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### An Economics Analysis of Rice Production in Tripura, India

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#### ABSTRACT

This study on production of rice in the all district of Tripura is based on the data collected from 160 rice producers from Khowai, Sepahijala, Unakoti, Dhalai, North, South, West and Gumati district during 2014-15. The costs on manures (21.72 %), hired male labour (14.90 %), have emerged as the major components in the total variable costs. The overall total cost on cultivation (Cost C<sub>3</sub>) of rice was found to be ₹42734.68 per ha and the overall return over Cost C<sub>3</sub> was ₹42220.77 per ha. The results of the study revealed that rice cultivation in Tripura is a profitable enterprise as the returns per rupee invested have been found to be ₹1.99 on overall basis.

#### 1. Introduction

Rice is one of the important food crops in the world and ranks second in terms of area and production. It is the staple food for about 50% of the population in Asia, where 90% of the world's rice is grown and consumed. Asia's food security depends largely on the irrigated rice fields, which account for more than 75% of the total rice production (Virk et al. 2004). The North-Eastern India is a chicken-necked region, connected to the mainland with a narrow corridor and surrounded by international boundaries of Bangladesh, Bhutan and China. North-Eastern India consists of seven states namely Assam, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Tripura long with Sikkim having an area of 255.08 million hectares which is about 8% of country's land mass. Area under paddy cultivation is 885 thousand ha with the production of 1804 thousand ton (Anonymous 2010). It occupies 8% area under rice. Tripura is the second largest producer of rice in the North-Eastern region after Assam. During 2011-12 the area covered under paddy cultivation in Tripura was 266 thousand ha with production of 718 thousand ton.

In Tripura Rice is the principle crop of the state covering 78% of cultivable area. Rice is practiced in all three season *i.e.* *Aush*, *Aman* and *Boro* in Tripura. It is grown in upland as well as in low land. Paddy production during the last decade was observed to be fluctuated between 0.74 to 0.93 million tonnes and the productivity ranged from 2.9 to 3.7 t ha<sup>-1</sup> in the state. Besides providing livelihood opportunities to millions of farmers in India, cultivation of paddy crop directly provides employment opportunities to the rural labourers who are relying on agriculture for their livelihood. Unlike the other crops, paddy, which is also paid as wage (in kind) to the agricultural workers after harvesting in most part of south Asia, also helps to reduce poverty of those families working in the paddy field to a greater extent.

#### 2. Material and Method

The state was selected purposely based on higher area concentration under rice cultivation. The eight districts viz., Khowai, Sepahijala, Unakoti, Dhalai, North, South, West and Gumati of Tripura state were selected purposively for the study based on the criteria of maximum production and sale of rice. A list of rice growing farmers from eight districts was prepared and a total of 160 farmers were selected randomly. For the study, primary data relating to agricultural year 2014-15 were collected from the selected farmers through personal interview using a set of pretested schedules developed specially for the purpose.

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**Table 1.** Per hectare input utilization of selected rice cultivators

Sl. No	Particulars	Unit	District								
			Khowai	Sepahijala	Unakoti	Dhalai	North	South	West	Gumati	Overall
1	Hired Human Labour										
a	Male	Days	29.40	28.01	22.51	23.13	17.81	23.17	26.40	22.82	24.16
b	Female	Days	4.76	1.67	4.62	3.97	4.60	5.92	7.21	5.57	4.79
2	Family Labour										
a	Male	Days	35.56	30.02	22.26	30.49	19.41	34.21	19.71	39.26	28.87
b	Female	Days	5.41	6.47	1.09	1.98	1.50	4.58	1.23	4.89	3.39
3	Machinery	Hours	7.99	6.76	7.55	6.32	7.87	7.21	7.65	8.21	7.45
4	Seed	Kgs.	36.91	35.31	37.81	39.53	36.40	39.68	37.50	33.25	37.05
5	Manure	Kgs.	2361.00	2482.80	2521.65	2543.70	2491.66	2387.43	2492.95	2568.80	2481.25
6	Fertilizer										
a	Urea	Kgs.	78.27	73.50	81.20	74.20	86.55	77.79	88.35	83.80	80.46
b	SSP	Kgs.	153.11	174.36	168.09	173.70	169.60	171.40	185.10	179.31	171.83
c	MOP	Kgs.	38.20	35.40	39.60	35.90	30.68	32.60	38.00	33.10	35.44
d	ZnSO4	Kgs.	6.73	5.52	9.28	6.14	4.41	5.05	3.65	6.45	5.91
e	Bio-Fertilizer	Kgs.	2.80	3.91	6.56	2.44	2.18	2.69	3.52	2.99	3.39

