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Economic analysis of grape production in Tamil Nadu

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ABSTRACT

The study aimed to analyze the trend in grapes, economics of grape production, resource use efficiency and constraints. Results revealed that area under grape cultivation is decreasing over a decade by 1.17 per cent. The production and productivity also declined by 10.16 and 9.55 per cent, per annum, respectively. Total cost of grape cultivation (Panneer variety) was about Rs. 3.20, Rs.3.60 and Rs.1.50 lakh per ha in Theni, Coimbatore and Dindigul districts, respectively. Net income per ha was Rs. 3.74 lakhs, Rs.2.97 lakhs and Rs.2.09 lakhs for the samples districts. Age of vine yard, FYM and phosphorus are the factors that have positive and significant influence on the yield of grapes. Pest and disease infestation, labour problem, water scarcity, price fluctuation and lack of price information were the major constraints faced by the gape farmers. The study suggested that grape growers association may provide price information and research should focus on developing new high yielding variety that are resistant to disease infestation and tolerant to local climatic condition.

Key words: Grape, trend, cost, returns, cobb douglas production function, constraints.

Grape is an (*Vitis vinifera*) important commercial fruit crop of south India and regarded as most remunerative enterprise. World production of grapes has increased from 15.5.million tonnes in the year 2000 to 27 million tonnes in 2014. World average productivity was 10.78 tonnes/ha during 2014 (FAO, 2014). Of the total world production, about 78 per cent of grape is used for edible purpose (fresh grapes), nearly 17.20 per cent for raisin production while 1.5 per cent is used for juice and 0.5 per cent for manufacturing wine. Processing of grapes in India is much less than the processing found in the traditional grape growing countries in the world where 80 per cent is processed. In India, about 60 per cent of grapes are eaten fresh as table fruit, 6.5 per cent is exported as fresh grapes and more than 30 per cent of grapes used for making raisins (NRCG, 2013).

In India, area under grapes was 1.11 lakh ha with an annual production of about 25.85 lakh tonnes in the year 2013-14. Highest area in grape cultivation was found in Maharashtra with 76 per cent, followed by Karnataka with 17 per cent, Tamil Nadu with three per cent and others states four per cent. In terms of production, Maharashtra ranks first with 84 per cent followed by Karnataka with 17 per cent and Tamil Nadu with 3 per cent. Productivity of grapes per ha was also highest in Maharashtra with 24 tonnes per ha followed by Andhra Pradesh with 20.8 tonnes and Tamil Nadu with 16.8 tonnes (Indian Horticulture database, 2014). The major varieties grown in India are Anab-e-Shahi, Bangalore Blue, Bhokri, Flame Seedless, Gulabi Syn. Muscat Hamburg, Perlette, Sharad Seedless and Thomson Seedless. The potential competitors for grapes are Australia, USA, South Africa, Syria and Chile. India exported 160256 tonnes of grapes during the year 2013-14 with total foreign exchange of Rs.143707 lakhs. Grape is mainly exported to the Netherlands (29 per cent), Bangladesh (19 per cent), Russia (15 per cent), UK (10 per cent) and UAE with 7 per cent (APEDA, 2015).

In Tamil Nadu, Theni district accounted for a major share of area under grapes (1886.7 ha) representing 78 per cent to the total grape area in Tamil Nadu followed by Coimbatore district (9 per cent) and Dindigul district (8 per cent). In terms of production also, Theni district ranks first with 76 per cent share in the State's total production of grape (29338 tonnes), followed by the Coimbatore district with 11 per cent (4110 tonnes) and Dindigul district with 8 per cent (3246 T). In terms of productivity,

Coimbatore ranks first with19.1 tonnes per ha followed by Dindigul district with 16.9 tonnes per ha (GoTN, Season and Crop Report, Triennium ending 2013). Though grapes cultivation is financially attractive, farmers are not interested to invest in it further because of high fluctuating price, disease infestation such as downy mildew and powdery mildew, pest infestation (Ramanan *et al.*, 2012), high initial investment (Sumathi, 1992), lack of remunerative price (Vairam and Muniyandi, 2013), whereas the traders reported that there are no adequate infrastructure facilities like road, transport and cold storage. Even then, grape is one of the major fruit crops in Tamil Nadu due to its demand. Hence, the study aimed to analyze the economics of grape cultivation in Tamil Nadu with the following specific objectives viz., i) to analyze the trend in area, production and productivity of grapes in Tamil Nadu, ii) to estimate cost and returns of grape cultivation iii) to assess the resource use efficiency in grape cultivation and iv) to identify the constraints in production of grapes in Tamil Nadu.

