 1.84 1 haG^1 at 42 DAT; W_7 = Ronstar 25 EC@ 2.0 1 haG^1 at pre emergence + one hand weeding at 42 DAT; W_8 = One hand weeding at 21 DAT + 2, 4 amine @ 1.84 1 haG^1 at 42 DAT and W_9 = Weed free.

may be seen that at any weeding regime cost of production varied according to methods of land preparation. It was highest in the plots prepared by country plough, which was followed that in the plots prepared by power tiller and it was lowest in the plots prepared by tractor. Again, in any method of land preparation, cost of production was highest in the weed free crop and lowest in crops receiving no weeding. This was because of the fact that weeds free crop required highest weeding cost due to frequent weeding to keep the crop weed free.

On the other hand, the crop receiving no weeding required no weeding cost. Among the one hand weeding, two hand weeding, three hand weeding, Ronstar 25 EC @

2.0 1haG^{1}, 2,4-D amine @ 1.84 1 haG^{1}, Ronstar 25 EC @ 2.0 1haG^{1} + 2, 4-D amine @ 1.84 1haG^{1}, Ronstar 25 EC @ 2.0 1haG^{1}+ one hand weeding, One hand weeding + 2,4-D amine @ 1.84 1haG^{1}, the cost of production was lowest in the crop weeded by one hand weeding and the highest in the crop weeded by Ronstar 25 EC @ 2.0 lhaG^{1} + 2, 4-D amine @ 1.84 1haG^{1} ,irrespective of method of land preparation. This variation in the cost of production occurred, as these tables indicate, due to difference in the labor cost, the herbicide cost and the overhead cost. The material input cost viz cost of seed, fertilizer, water for irrigation and insecticide was the same irrespective of methods of land preparation and weeding regime. The material input cost of herbicide though differed according to weeding regime; it did not differ with respect to methods of land preparation.

Irrespective of weeding regime, cost of labor for nursery bed preparation, uprooting of seedling, fertilizer application, transplanting, irrigation, insect control, guard against bird and animals was the same whether the land was prepared by country plough, power tiller or tractor (Table 5, 6 and 7). It differed in case of land preparation, weeding, harvesting and post harvest operation.

Irrespective of weeding regime labor cost for land preparation by country plough, power tiller and tractor was Tk. 3200, Tk. 2475 and Tk.1617 haG^{1}, respectively (Table 5, 6 and 7). This difference in the labor cost for land preparation was accounted for the difference in the (i) number of ploughing needed and (ii) the time needed to perform each ploughing.

At any weeding regime, labor cost for weeding was highest in the crop raised in country plough prepared plots and lowest the crop raised in tractor prepared plots (Table 5,6,7), Labor for weeding in the crop raised in power tiller prepared plots was in between the labor costs for country plough and factor prepared plots. This difference in the labor cost for weeding was accounted for the difference in weed infestation. From Appendix VII, it may be seen that compared to those in country plough, weed density and weed dry weight were 44.46 and 46.35%, respectively, lower in power tiller and 56.40 and 63.12%, respectively, lower in tractor. Irrespective of methods of land preparation, labor cost for weeding was the highest in case of weed free treatment (Table 5, 6 and 7). Because, it required frequent weeding to keep the plot weed free. Next to it was labor cost for three hand weeding which was followed by that in two hand weeding and one hand weeding. It is natural that three weeding will require more labor than one or two weeding. Labor cost for chemical weeding by Ronstar 25 EC @ 2.0 1haG^{1} or 2, 4-D amine @ 1.84 1haG^{1} was the lowest. It increased in Ronstar 25 EC @ 2.0 1haG^{1} + 2, 4-D amine @ 1.84 1ha^{-1} was the lowest. It increased in Ronstar 25 EC @ 2.0 1haG^{1} + 2, 4-D amine @ 1.84 1haG^{1}, Ronstar 25 EC @ 2.0 1haG^{1} + One hand weeding and one hand weeding + 2, 4-D amine @ 1.84 1haG^{1} because of addition one herbicide with the other or one hand weeding with the herbicide.