**2.1 Cost concepts**

The cost concepts approach to farm costing is widely used in India (Raju and Rao 1990).The cost of cultivation of rice was worked out by using by Commission on Agriculture Cost and Prices (CACP) concept.

Cost A<sub>1</sub> = All actual expenses in cash and kind incurred in production by the producer. The items covered in cost A<sub>1</sub> are costs on: i) third human labour, ii) hired bullock labour., iii) owned bullock labour, iv) home produced/purchased seed, v) plant protection chemicals, vi) home produced/purchased manure, vii) fertilizers, viii) insecticides and pesticides, ix) depreciation on farm machinery, equipment and farm building, x) irrigation, xi) land revenue, land development tax and other taxes, xii) interest on working capital, xiii) interest on crop loan and xiv) miscellaneous expenses.

Cost A<sub>2</sub> = Cost A<sub>1</sub> + Rent paid for leased-in land.

Cost B<sub>1</sub> = Cost A<sub>1</sub> + Interest on value of owned capital assets (excluding land).

Cost B<sub>2</sub> = Cost B<sub>1</sub> + Rental value of owned land (net of land revenue) and rent paid for leased-in land.

Cost C<sub>1</sub> = Cost B<sub>1</sub> + Imputed value of family labour.

Cost C<sub>2</sub> = Cost B<sub>2</sub> + Imputed value of family labour.

Cost C<sub>2</sub>\* = Cost C<sub>2</sub> + estimated by taking into account or actual wage rate whichever is higher.

Cost C<sub>3</sub> = Cost C<sub>2</sub>\* + 10% Cost C<sub>2</sub>\* to (on account of managerial functions performed by farmers).

**2.2 Efficiency of production function**

This study utilized a Cobb-Douglas production function model to empirically quantify the relative influence of various factors in the decision as,

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} \dots \dots \dots X_n^{b_n}$$

Transforming into logarithmic linear form-

$$\text{Log } Y = \text{log } a + b_1 \text{ log } X_1 + b_2 \text{ log } X_2 + b_3 \text{ log } X_3 + b_4 \text{ log } X_4 \dots \dots \dots + b_n \text{ log } X_n + u$$

Where, Y is the crop output Value, 'a' is constant or intercept term, 'X<sub>1</sub> , X<sub>2</sub> , X<sub>3</sub> , X<sub>4</sub>.....X<sub>n</sub>' is Hired Human Labour, Family Labour, Machinery Labour, Seeds, Manures and Fertilizer, Irrigation Charges, Plant Protection etc. Variables, b<sub>i</sub> (i = 1 to n) is the regression coefficients of factor inputs and 'u' is the Error-term.

**3. Results and Discussion**

Cost of production generally refers to cost of production per unit of output. Normally in economics, the cost of production and cost of cultivation are used synonymously to convey the cost of cultivation per hectare and cost of production per quintal. The cost were determined on the basis of common cost concepts having different unity of different individual like researchers, cultivator, institution, or in policy decision are useful in estimating returns to the various factors of production.