MATERIALS AND METHODS

Sampling: The universe of the study is Tamil Nadu state. Purposive sampling was employed for selection of districts and blocks. Major three districts growing grapes *viz.*, Theni, Coimbatore and Dindigul were purposively selected for the present study. Based on area under grapes Thondamuthur from Coimbatore district, Chinnamanur from Theni district, and Dindigul block from Dindigul district were also purposively selected. From each block, 30 grape growers were randomly selected for the study. Thus, the total sample size was 90 grape growers. The primary data was collected using well defined and pre-tested interview schedule by personal interview method. Details on initial investment for grapes cultivation, varieties grown, input use, cost of cultivation, yield and constraints in production were collected for the year 2013-14.

Tools of analysis: Percentage and average analysis was employed to analyze the data wherever necessary.

Growth rate: Trend in area, production and productivity of grapes in Tamil Nadu was analyzed using compound growth rate. $Y = f(t)$

$$\text{Ln } Y = \text{Ln } a + \text{Ln} b_t + e$$

Where, Y = Area (ha) / Production (tonnes) / Productivity (t/ha)

t = time period;

a and b are parameters to be estimated;

e = error term

Compound Growth Rate (CGR) = { (Anti log of b) – 1} X 100

Cost of cultivation: Cost of cultivation of grapes was estimated using the fixed and variable cost approach. *i.e.* Total Cost = Fixed Cost (FC) + Variable Cost (VC). FC also includes annual establishment cost of grape vineyard per year . Cost of Production (Rs. /Kg) was obtained by dividing the total cost by yield of grapes.

Resource use efficiency: Cobb-Douglas production function was employed to analyze the determinants of grape cultivation taking yield as dependent variable. The model is as follows.

$$\log Y = \log a + \log b\, Xi + e$$

Where,

Y	-Yield of grapes (Kg/ha per ha)
X1	-Labour use (Mandays per ha)
X2	-Nitrogen (kg / ha)
X3	-Phosphorus (kg / ha)
X4	-Potash (kg / ha)
X5	-Farmyard manure (Kg / ha)
X6	-Cost of Plant Protection Chemicals (Rs. /ha)
X7	-Age of vine yard (Yrs)
e	-Error term
a, bi	-parameters to be estimated

RESULTS AND DISCUSSION

Trend in Area, Production and Productivity of Grapes in Tamil Nadu

The data on area, production and productivity of grapes for 10 years (2004-2014) in Tamil Nadu were collected and analyzed. The results are presented in Table 1. The area under grapes had declined from 2475 ha in 2004-2005 to 2247 ha in

2013-2014. During the same period, productivity had also declined from 28.2 tonnes / ha to 13.4 tonnes/ ha. Compound growth rate analysis (CGR) revealed that area under grape cultivation has decreased over a decade to the tune of 1.17 per cent per annum. The decline in production was high with 10.16 per cent and productivity decline was 9.55 per cent for the same period. The results indicated clearly that area, production and productivity of grapes in Tamil Nadu had declining trend during the last decade due to various reasons.

Table 1. Compound growth rate of Area, Production, and Productivity of Grapes in Tamil Nadu

SNo.	Particulars	Compound growth rate (%)
1.	Area	-1.17
2.	Production	-10.16
3.	Productivity	-9.55

Economics of Grape Production

In Tamil Nadu, only Panneer variety (Muscat Hamburg) is being grown in all the sample districts. Crop rotation is followed once in 15 years. Three pruning in a year and three harvests after 90 days of pruning is practiced in Theni and Dindigul district. However, two pruning in a year and two harvests after 120 days of pruning is followed in Coimbatore district. Sonaka Das Ganesh, Maniksom, Red globe are the new varieties that are being practiced recently in sample farms of Theni district.

Establishment Cost of grapevine orchard

The details of establishment cost of grapevine orchard are presented in Table 2. Assuming 15 years of life period of grapevine orchard in all the sample districts per year establishment cost was worked out. It is evident from the table that in Theni district, the establishment cost per ha was worked out to Rs. 7.18 lakhs. Of which, stone, & wire mess and pandal erection accounted for major share (42 per cent) followed by planting material (22 per cent). It is high due to rootstock method followed in grape cultivation. The share of intercultural operations were15 per cent. The annual establishment cost was worked out to Rs.35473 per ha.

