



**Research Paper**

# Economics of tur production in Amravati district

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**ABSTRACT :** In this study, an attempt has been made to study the “analysis of yield gap in tur in Amravati district” with view to work out the economics tur production and resource use efficiency. The study was based on primary data on input used and there upon costs was collected from two tahsils viz., Amravati and Nandgoan khandeshwar from two tahsils 45 samples were selected. Per hectare input utilization for tur indicated that the medium farmers were used higher inputs as compared to other farm size group of farmers. Per hectare total cost of cultivation of tur for the sample as whole was Rs. 43118.82 per hectore. Gross returns from tur at overall level was Rs.71349.48. The input-Output ratio at overall size cost ‘C’ was 1.65. for the study resource use efficiency of tur, Cobb-Douglas production function was used. In the overall group resources human labour, bullock labour, machine labour, fertilizer, plant protection and area were significant. Marginal value of product to factor cost ratio at overall group in case of human labour, machine labour, fertilizer was positive and bullock labour, seeds, manure, plant protection are negative. Marginal physical product to factor cost ratio indicates the change in total physical product to the change in input level of particular independent variable.

**KEY WORDS :** Cost of cultivation, Gross return, Resource use efficiency, Tur

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## INTRODUCTION :

Tur is an important pulse crop in India. It is also known as Pigeonpea, Arhar and Red gram. Tur is mainly cultivated and consumed in developing countries of the world. This crop is widely grown in India. India is the largest producer and consumer of tur in the world. Tur is cultivated in India for more than 3500 years ago. It has been reported to occur in wild state in the upper region of Nile river and coastal district of Angola in Africa. Therefore, Africa is supposed to be a native of pigeon form where it might have been introduced in India. Tur are given in Nutritional values of edible portion per 100 g of Red gram dal contains proteins 22.3 g, fat 1.7g, calcium

7.3g, ferrous (Iron) 5.8mg, thimin 0.45mg, riboflavin 0.19mg, niacin 2.9mg, vit. A value 132 mg. In addition to being an important source of human food and animal feed, Tur also plays an important role in sustaining soil fertility by improving physical properties of soil and fixing atmospheric nitrogen. India has second rank in world tur production. In India 2013-14 tur area was 3.90 (million'ha), production 3.17 (million tons), productivity 813 (kg/ha). In Maharashtra area production and productivity is 1180.0(000'ha), 966.0(000'tons) and 819 (kg/ha), respectively. In 2013-14, Area, Production and Productivity of tur in Amravati district was 962(00' ha), 1339 (00' tons) and 1392 (kg/ha), respectively.

The specific objectives have been undertaken as

follows :

- To study the economics of tur production in Amravati District.
- To study the resource use efficiency in tur production.

## MATERIALS AND METHODS :

### Selection of area :

Two Tahsil from Amravati district viz., Amravati and Nandgoan khandeshwar were purposively selected and about 45 samples of each tahsils i.e. Amravati and Nandgoan khandeshwar were selected for present study purpose. In overall 90 farmers were selected.

### Collection of data :

The study was based on primary as well as secondary data collected from Amravati district.

### Primary data :

The primary data on inputs used and yield obtained from tur were collected from selected farmers by survey method. Secondary data on inputs used and yield obtained from demonstration plot were collected from research unit / station. In all 90 farmers were selected for the study. The data pertain to the year 2013-14. The selected farmers were stratified into three groups on the basis of size of holdings viz., small farmers with the size of holding (0.01 ha to 2.00 ha), medium farmers with (2.01 to 4.00 ha) and large farmers (4.01 ha and above).

### Economics of tur production :

Economics of tur production was worked out by using standard cost concepts.

### Cost 'A' :

It is the actual paid out cost incurred by the cultivator. This cost comprise of the expenditure incurred by the farmers in cash as well kind for the cultivation of tur in respect of the following items. Hired human labour, Hired and owned bullock labour, machine labour, Seed, Manure, Fertilizer, Plant protection measures adopted, Incidental charges, Depreciation, Land revenue and other taxes, Miscellaneous charges, Intrest on working capital @ 6 per cent per annum.

### Cost 'B' :

Cost B = Cost A + Rental value of owned land (@

of 1/6 of the value of gross produce – land revenue) + interest on fixed capital @ of 10 per cent per annum.

### Cost 'C' :

Total of direct as well indirect cost including value of family labour constituents Cost C. It is calculated by adding imputed value of family labour to Cost B.

Cost C = Cost B + imputed value of family labour.

### Gross and net return :

*Gross return:*

Return obtained from the sale of crop output i.e. main products and by product.

