International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 2, 2019, pp.-7782-7785.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

COMPARATIVE ANALYSIS ON THE ECONOMICS OF BANANA AND TAPIOCA CULTIVATION IN THIRUVANANTHAPURAM DISTRICT IN KERALA

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Received: January 15, 2019; Revised: January 24, 2019; Accepted: January 25, 2019; Published: January 30, 2019

Abstract: Thiruvananthapuram is blessed with the weather and climate suitable for the cultivation of the two major cash crops of Kerala *viz*. banana and tapioca. A large number of farmers in the district cultivate these crops. Hence the study was conducted in order to know the profitability of each enterprise. The total cost of cultivation of banana was found to be Rs.2,72,170 ha^{-1} with increasing returns to scale. The total cost of cultivation of tapioca was found to be Rs.1,81,259.60 ha^{-1} with constant returns to scale. Banana enterprise was found to be more profitable.

Keywords: Cost of cultivation, Resource use efficiency, Allocative efficiency, Returns to scale

Citation: Kshama A.V., *et al*., (2019) Comparative Analysis on the Economics of Banana and Tapioca Cultivation in Thiruvananthapuram district in Kerala. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 2, pp.- 7782-7785.

Introduction

Banana and tapioca being the prominent crops of Kerala are cultivated by a large number of farmers in the state. The area under banana cultivation in the state during 2016-17 was 57,158 ha with Palakkad, Wayand and Malappuram districts having the highest area under banana. The area under tapioca cultivation was 68,664 ha with Thiruvananthapuram, Kollam and Idukki districts as having the highest area under cultivation. As many of the farmers are interested to cultivate these crops, an investigation was conducted to ascertain the profitability. The study is based on the primary data collected through survey from Parassala panchayat of Neyyattinkara taluk in Thiruvananthapuram district. The total sample size was 60. Out of the total, 37 farmers were growing banana and 28 farmers were growing tapioca. It can be noted that majority of the farmers in the study area cultivated more than one crop as pure crop in their fields. A study in Bhagalpur district of Bihar showed that the average cost of cultivation for growing banana was Rs. 96,381.31 ha^{-1}[3]. Another study in Theni district of Tamil Nadu showed a net profit of Rs. 6,74,720.33 per acre of banana with a total cost of Rs. 1,04,726.85 for cultivation [4].

Materials and Methods

Annual Cost of Maintenance (Cost of Cultivation)

Cost of cultivation was worked out as the sum total of cost incurred on various inputs that are used in the production of the commodity. In this study ABC cost concepts were used to work out the cost of cultivation.

ABC Cost Concepts

Cost A_1 includes

1. Cost of hired labour
2. Cost of manures, fertilizers and soil ameliorants and micro nutrients
3. Cost of plant protection chemicals
4. Land revenue
5. Depreciation
6. Maintenance cost of equipment and machineries
7. Interest on working capital
8. Miscellaneous

Cost A_2

Includes the sum of Cost A_1 and rental value of leased in land

Cost B

Includes the sum of Cost A_2 and rental value of owned land and interest on owned fixed capital excluding land.

Cost C

Includes the sum of Cost B and imputed value of family labour (CSO, 2008)

Resource Use Efficiency

Cobb-Douglas production function was used to find the resource use efficiency of the various resources used in the production process.

The Cobb-Douglas production function is given by:

$$Y = aX_1^{b_1}X_2^{b_2}X_3^{b_3}X_4^{b_4}\ e^n$$

This is modified into a log linear model by application of logarithm.

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + u$$

Where, Y= Yield (kg ha^{-1}).

X_1 = Quantity of hired labour (ha^{-1})

X_2 = Quantity of family labour (ha^{-1}).

X_3 = Quantity of fertilizers and manures (kg ha^{-1}).

X_4 = Quantity of plant protection chemicals (kg ha^{-1}).

a = Intercept

$b_1 \ldots b_4$ = Regression coefficients of explanatory variables.

e^n = Stochastic error term

The Cobb-Douglas production function was estimated by using OLS method assuming the error term (e) to be independently and normally distributed.