Table 2. District wise Establishment Cost of Grapevine Orchard (Rs. / ha)

S.No	Particulars	Theni District	Coimbatore District	Dindigul District
1.	Land preparation and digging of pits	71250 (9.93)	18278 (4.00)	3000 (1.09)
2.	Pillar Stones, Wire mess and pandal erection	302750 (42.18)	296400 (69.80)	187500 (68.34)
3.	Cuttings (seedlings)	158100 (22.03)	29640 (7.00)	1625 (0.61)
4.	Planting	17800 (2.48)	1976 (1.00)	1000 (0.59)
5.	Inter cultural operations	105000 (14.63)	22724 (5.00)	70000 (25.51)
6.	FYM & Fertilizers	58075 (8.09)	49400 (12.00)	11250 (4.10)
7.	Pesticides	4700 (0.65)	6175 (1.00)	-
Total		717675 (100.00)	424593 (100.00)	274375 (100.00)
Annual Establishment Cost		**35473**	**28300**	**18290**

(Figures in parentheses are percentages to the respective total)

Table 3.Economics of Grape Cultivation - Panneer Variety (Rs. / ha / yr)

S.No	Particulars	Theni		Coimbatore		Dindigul	
		Amount	Per cent to total	Amount	Per cent to total	Amount	Per cent to total
I	**Operational Cost**						
1.	Human Labour	94025	29.31	130330	36.20	45875	30.52
2.	Machine power	…	…	43720	12.14	…	…
3.	Organic manures	…	…	23057	6.40	…	…
4.	Inorganic fertilizers	72200	22.51	19990	5.55	37500	24.95
5.	Plant protection chemicals	65625	20.46	54285	15.08	19250	12.81
6.	Irrigation charges	2000	0.62	4000	1.11	2000	1.33
7.	Interest on working capital@ 7 %	16370	5.1	19275	5.35	7324	4.87
	Total Operational cost	**250220**	**78.01**	**294657**	**81.83**	**111950**	**74.48**
II	**Fixed cost**						
1.	Annual establishment cost	35473	11.06	28300	7.86	18290	12.17
2.	Land revenue	60	0.02	60	0.02	60	0.04
3.	Imputed rental value of owned land	35000	10.91	37050	10.29	20000	13.31
	Total fixed cost	70533	21.99	65410	18.17	38350	25.52
III	**Total cost (I+II)**	**320753**	**100.00**	**360067**	**100.00**	**150300**	**100.00**
	Yield (Kg/ha)	27800		24368		12000	
	Price (Rs/Kg)	25		27		30	
IV	Gross Return	695000		657936		360000	
V	Net Return (**IV – III)**	**374248**		**297869**		**209700**	
VI	**Cost of Production (Rs/Kg)**	11.54		14.77		12.52	

Table 4.Results of Cobb-Douglas Production function analysis of Grapes

S. No	Explanatory variables	Coefficients	Standard error	t-ratio
1	Constant	0.4484	3.8105	0.1176
2	Age of vine yard (yrs)	0.2793*	0.0981	2.8474
3	Farmyard Manure (Kg/ha)	0.9537**	0.3905	2.4419
4	Labour (Mandays/ha)	-0.1800 ^{NS}	0.1552	-1.1595
5	Plant Protection Chemicals (Rs/ha)	-0.0026^{NS}	0.0392	-0.0679
6	N (Kg/ha)	0.0336^{NS}	0.0527	0.6366
7	P (Kg/ha)	0.1545**	0.0707	2.1828
8	K (Kg/ha)	0.0259^{NS}	0.0354	0.7309

Adjusted R^2 : 0.7539.

*Significant at one per cent level, ** Significant at five per cent level NS- Non Significant

In Coimbatore district, establishment cost was worked out to Rs. 4.25 lakhs /ha. Of which, stone, wire mess and pandal erection accounted for major share (69.80 per cent) followed by farmyard manure & fertilizer (12 per cent). The annual establishment cost was worked out to Rs.28300 per ha. In Dindigul district, total establishment cost of grapevine orchard was Rs.274375. The major cost item was pandal erection that accounted for 68.34 per cent. Since farmers used their own planting materials, its cost was only 0.61 per cent of total establishment cost. All farmers were growing Panneer variety (Muscat) and the cuttings were planted at spacing of 3×3m. The annual establishment cost per ha was Rs. 18290.