**Table 2.** Per Ha Variable and Fixed costs (₹/Ha) in cultivation of Rice crop

Sr. No	Particulars	District								
		Khowai	Sepahijala	Unakoti	Dhalai	North	South	West	Gumati	Overall
<b>A</b>	<b>Variable costs</b>									
1	Hired Human Labour									
a	Male	7362.00 17.64	6945.00 17.47	5295.00 14.36	5481.00 14.48	3885.00 11.38	5493.00 13.77	6462.00 16.93	5388.00 12.71	5788.88 14.90
b	Female	1032.92 2.48	362.39 0.91	1002.54 2.72	861.49 2.28	998.20 2.92	1284.64 3.22	1564.57 4.10	1208.69 2.85	1039.43 2.68
2	Family Labour									
a	Male	6765.00 16.21	5380.00 13.54	3440.00 9.33	5497.50 14.53	2727.50 7.99	6427.50 16.11	2802.50 7.34	7690.00 18.15	5091.25 13.10
b	Female	1082.00 2.59	1294.00 3.26	218.00 0.59	396.00 1.05	300.00 0.88	916.00 2.30	246.00 0.64	978.00 2.31	678.75 1.75
3	Machinery Labour	3995.00 9.57	3380.00 8.50	3775.00 10.24	3160.00 8.35	3935.00 11.52	3605.00 9.04	3825.00 10.02	4105.00 9.69	3722.50 9.58
4	Seeds	703.65 1.69	529.65 1.33	567.15 1.54	592.95 1.57	636.00 1.86	595.20 1.49	562.50 1.47	618.75 1.46	600.73 1.55
5	Manures	8027.40 19.24	8441.52 21.24	8573.61 23.25	8648.58 22.85	8471.64 24.81	8117.26 20.35	8476.03 22.20	8733.92 20.61	8436.25 21.72
6	Fertilizer									
a	Urea	645.75 1.55	679.88 1.71	751.10 2.04	760.51 2.01	800.58 2.34	719.52 1.80	905.54 2.37	858.99 2.03	765.23 1.97
b	SSP	1531.10 3.67	1569.24 3.95	1344.72 3.65	1650.15 4.36	1696.00 4.97	1628.30 4.08	2036.10 5.33	1613.79 3.81	1633.68 4.21
c	MOP	662.77 1.59	649.59 1.63	766.26 2.08	622.87 1.65	593.66 1.74	630.81 1.58	735.30 1.93	640.49 1.51	662.72 1.71
d	ZnSO4	538.37 1.29	414.34 1.04	761.11 2.06	497.73 1.32	343.67 1.01	388.94 0.97	284.95 0.75	516.30 1.22	468.18 1.21
e	Bio-Fertilizer	279.82 0.67	382.81 0.96	636.60 1.73	246.60 0.65	215.90 0.63	280.17 0.70	334.51 0.88	272.01 0.64	331.05 0.86
7	Irrigation Charges	1120.37 2.69	932.54 2.35	1165.38 3.16	1258.56 3.33	1276.41 3.74	1274.71 3.19	1363.57 3.57	1158.63 2.73	1193.77 3.07
8	Plant Protection	882.02 2.11	865.32 2.18	844.61 2.29	917.53 2.42	1052.10 3.08	948.42 2.38	897.82 2.35	806.32 1.90	901.77 2.32
9	Repairing Charges	358.19 0.86	333.25 0.84	258.60 0.70	308.74 0.82	287.81 0.84	325.60 0.82	354.99 0.93	353.63 0.83	322.60 0.83
10	Others	105.33 0.25	112.80 0.28	115.67 0.31	142.23 0.38	132.64 0.39	121.28 0.30	127.36 0.33	109.66 0.26	120.87 0.31
<b>Total Variable costs</b>		<b>35091.71</b> <b>84.10</b>	<b>32272.33</b> <b>81.20</b>	<b>29515.35</b> <b>80.03</b>	<b>31042.44</b> <b>82.03</b>	<b>27352.12</b> <b>80.09</b>	<b>32756.35</b> <b>82.10</b>	<b>30978.74</b> <b>81.14</b>	<b>35052.19</b> <b>82.71</b>	<b>31757.65</b> <b>81.68</b>
<b>B</b>	<b>Fixed costs</b>									
1	Interest on Working Capital @ 6%	2014.35 4.83	1973.39 4.96	2015.60 5.47	1948.98 5.15	1856.16 5.44	1909.52 4.79	2069.70 5.42	2053.62 4.85	1980.17 5.10
2	Depreciation	426.28 1.02	410.62 1.03	344.95 0.94	376.54 1.00	353.81 1.04	412.60 1.03	432.36 1.13	421.72 1.00	397.36 1.02
3	Land Revenue	41.78 0.10	38.72 0.10	40.22 0.11	43.25 0.11	40.92 0.12	44.21 0.11	39.31 0.10	41.37 0.10	41.22 0.11
4	Rental Value of Land	3936.23 9.43	4810.32 12.10	4724.65 12.81	4212.39 11.13	4328.65 12.68	4544.47 11.39	4426.33 11.59	4573.19 10.79	4444.53 11.44
5	Interest on Fixed Capital @ 10%/ Annum	213.95 0.51	241.10 0.61	237.51 0.64	219.37 0.58	219.32 0.64	230.36 0.58	232.26 0.61	236.33 0.56	228.78 0.59
<b>Total Fixed costs</b>		<b>6632.60</b> <b>15.90</b>	<b>7474.15</b> <b>18.80</b>	<b>7362.93</b> <b>19.97</b>	<b>6800.54</b> <b>17.97</b>	<b>6798.86</b> <b>19.91</b>	<b>7141.16</b> <b>17.90</b>	<b>7199.96</b> <b>18.86</b>	<b>7326.23</b> <b>17.29</b>	<b>7092.05</b> <b>18.26</b>
<b>Total (A+B)</b>		<b>41724.30</b> <b>100.00</b>	<b>39746.48</b> <b>100.00</b>	<b>36878.29</b> <b>100.00</b>	<b>37842.98</b> <b>100.00</b>	<b>34150.98</b> <b>100.00</b>	<b>39897.51</b> <b>100.00</b>	<b>38178.70</b> <b>100.00</b>	<b>42378.42</b> <b>100.00</b>	<b>38849.71</b> <b>100.00</b>