*Net return:*

Net return was computed at different cost concepts i.e. Cost 'A', cost 'B' and Cost 'C' by deducting respective costs from the gross returns.

*Input output ratio :*

The input-output relationship was work out on the basis of standard cost concepts

Input-output ratio at Cost 'A', Cost 'B', Cost 'C'

$$\text{Input - output ratio} = \frac{\text{Gross income}}{\text{Respective cost}}$$

### Resource use efficiency of tur :

The resource use efficiency of tur was workout by using Linear as well as Cobb-Douglas production function.

Linear =  $Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8$

Cobb-Douglas =  $Y = ax_1^{b_1} x_2^{b_2} x_3^{b_3} x_4^{b_4} x_5^{b_5} x_6^{b_6} x_7^{b_7} x_8^{b_8} U$

where,

y = Yield q / ha

a = Constant intercept which indicated the level of output when zero inputs are used.

$b_1 - b_n$  = Regression co-efficient of the respective factors fitted as below.

$X_1$  = Human labour (Days/ha)

$X_2$  = Bullock pair (Days/ha)

$X_3$  = Machinery charges (Hrs/ha)

$X_4$  = Seeds (kg/ha)

$X_5$  = Fertilizers (kg/ha)

$X_6$  = Manure (CL/ha)

$X_7$  = Plant protection measures (Rs./ ha)

$X_8$  = Area (ha)

**Marginal value of product to factor cost ratio :**

$$MVP = b_i \frac{\bar{Y} \text{ (Geometric mean)}}{\bar{X}_i \text{ (Geometric mean)}}$$

where,

$\bar{Y}$  = Geometric mean of Y

$b_i$  = The elasticity of output with respect to into X

$\bar{X}_i$  = Geometric mean of  $X_i$

Marginal physical product to factor cost ratio

$$MPP = \frac{\Delta y}{\Delta x}$$

where

$\Delta y$  = Change in total physical product

$\Delta x$  = Change in input

**RESULTS AND DATA ANALYSIS :**

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

**Economics of tur production :**

*Per hectare input utilization of tur :*

Farm product is the result of different input factors

utilized in the process of production. A study of input utilization helps to determine the profitability of crop enterprise. Realizing the importance of cost studies, an attempt has been made to study the inputs utilized and cost associated with them for tur in the study area. Results obtained are presented in Table 1.

The Table 1 depicts information on the use of inputs in tur production. The study reveals that per hectare use of human labour for tur sample as a whole was 70.08 *i.e.* 70 man days while total bullock labour was 5.45 days per hectare. At overall level, the use of fertilizer was observed to be 88.07 kg N, P, and K per hectare.

Inter-group comparison revealed that with increase in size of holding, there was decrease in per hectare use of human labour. Result presented in the Table 1 revealed that the level of fertilizer use increase with increase of size of holding. The level of fertilizer use by small farmers was near about same medium and large farmers. However, the use of bullock labour was observed more by medium farmers followed by small farmers and large farmers. Comparison of input use between different size groups indicated that per hectare use of human labour and fertilizer was highest in large size group and bullock labour was highest in medium size group. The yield of

Sr. No.	Input	Unit	Size of groups				(Units/ha)
			Small	Medium	Large	Overall	
1.	Total human labour						
	Male	Days	32.11	30.32	33.14	31.81	
	Female	Days	37.56	38.76	39.3	38.27	
	Total		69.67	69.08	72.44	70.08	
2.	Hired human labour						
	Male	Days	20.49	19.65	22.18	20.60	
	Female	Days	25.30	24.17	25.56	25.03	
3.	Bullock labour	Days	5.38	5.73	5.32	5.45	
4.	Machine labour	Hrs	4.17	4.23	4.91	4.34	
5.	Seeds	Kg	12.88	12.16	12.54	12.60	
6.	Manure	Cl.	4.67	5.51	5.14	5.01	
7.	Fertilizer						
	N	Kg	21.16	23.84	22.50	22.22	
	P	Kg	41.42	48.14	45.20	44.16	
	K	Kg	20.43	23.03	22.84	21.69	
	Total		83.02	95.02	90.55	88.07	
8.	Family labour						
	Male	Days	11.62	10.67	10.96	11.21	
	Female	Days	12.26	14.59	14.04	13.31	
9.	Yield						
	Main produce	Qtls.	13.18	12.49	11.15	12.55	
	By-produce	Qtls.	5.22	4.91	4.21	4.92	

tur was highest *i.e.* 13.18 quintals per hectare in small size group of holding and lowest in large size group *i.e.* (11.15 q/ha).