Economics of grapevine orchard

The costs and returns of grape cultivation (Panneer variety) were worked out for one year and are presented in Table 3. It could be seen from the table that the total cost of cultivation per ha was about Rs.3.20 lakhs / annum in Theni district and the total operational cost per year Rs. 2.50 lakhs. Of which, the share of labour cost was high with 29 per cent followed by cost of fertilizers (23 per cent) and pesticides (21 per cent). The share of fixed cost in the total cost was 22 percent. On an average, yield realized was 27800 kg/ ha and the average price received by the farmers was Rs.25/kg. Cost of production per kg was Rs.11.54. The average price was higher than the cost of production and hence, the farmers got net return of Rs. 3.74 lakh / ha / year. In Coimbatore district, the total operational cost per ha was Rs. 2.95 lakhs. Of which, the share of labour cost was 36.20 per cent followed by cost of pesticides (15 per cent) and fertilizers including manures (12 per cent). Fixed cost accounted for 18 per cent to the total cost. The total cost of cultivation was about 3.60 lakhs /ha/annum. On an average, yield realized was 24368 kg/ ha and the average price received was Rs.27/kg. Cost of production was Rs.14.77/kg which is lesser than the average price and hence, the farmers earned net return of Rs.2.98 lakh / ha / year. The cost of cultivation of grapes in Dindigul district was Rs.1.50 lakh per year. The total operational cost was around Rs.1.12 lakh and it accounted for about 75 per cent of total cost. The share of labour cost, fertilizers and pesticides was 30.52, 25 and 12.81per cent, respectively. Average yield in the sample farms of Dindigul district was 12000 kg/ha / year. The peak yield was obtained during May-June (second season). The average price of grapes received by the sample farmers was Rs.30/kg. The gross and net income realised was Rs.3.60 lakh/ha and Rs.2.10 lakh/ha /year, respectively. As compared to other two districts the yield was low mainly due to water scarcity.

Resource use efficiency in Grape Cultivation

The factors influencing grape cultivation was analyzed for Coimbatore district alone and the results are shown in Table 4. The co-efficient of multiple determination (Adjusted R^2) value was 0.7539 which indicates that approximately 75 per cent of the variation in the yield was explained by the independent variables included in the model. Age of vine yard was found to be positive significant at one per cent level of probability. The value of coefficient was 0.27 which indicated that an increase in age of vine yard by one per cent, *ceteris paribus*, would increase yield by 0.27 per cent. Farmyard manure and Phosphorus were also found to be significant with coefficient of 0.95 and 0.15 indicate that one per cent increase in use of these variables would increase the yield by 0.95 per cent and 0.15 per cent, respectively. It is concluded that age of the vine yard, farmyard manure and Phosphorus was the major factors that determine the yield of grapes.

Constraints in grape cultivation

The analysis of constraints faced by grape farmers in production and marketing revealed that in Theni and Coimbatore district, the most important constraint was pest and disease infestation (downy mildew and powdery mildew) followed by labour scarcity. In marketing of grapes price fluctuation was the major constraint followed by lack of price information. Coimbatore district farmers faced water scarcity. In Dindigul district also water scarcity is the major problem and hence the farmers adopted drip irrigation. The other problems are damage by Wild bear / Peacock / Bison as the grape gardens are in the foothills of Sirumalai. The farmers were of the opinion that they could not achieve the maximum yield due to severe water scarcity, pest and diseases attacks, and damage by wild animals.

CONCLUSION

Based on the results of the study, it is concluded that area, production and productivity of

grapes had declined during the decade 2004 -2014 in Tamilnadu state. Net income from grape cultivation was found to be high in Theni district with Rs. 3.74 lakh / ha / year followed by Coimbatore district with Rs.2.98 lakh and Dindigul district with Rs.2.10 lakh/ha /year. This clearly showed the profitability of grapes cultivation in all the sample districts. Powdery and downy mildew is a major disease and hence, farmer use more of inorganic chemicals which affects the marketing of produce. Hence, it is suggested that research may be conducted to control the disease in an effective manner. Lack of price information was also major constraint faced by the farmers. The grape growers association may provide the price information to the growers and technology and credit support through the Department of Horticulture and banks may be given to promote grape production in Tamil Nadu.

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