Note: Figure in parentheses indicates % to the total cost

In overall variable Costs, the expenditure was highest on manures (21.72%), followed by hired male labour (14.90%), total male family labour (13.10 %) and machine labour (9.58%) with the significant utilization of 2481.25 kgs manures (6.51\*\*\*), 24.16 days male hired labour, 28.87 days male family labour and 7.45 hours machine labour (1.48\*). Thus, manures were main component of variable Cost. The higher use of manures on overall farms was attributed to lesser use of total fertilizer, i.e. 9.96%. Another major component of the variable cost was found to be hired male labour, which was maximum on khowai (17.64%), followed by Sepahijala (17.47%), Dhalai (14.36%) farms. The share of cost of plant protection in variable cost ranged from 1.90 to 3.08% on different farm groups with the overall value of 2.32%. The share of total variable cost observed to be fluctuated from 80.09 to 84.10% on different farm groups with the overall value of 81.68% whereas, the share of cost of total fixed cost ranged from 15.90 to 19.97% on different farm groups with the overall value of 18.26%. The rental value of land found to be was major component of the overhead costs.

The nitrogenous fertilizer application was observed to be highest by the farmers of west district followed by others. The overall level of utilization of nitrogen, phosphorus and potassium were worked out to be 80.46 kg, 171.83 kg and 35.44 kg, respectively. The study also revealed that (Table 3) the overall level of input use efficiency or production function was influenced by hired human labour, family labour, machinery labour, seeds, manures, MOP, ZnSO<sub>4</sub> and irrigation charges significantly. Cost structure of the crop was analysed by working out the share of each item in the total cost of cultivation. The overall total cost on cultivation (Cost C<sub>3</sub>) of rice was found to be ₹42734.68 per ha, being highest on Gumati district (₹46616.26/ha) followed by Khowai (₹45896.73/ha) and South (₹43887.26/ha) farms. The lowest total cost on cultivation (Cost C<sub>3</sub>) of rice was observed in North district (₹37566.08/ha). The overall Cost A1 was found to be ₹8406.40 per ha, and was also highest on West district (₹30471.61/ha), followed by Khowai (₹9727.12/ha) and Gumati (₹8900.90/ha) among the selected farms. The overall gross income from rice cultivation was found to be ₹84955.44 per ha (Table 5) among the selected farms.