Estimation of Marginal products and Marginal Value Products

In this study marginal product (MP) and marginal value product (MVP) were also calculated by comparing MVP of each resource with the marginal factor cost (MFC).

The marginal products were calculated at geometric mean levels of variables by using following formula

Marginal product of input (MP_i) = $b_i \times \frac{\bar{Y}}{\bar{X}_i}$

Where

P_Y = price of crops grown by the respondents

The comparison of ratios (MVP/MFC = k) for judging the efficiencies are

k > 1 indicating under use or sub optimal use of resources

k = 1 optimum use of resources (allocative efficiency)

k < 1 indicating excess use of resources.

Results

Economics of banana

Land holding pattern of banana growers

From the study it is evident that the average under banana cultivation was found to be 43.72 percent and the land holding pattern of the respondents is presented in [Table-1]. As many as 37.9 percent of the respondents had an area of 30-40 percent under banana cultivation followed by 21.6 percent of farmers having 20-30 percent under banana cultivation.

Table-1 Land holding pattern of the respondents cultivating banana Sl

SN	Particulars	Number of farmers
1	< 20	2 (5.4)
2	20-30	8 (21.6)
3	30-40	14 (37.9)
4	40-50	6 (16.2)
5	50-60	5 (13.5)
6	>60	2 (5.4)
7	Total	37 (100)
8	Average area (percent)	43.72

Cost of cultivation of banana

The cost of cultivation of banana was worked out and presented in [Table-2]. The total cost of cultivation was found to be Rs.2,72,170 ha^{-1}, Cost A_1 was found to be Rs.1,19,351.70 ha^{-1}, Cost A_2 was Rs.1,59,459.80 ha^{-1} and Cost B was Rs.2,63,920.20 ha^{-1}. When we consider Cost A_1 about 51.61 percent of which was accounted by hired labour, followed by manures and soil ameliorants (22.59 percent), fertilizers (7.12 percent).

Table-2 Cost of cultivation of banana

SN	Particulars	Cost (Rs/ha)	Percent to cost A_1
1	Hired labour	61608.11	51.61
2	Seed	7411.08	6.21
3	Fertilizer	8507.56	7.12
4	Manures and soil ameliorants	26970.27	22.59
5	Plant protection chemicals	2569.71	2.15
6	Land revenue	41.15	0.034
7	Depreciation	159.86	0.13
8	Interest on working capital	7502.89	6.28
9	Miscellaneous	4581.08	3.83
	Cost A_1	119351.7	100
10	Rental value of leased in land	40108.11	
	Cost A_2	159459.8	
11	Rental value of owned land	95351.35	
12	Interest on owned fixed capital excluding land	9109.03	
	Cost B	263920.2	
13	Family labour	8249.73	
	Cost C	272170	

Returns from banana and B:C ratio

The returns and the B:C ratio were worked and presented in [Table-3]. The yield was found to be 4613.09 kg ha^{-1} with a gross income of Rs.2,99,851.4 ha^{-1}. The income at Cost A_1, Cost A_2 was found to be Rs.1,80,499.7 ha^{-1} and Rs.1,40391.6 ha^{-1}. The family labour income at Cost B was found to be Rs.35,931.2 ha^{-1} and the net income at Cost C was Rs.27,681.4 ha^{-1}. The B:C ratio at Cost A_1, Cost A_2, Cost B and Cost C were found to be 2.51, 1.88, 1.14 and 1.10 respectively.