Irrespective of weeding regime, labor cost for crop harvest was highest in tractor prepared plot and lowest in country plough prepared plot that for power tiller prepared plots occupying a mid value between these two. This difference of harvesting cost among the crops raised by these three methods was accounted for the difference in the crop performance (bulk of crop). It may be seen form table 12 that crop performance in respect of yield, yield attributes and biological yield were the superior - most in case of crop raised in tractor prepared plots and inferior most in case of country plough prepared plots. Harvesting of weed free crop incurred the harvest labor cost followed by the crop weeded by one hand weeding + 2, 4-D amine @ 1.84 1haG^{1}, The labor cost for harvesting the crop weeded by three hand weeding, Ronstar 25 EC @ 2.0 1haG^{1}, Ronstar 25 EC @ 2.0 1haG^{1} +2, 4-D amine @ 1.84 1haG^{1} and 2, 4-D amine @ 1.84 1haG^{1} + one hand weeding was the same. It was lowest in case of no weeding. The difference in the labor cost for harvesting the crops raised under different weeding regime was attributed to differential crop performance.

As regard to labor cost for the all of post harvest operative viz. carrying, threshing, cleaning, drying weighing and bagging. It may be seen that in any weeding regime, the cost of post harvest operation was highest in the crop raised in the tractor prepared plots and the lowest in the country plough and that for the crop raised in the tractor prepared plots and the lowest in the country plough and that for the crop raised in power tiller was in between that for country plough and tractor (Table 5, 6 and 7). The reason for this difference was the same as that discussed in case of harvesting cost. The labor cost for post harvest operation was highest in case of weed free crop which was followed by the crop weeded by Ronstar 25 EC @ 2.0 1haG^{1} + one hand weeding . The lowest labor cost for post harvest operation was required for the crop not weeded at all. This difference of labor cost for post harvest operations was also attributed to differential performance of crop in response to weeding regime. The price of Ronstar 25 EC @ 2.0 1haG^{1} and 2, 4-D amine @ 1.84 1haG^{1} was not the same; it was higher in case of Ronstar 25 EC. So, the cost of herbicide in case of Ronstar

25 EC @ 2.0 1haG^{1} treated crop was higher than that in the 2, 4-D amine@ 1.84 1haG^{1} treated crops. The cost of herbicide in Ronstar 25 EC @ 2.0 1haG^{1} + 2, 4-D amine @ 1.84 1haG^{1} treated crops would definitely he higher than that in the crop weeded by either of the herbicide singly. Overhead cost was considered to be the sum total of the (i) interest on input cost, (ii) interest on value of land and (iii) miscellaneous cost which was taken to be 5% of plant cost. As the interest on the value of land was the same irrespective of methods of land preparation and weeding regime. The difference on the overhead cost was attributed to difference in the input cost with respect to methods of land preparation and weeding regime (Table 1, 2 and 3). Irrespective of weeding regime, the highest net return as well as the highest benefit-cost ratio was obtained from the land prepared by tractor and the lowest from that prepared by country plough, net return and benefit-cost ratio in the plots prepared by power tiller were in -between those of country plough and tractor (Table 8, 9 and 10). However, irrespective of methods of land preparation, net return and benefit-cost ratio were highest in the crop weeded by Ronstar 25 EC @ 2.0 1haG^{1} + one hand weeding. So, considering the weed control efficiency and agro-economic performance of transplant *amn* rice in respect to methods of land preparation and weeding regime, in the context of the present study, recommendation should go for land preparation by tractor and weed control by Ronstar 25 EC @ 2.0 1haG^{1}+ one hand weeding. In the absence of tractor, if however, power tiller is available, performance should be given to land preparation by power tiller over than land preparation by country plough. If, however, herbicide is not available and the weeds to be controlled by hand weeding, then one hand weeding at 21 DAT is recommended. This is because of the fact that, irrespective of methods of land preparation, the net return and benefit-cost ratio were higher in one hand weeding at DAT than either two hand weeding or three hand weeding. Hand weeding more than once would be just wastage of money and energy. On the other hand, where there is scarcity of labor and the situation demands the use of herbicide for controlling the weeds, one should go for controlling weeds by Ronstar 25 EC @ 2.01 haG^{1}. As because, compared to those in 2, 4-D amine @ 1.84 1haG^{1}, the net return and benefit-cost ratio were higher, irrespective of methods of land preparation, in Ronstar 25 EC @ 2.0 1haG^{1}. Moreover, Ronstar 25 EC @ 2.0 1haG^{1} was only slightly toxic to the rice plants, from which the rice plants recovered within only 8 to 10 days and it eliminated the competition from weeds at the very early crop growth stage, 2, 4-D amine @ 1.84 1haG^{1}, on the other hand, should not be recommended as because it is a post-emergence herbicide and it is usually applied 42 days after transplanting. During this period weeds growing in the field may cause a serious damage to the crop. Moreover, through 2, 4-D amine @ 1.84 l haG^{1} was found to be less toxic than the Ronstar 25 EC @ 2.0 1haG^{1}.

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