**Table 3.** Efficiency of production function in cultivation of Rice crop

Variables	Khowai	Sepahijala	Unakoti	Dhalai	North	South	West	Gumati	Overall
Intercept	18268	84055	32972	44619	26106	240094	403112	7013	34595
Hired Human Labour	1.43 (0.13)	0.36 (0.65)	1.50 (0.77)	1.13 (0.62)	9.06** (2.00)	28.91 (1.03)	3.86 (0.56)	7.59 (1.08)	2.48*** (2.10)
Family Labour	9.30 (0.78)	0.59 (0.37)	4.28** (2.20)	2.38 (2.07)	7.76 (1.30)	8.20 (1.25)	18.83** (1.99)	3.99 (1.17)	2.09*** (2.82)
Machinery Labour	17.93 (0.59)	0.96 (0.43)	6.77*** (3.27)	11.12 (3.13)	13.64** (2.08)	8.65 (0.40)	19.15 (0.98)	2.30 (0.19)	6.51*** (3.51)
Seeds	63.36 (0.74)	1.77 (0.20)	8.15 (0.45)	18.83 (1.07)	49.79* (1.53)	84.30 (0.54)	98.92 (0.91)	14.76 (0.15)	32.59** (2.26)
Manures	3.33 (0.45)	0.46* (1.60)	1.28 (1.14)	1.46 (1.37)	0.31 (0.17)	20.66 (0.97)	0.19 (0.04)	6.60* (1.33)	1.48* (1.58)
Urea	120.87 (0.34)	1.67 (0.44)	2.98 (0.28)	0.85 (0.08)	9.65 (0.51)	11.85 (0.20)	23.34 (0.43)	30.17 (0.67)	2.61 (0.28)
SSP	51.18 (0.97)	0.63 (0.39)	8.47 (0.96)	8.11 (1.14)	1.30 (0.13)	26.54 (0.43)	8.18 (0.34)	5.30 (0.34)	4.15 (1.01)
MOP	37.94 (0.44)	3.03 (0.15)	19.83 (1.17)	21.44 (1.08)	17.30 (0.65)	114.70 (0.61)	19.04 (0.31)	15.71 (0.36)	43.67*** (3.91)
ZnSO <sub>4</sub>	41.06** (1.99)	3.11 (0.19)	17.79* (1.52)	21.04 (1.21)	41.94 (0.88)	66.56 (0.25)	31.40 (0.18)	37.60 (0.47)	20.18* (1.49)
Bio-Fertilizer	36.57* (1.62)	2.63 (0.22)	22.34 (1.09)	71.99* (1.43)	49.81** (2.38)	20.80 (0.54)	11.45 (1.34)	35.17 (1.22)	7.91 (0.58)
Irrigation Charges	28.96 (0.58)	1.05 (0.21)	7.90 (0.83)	5.60 (0.66)	20.31* (1.32)	6.37 (0.16)	13.32 (0.39)	42.17* (1.64)	16.44*** (2.92)
Plant Protection	35.71 (0.26)	1.52 (0.18)	7.06 (0.70)	4.39 (0.49)	19.03 (1.29)	7.58 (0.16)	6.89 (0.13)	28.43 (0.70)	6.27 (0.87)
R <sup>2</sup>	0.57	0.46	0.79	0.78	0.89	0.42	0.57	0.60	0.30

**Note:** \*, \*\*, \*\*\* indicate significance at 10%, 5% and 1% probability levels, respectively and figure in parentheses indicates the t-values of regression coefficient.

**Table 4.** Cost of cultivation (₹/Ha) of Rice crop

Sl. No	Particulars	District								
		Khowai	Sepahijala	Unakoti	Dhalai	North	South	West	Gumati	Overall
1	Cost 'A <sub>1</sub> '	29727.12	28021.06	28258.12	27517.72	26575.51	27779.18	30471.61	28900.90	28406.40
2	Cost 'A <sub>2</sub> '	29727.12	28021.06	28258.12	27517.72	26575.51	27779.18	30471.61	28900.90	28406.40
3	Cost 'B <sub>1</sub> '	29941.07	28262.16	28495.64	27737.09	26794.83	28009.54	30703.87	29137.23	28635.18
4	Cost 'B <sub>2</sub> '	33877.30	33072.48	33220.29	31949.48	31123.48	32554.01	35130.20	33710.42	33079.71
5	Cost 'C <sub>1</sub> '	37788.07	34936.16	32153.64	33630.59	29822.33	35353.04	33752.37	37805.23	34405.18
6	Cost 'C <sub>2</sub> '	41724.30	39746.48	36878.29	37842.98	34150.98	39897.51	38178.70	42378.42	38849.71
7	Cost 'C <sub>3</sub> '	45896.73	43721.13	40566.11	41627.28	37566.08	43887.26	41996.57	46616.26	42734.68