### Cost of cultivation of tur :

The per hectare cost of cultivation of tur was worked out by using standard cost concepts explained in methodology. The estimation of cost help us to know the profitability of a particular crop enterprise. For the purpose of crop planning, more emphasis given on Cost 'A' *i.e.* direct cost. Per hectare item wise cost for tur production worked out and presented in Table 2.

It could be seen from the Table 2 that the per hectare total cost of cultivation of tur for the sample as a whole was Rs. 43118.82. Among the different items of expenditure human labour accounted highest share of the total Cost *i.e.* (27.97%). The proportion of other item of expenditure were bullock labour (6.33%), seeds (2.92%), fertilizer (2.42%) and interest on working capital

(3.08%) and fixed capital (5.74%), respectively. The proportion of expenditure on irrigation was (4.56%). The proportion of expenditure on rental value of land (27.07%) which was highest share of total cost of cultivation. The per hectare total cost of cultivation *i.e.* Cost 'C' ranges from Rs. 43532.99/- in small size group to Rs. 43183.37/- in medium size group to Rs. 42049.6/- in large size group. Higher total cost on small size farm was obviously due to higher use of inputs.

At overall level Cost 'A' and Cost 'B' per hectare was Rs.24656.93 and Rs.38863.08, respectively which was 57.20 per cent and 90.16 per cent of total Cost *i.e.* Cost 'C'.

### Economics of production of tur :

Studies on economics of production of tur help to understand the profitability and selection of appropriate crop on the farm. The data on cost and returns from tur is presented in the following Table 3.

Sr. No.	Particulars	Size of holding			Overall
		Small	Medium	Large	
1.	Hired human labour				
	Male	4098.14 (9.41)	3931.41 (9.10)	4200.79 (9.99)	4071.64 (9.44)
	Female	3795.83 (8.71)	3626.44 (8.39)	3834.63 (9.11)	3755.08 (8.71)
2.	Bullock labour	2690.27 (6.17)	2865.38 (6.63)	2650.31 (6.30)	2732.42 (6.33)
3.	Machine labour	1521.66 (3.49)	1270.67 (2.94)	1475.77 (3.50)	1439.46 (3.33)
4.	Seeds	1288.88 (2.96)	1216.18 (2.81)	1254.06 (2.98)	1260.53 (2.92)
5.	Plant protection	1853.70 (4.26)	1865.38 (4.32)	1840.11 (4.38)	1854.20 (4.30)
6.	Manure	3274.44 (7.52)	3862.34 (8.94)	3597.97 (8.55)	3512.58 (8.14)
7.	Fertilizer				
	N	126.97 (0.20)	143.04 (0.33)	135.04 (0.32)	133.32 (0.36)
	P	490.44 (1.03)	552.84 (1.28)	548.27 (1.30)	520.67 (1.16)
	K	367.83 (0.84)	414.63 (0.96)	411.20 (0.98)	390.50 (0.90)
8.	Repairing charges	537.68 (1.23)	568.15 (1.31)	585.71 (1.39)	556.62 (1.29)
9.	Irrigation charges	1966.66 (4.51)	1908.33 (4.42)	2037.63 (4.84)	1964.79 (4.56)
10.	Working capital	22012.50 (50.56)	22224.79 (51.46)	22571.49 (53.68)	22191.84 (51.48)
11.	Depreciation	1044.79 (2.39)	1103.92 (2.56)	1116.24 (2.65)	1076.96 (2.49)
12.	Land revenue	204.25 (0.46)	211.12 (0.48)	220.04 (0.52)	209.57 (0.48)
13.	Interest on working capital @ 6% per annum	1320.75 (3.03)	1333.48 (3.08)	1354.28 (3.22)	1331.51 (3.08)
14.	Cost 'A'	24582.29 (56.47)	24873.31 (57.59)	25262.06 (60.07)	24809.9 (57.55)
15.	Rental value of land =1/6th of gross produce-land revenue	12254.69 (28.15)	11627.83 (26.92)	10399.8 (24.73)	11682.00 (27.07)
16.	Interest on fixed capital	2530.46 (5.81)	2358.52 (5.46)	2087.92 (5.96)	2587.36 (5.74)
17.	Cost 'B'	39367.44 (90.43)	38859.66 (89.98)	37749.78 (89.77)	38879.24 (90.16)
18.	Imputed value of family labour				
	Male	2325.55 (5.34)	2134.29 (4.94)	2192.62 (5.21)	2242.23 (5.20)
	Female	1840 (4.22)	2189.42 (5.07)	2107.20 (5.01)	1997.35 (4.63)
19.	Cost 'C'	43532.99 (100.00)	43183.37 (100.00)	42049.6 (100.00)	43118.82 (100.00)

It could be revealed from the Table 3 that the gross return from tur production for overall average size group was Rs. 71349.48 per hectare. The gross return ranged between Rs.63719.03 in large size group to Rs. 74753.68 in small size group. The overall cost 'A', cost 'B' and cost 'C' were Rs.24656.93, Rs.38863.08 and Rs. 43102.66, respectively. Profit at Cost 'A' for overall size group from tur cultivation was Rs. 46539.61 and at Cost C it was Rs. 28230.65.