Table-3 Returns and B:C ratio of banana

SN	Particulars	Total
1	Yield (kg/ha)	4613.09
2	Price (Rs./kg)	65
3	Gross returns (Rs./ha)	299851.4
4	Net returns at Cost A_1 (Rs./ha)	180499.7
5	Net returns at Cost A_2 (Rs./ha)	140391.6
6	Net returns at Cost B (Rs./ha)	35931.2
7	Net returns at Cost C (Rs./ha)	27681.4
	B:C ratio	
8	Cost A_1	2.51
9	Cost A_2	1.88
10	Cost B	1.14
11	Cost C	1.10

Resource use efficiency of banana cultivation

The resource use efficiency was worked out and is presented in [Table-4]. The R^2 value of 0.77 explains that 77 percent of the variation in the yield is due to the independent variables included in the model. Among the different variables under study manures and fertilizers was found to be significant at five percent level of significance and positively influencing the yield. The other variables considered in the study were also positive, but not significantly influencing the yield. A one percent increase in the use of hired labour, family labour, manures and fertilizers and plant protection chemicals are found to increase yield by 0.32, 0.21, 0.65 and 0.15 percent. The Σb_i value was found to be 1.36, means a simultaneous increase in all the independent variables by one percent will increase the yield by 1.36 percent which in turn is showing increasing returns to scale. The VIF was found be less hence there was no problem of multicollinearity.

Allocative efficiency in banana

Marginal value productivity analysis was carried out and allocative efficiency was worked out in order to know the efficiency in the utilization of the resources and the results are presented in [Table-5]. The allocative efficiency was found to be greater than one for all the resources indicating underutilization of the resources. This is an indication that the respondents can enhance the use of the resources which would lead to increase the yield of the crop thereby the income of the respondents.

Table-4 Estimated production function for aggregate under banana cultivation

SN	Particulars	Coefficients	Standard error	P value	VIF
1	Intercept	2.961	0.782	0.0006	-
2	Quantity of Hired labour	0.329	0.153	0.168	1.19
3	Quantity of Family labour	0.219	0.156	0.105	1.00
4	Quantity of Manures and fertilizers	0.656*	0.125	0.039	1.10
5	Quantity of Plant protection chemicals	0.157	0.141	0.274	1.11
6	R^2	0.77			
7	$\overline{R^2}$	0.71			
8	Calculated F	11.78			
9	Σb_i	1.36			
10	Number of observations	37			

**Significant at 5 percent level, Note: The coefficients were obtained with log value*

Table-5 MVP and MFC of different inputs used in banana production

SN	Particulars	Geometric mean	MVP	MFC	k = MVP/MFC
1	Yield	3287.82	-	-	-
2	Hired labour	11.11	4228.75	220.87	19.14
3	Family labour	12.06	5669.60	206.77	27.41
4	Fertilizers and manures	213.63	650.21	251	2.59
5	Plant protection chemicals	3.49	9162.77	587.5	15.59

Economics of Tapioca

Land holding pattern of tapioca growers

The average area under tapioca cultivation was found to be 35.11 percent. The land holding pattern of the respondents is given [Table-6]. About 35.7% of the respondents had an area of 20-30 percent under tapioca cultivation followed by 25 percent of the respondents having an area of 30-40 percent under cultivation.

Table-6 Land holding pattern of the respondents cultivating tapioca

SN	Particulars	Total
1	< 20	6 (21.4)
2	20-30	10 (35.7)
3	30-40	7 (25.0)
4	40-50	3 (10.7)
5	50-60	1 (3.5)
6	>60	1 (3.5)
7	Total	28 (100)
8	Average area (percent)	35.11

Cost of cultivation of tapioca

From the data analysed it was found that, the total cost of cultivation was found to be Rs.1,81,259.60 ha^{-1}, Cost A_1 was found to be Rs.74,591.32 ha^{-1} out of which 66.12 percent was accounted by hired labour, followed by manures and soli ameliorants (15.39 percent), fertilizers (9.14 percent), Cost A_2 was found to be Rs.1,01,930.60 ha^{-1} and Cost B was Rs.1,74,902.40 ha^{-1}.The details of which is presented in [Table-7].