**Table 5.** Returns (₹/Ha) from cultivation of Rice crop

Sl. No	Particulars	District								
		Khowai	Sepahijala	Unakoti	Dhalai	North	South	West	Gumati	Overall
A	Value of main Produce	75824.74	81023.03	74680.70	67144.61	71085.11	78210.40	81089.70	83056.96	76514.40
B	Value of by Produce	9275.77	7466.52	8625.00	10192.76	9663.12	7855.04	6734.15	7715.96	8441.04
C	<b>Gross Returns</b>	<b>85100.52</b>	<b>88489.54</b>	<b>83305.70</b>	<b>77337.37</b>	<b>80748.23</b>	<b>86065.44</b>	<b>87823.85</b>	<b>90772.92</b>	<b>84955.44</b>
D	<b>Net return over cost</b>									
1	Cost 'A <sub>1</sub> '	55373.40	60468.49	55047.57	49819.66	54172.72	58286.26	57352.24	61872.02	56549.04
2	Cost 'A <sub>2</sub> '	55373.40	60468.49	55047.57	49819.66	54172.72	58286.26	57352.24	61872.02	56549.04
3	Cost 'B <sub>1</sub> '	55159.44	60227.39	54810.06	49600.28	53953.40	58055.90	57119.98	61635.69	56320.27
4	Cost 'B <sub>2</sub> '	51223.21	55417.07	50085.41	45387.89	49624.75	53511.43	52693.65	57062.50	51875.74
5	Cost 'C <sub>1</sub> '	47312.44	53553.39	51152.06	43706.78	50925.90	50712.40	54071.48	52967.69	50550.27
6	Cost 'C <sub>2</sub> '	43376.21	48743.07	46427.41	39494.39	46597.25	46167.93	49645.15	48394.50	46105.74
7	Cost 'C <sub>3</sub> '	39203.78	44768.42	42739.58	35710.10	43182.15	42178.18	45827.28	44156.66	42220.77
E	<b>Returns per rupee</b>									
1	Cost 'A <sub>1</sub> '	2.86	3.16	2.95	2.81	3.04	3.10	2.88	3.14	2.99
2	Cost 'A <sub>2</sub> '	2.86	3.16	2.95	2.81	3.04	3.10	2.88	3.14	2.99
3	Cost 'B <sub>1</sub> '	2.84	3.13	2.92	2.79	3.01	3.07	2.86	3.12	2.97
4	Cost 'B <sub>2</sub> '	2.51	2.68	2.51	2.42	2.59	2.64	2.50	2.69	2.57
5	Cost 'C <sub>1</sub> '	2.25	2.53	2.59	2.30	2.71	2.43	2.60	2.40	2.48
6	Cost 'C <sub>2</sub> '	2.04	2.23	2.26	2.04	2.36	2.16	2.30	2.14	2.19
7	Cost 'C <sub>3</sub> '	1.85	2.02	2.05	1.86	2.15	1.96	2.09	1.95	1.99

The overall return over Cost A<sub>1</sub> was found to be ₹56549.04 per ha and the overall return over Cost C<sub>3</sub> was observed ₹42220.77 per ha. The return per rupee over Cost C<sub>3</sub> varied from 1.85 to 2.15 among the different districts with the return per rupee of 1.99. The return per rupee was highest in North district (2.15) due to the significant efficiency of hired human labour, machinery labour, seeds, bio-Fertilizer and irrigation Charges.

### Conclusion

The study revealed that rice cultivation is a profitable enterprise in all districts of Tripura. The net income on overall investment was found to be ₹ 42220.77 per ha, ranging from ₹ 35710.10 per ha in Dhalai district to ₹ 45827.28 per ha in West district. The return per rupee was highest in North district (2.15) compared to other district

and the overall level, it was found to be 1.99. Thus it is concluded from the study that the production of rice is profitable at the entire cost concept among all the selected farmer of the state.

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