### Input-output relationship of tur :

Efficiency of investment in the cultivation of crop is judged by calculating output – input ratio. The result are presented in Table.

An evident from the Table 4 that the output-input ratios for overall size group at Cost 'A', Cost 'B' and Cost 'C' were 2.88, 1.83 and 1.65, respectively. The output-input ratio calculated at cost A and cost C were greater than unity in all the size groups indicating there by the production of tur was profitable. Output-input ratio at cost 'A' was highest *i.e.* 3.04 in small size group followed by medium (2.85) and large (2.52) size group.

Thus, the study concludes that the tur is most profitable crop in Amravati district.

### Production function analysis :

#### Resource use efficiency :

One of the objectives of present investigation was to study the resource use efficiency in tur crop. This objective was accomplished through the production

function analysis. The production function framework is often used to determine optimal quantities of inputs that's the cultivators use in the production process. Out of two models, linear regression model and Cobb-Douglas model. On the basis number of significant variables, desired signs of estimated regression co-efficient and R<sup>2</sup> values, Cobb-Douglas production function was estimated on per farmer basis for small, medium and large size group. The elasticity of production and related parameters are presented in Table 5.

It is observed from the table, that the explanatory variables included in the production process have explained almost the variation in input for small, medium and large for the sample as a whole. In small size group, the regression co-efficient of human labour, manures and plant protection is significant at 1 per cent level of significance. In Cobb-Douglas production function the regression co-efficient directly shows the production function elasticity. Hence the regression co-efficient of human labour, Machine labour, manures and plant protection that increases by one unit in presence of contributing variable of tur production increase by one unit. In small size group, the regression co-efficient of human labour, manure and plant protection is significant at 1 per cent level of significance and machine labour is significant at 10 per cent level of significance and remaining variables are non-significant in small size group. In Cobb-Douglas production function the regression co-efficient directly shows the production function elasticity hence the regression co-efficient of human labour

**Table 3 : Costs and return from tur**

Sr. No.	Particulars	Size of holding			Overall
		Small	Medium	Large	
1.	Yield (Qtls.)	13.18	12.49	11.15	12.55
	Main produce				
	By Produce	5.22	4.91	4.21	4.92
2.	Price (Rs.)	5513.33	5530	5563.68	5528.77
	Main produce				
	By produce	2088.00	1964.00	1684.00	1966.89
3.	Gross return	74753.68	71033.7	63719.03	71349.48
4.	Cost of production	3144.54	3300.19	3620.23	71354.06
5.	Cost 'A'	24582.29	24873.31	25262.06	24809.86
6.	Cost 'B'	39367.44	38859.66	37749.78	38879.24
7.	Cost 'C'	43532.99	43183.37	42049.6	43118.83
8.	Net return over				
	Cost 'A'	50171.39	46160.39	38456.97	46539.61
	Cost 'B'	35386.24	32174.04	25969.25	32470.24
	Cost 'C'	31220.69	27850.33	21669.43	28230.65

machine labour that increases by one unit in presence of contributing variable of tur production increase by one unit. In medium size group human labour, bullock labour is significant at 1 per cent level and seed, fertilizer, manure, plant protection at 5per cent level as other variable are non-significant at medium size group. In large size human labour and seed is significant at 5 per cent level and

remaining at them is non-significant. At overall size human labour, bullock labour, fertilizer is significant at 1per cent level of significance and plant protection is significant at 5per cent and machine labour and area is significant 10 per cent level of significance and remaining variable is non-significant. Production could not give the desired profit from tur.

**Table 4 : Input-output relationship in tur**

Sr. No.	Particulars	Small	Medium	Large	Overall
1.	Cost 'A'	3.04	2.85	2.52	2.88
2.	Cost 'B'	1.89	1.82	1.68	1.83
3.	Cost 'C'	1.71	1.64	1.51	1.65

**Table 5 : Resource use efficiency in tur**

Sr. No.	Particulars	Units	Size Groups			Overall
			Small	Medium	Large	
1.	Intercept		-0.99	0.44	-0.45	-1.31
2.	Human labour (X <sub>1</sub> )	Days/ha	1.66***	0.008***	0.24**	1.38***
3.	Bullock labour (X <sub>2</sub> )	Days/ha	-0.04	-0.02***	-0.36	-0.33***
4.	Machine labour (X <sub>3</sub> )	Hrs/ha	0.10*	-0.01	0.25	0.08*
5.	Seed (X <sub>4</sub> )	Kg/ha	0.12	0.004**	-1.12**	-0.05
6.	Manure (X <sub>5</sub> )	CL/ha	-0.36***	-0.035**	0.032	-0.36
7.	Fertilizer (X <sub>6</sub> )	Kg/ha	0.39	0.006**	1.25	1.30***
8.	Plant Protection (X <sub>7</sub> )	Rs./ha	-0.74***	-0.001**	-0.005	-0.66**
9.	Area (X <sub>8</sub> )	Ha	0.025	0.0079	0.13	0.13*
	R <sup>2</sup>		0.65	0.64	0.60	0.53

\*, \*\* and \*\*\* indicate significance of values at P=0.01, 0.05 and 0.1, respectively

**Table 6 : Marginal value of product to factor cost ratio**

Sr. No.	Variables	Small	Medium	Large	Overall
1.	Human labour	0.20	0.001	0.05	0.25
2.	Bullock labour	-0.09	-0.05	-1.01	-0.79
3.	Machine labour	0.30	0.04	0.78	0.25
4.	Seeds	0.12	0.004	-1.32	-0.062
5.	Manure	-0.81	-0.08	0.09	-0.86
6.	Fertilizer	0.051	0.008	0.20	0.17
7.	Plant protection	-0.004	-1.023	-4.34	-0.0045
8.	Area	0.34	0.108	1.54	1.79

**Table 7 : Marginal physical product to factor cost ratio**

Sr. No.	Variables	Small	Medium	Large	Overall
1.	Human labour	0.42	0.36	0.42	0.42
2.	Bullock labour	1.11	0.66	2.58	0.92
3.	Machine labour	4.70	1.2	4.38	4.70
4.	Seeds	4.5	1.33	2.15	4.5
5.	Manure	7.20	3	8.47	7.20
6.	Fertilizer	0.54	0.30	0.76	-7.37
7.	Plant protection	0.01	0.008	0.02	-6.16
8.	Area	5.54	3.12	5.44	7.07

**Marginal value product to factor cost ratio :**

Marginal value of product to factor cost ratio is the measure of resource use efficiency. The ratio of MVP to factor cost indicates the optimum resource use efficiency of particular input. The marginal value product of each input factor was worked out and compared with prices of respected input in respect of small, medium, large and overall group.

In overall group the marginal value of product to factor cost ratio of human labour, machine labour and fertilizer was positive but less than one mean there is a scope to increase the level of these inputs in tur production.

In small, medium and large farmer the MVP of human labour, machine labour and fertilizer to factor cost ratio of a variable are positive.

In large size farmers human labour (0.05), machine labour (0.78), manure (0.09) and fertilizer (0.20) and area is 1.54. In overall size farmers human labour (0.25), machine labour (0.25), fertilizer (0.17) and area is 1.79 (Table 6).

The marginal value of product to factor cost ratio for fertilizers in small, medium, large and overall level are positive indicating the less use of these resources and there is scope increase the use of these resources in tur production. The MVP of Bullock labour in medium farmers (-0.05) and at overall (-0.79) shows excesses used. In small farmers manures (-0.81) negative and seeds also shows (-0.062) negative value indicated the excess uses of these resources in tur production.

**Marginal physical product to factor cost ratio :**

Marginal physical product to factor cost ratio indicates the change in total physical product to the change in input level of particular independent variable.

Marginal physical product to calculate resource use efficiency of various input the marginal physical product of these input was obtained by taking derivatives of production function. It can be seen from Table 7. It reveals that marginal physical change in area contributed to more change in production in all three categories *i.e.* small, medium, large and overall level.

Marginal physical product of area for small farmers 5.54, medium 3.12, large 5.44 and overall level 7.07, respectively. Among these marginal physical product of area is highest for small farmer.

**Conclusion :**

Resource use efficiency worked out with the help of Cobb-Douglas production function. In overall group the regression co-efficient of human labour, bullock labour, machine labour, fertilizer and area are significant and other variable shows non-significant result.

The output-input ratios were greater than unity which indicates that the tur is profitable crop in Amravati district.

It could be concluded that, the farmers were using less technology than recommended and there by producing less than possible yield. This calls for appropriate policy with regards to transfer of recommended technology.

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