Table-7 Cost of cultivation of tapioca

SN	Particulars	Cost (Rs./ha)	Percent to cost A_1
1	Hired labour	49321.43	66.12
2	Seed	1250.35	1.67
3	Fertilizer	6823.21	9.14
4	Manures and soil ameliorants	11485	15.39
5	Plant protection chemicals	398.21	0.53
6	Land revenue	32.39	0.04
7	Depreciation	160.52	0.22
8	Interest on working capital	4849.47	6.50
9	Miscellaneous	270.74	0.36
	Cost A_1	74591.32	100
10	Rental value of leased in land	27339.28	
	Cost A_2	101930.60	
11	Rental value of owned land	63750	
12	Interest on owned fixed capital excluding land	9221.83	
	Cost B	174902.40	
13	Family labour	6357.14	
	Cost C	181259.60	

Returns from tapioca and B:C ratio

The returns and B:C ratio are presented in [Table-8]. The yield was found to be 7492.14 kg ha^{-1} with a gross income of Rs.1,87,303.60 ha^{-1}. The net income at Cost C was Rs.6,044 ha^{-1} with a B:C ratio of 1.03, the family labour income at Cost B was Rs.12,401.20 ha^{-1}, B:C ratio was found to be 1.07. The farm business income at Cost A_1 and Cost A_2 were Rs.1,12,712.28 ha^{-1} and Rs.85,373 ha^{-1} respectively and the B:C ratio at these costs were found to be 2.51 and 1.83 respectively.

Table-8 Returns and B:C ratio of tapioca

SN	Particulars	Total
1	Yield (kg/ha)	7492.14
2	Price (Rs./kg)	25
3	Gross returns (Rs./ha)	187303.60
4	Net returns at Cost A_1 (Rs./ha)	112712.28
5	Net returns at Cost A_2 (Rs./ha)	85373
6	Net returns at Cost B (Rs./ha)	12401.20
7	Net returns at Cost C (Rs./ha)	6044
B:C ratio		
8	Cost A_1	2.51
9	Cost A_2	1.83
10	Cost B	1.07
11	Cost C	1.03

Resource use efficiency of tapioca cultivation

The resource use efficiency was worked out for tapioca and is presented in [Table-9]. Among the different variables manures and fertilizers was found to have positive and significant influence on yield at one percent level of significance. A one percent increase in the use of manures and fertilizers is found to increase the yield by 0.11 percent. The variables hired labour and plant protection chemicals were positive and found to be significant at five percent level of significance. A one percent increase in the use of hired labour and plant protection chemicals was found to increase the yield by 0.28 and 0.33 percent respectively. The R^2 value of 0.68 explains that 68 percent of the variation in the yield is due to the independent variables included in the model. The Σb_i value was found to be 1.06, means a simultaneous increase in all the independent variables by one percent will increase the yield by 1.06 percent which in turn is showing constant returns to scale. The VIF was found be less hence the there was no problem of multicollinearity.

Table-9 Estimated production function for aggregate under tapioca cultivation

SN	Particulars	Coefficients	Standard error	P value	VIF
1	Intercept	5.271	0.351	2.281	-
2	Quantity of hired labour	0.281*	0.161	0.016	1.72
3	Quantity of family labour	0.327	0.127	0.094	1.71
4	Quantity of manures and fertilizers	0.118**	0.042	0.009	1.39
5	Quantity of plant protection chemicals	0.339*	0.134	0.018	1.27
6	R^2	0.68			
7	$\overline{R^2}$	0.63			
8	Calculated F	12.65			
9	Σb_i	1.06			
10	Number of observations	28			

** Significant at 5 percent level, **Significant at 1 percent level, Note: The coefficients were obtained with log value*

Marginal Value Productivity Analysis of tapioca

The marginal productivity analysis of tapioca showed [Table-10] that the values of the allocative efficiency was found to be less than one for manures and fertilizers and plant protection chemicals indicating the over utilization of resources. In case of hired labour and family labour allocative efficiency was found to be greater than one indicating sub optimal utilization of resources. Hence suitable measures should be taken for optimum use of resources to increase profitability.

Table-10 MVP and MFC of different inputs used in tapioca production

SN	Particulars	Geometric mean	MVP	MFC	k = MVP/MFC
1	Yield	1263.97	-	-	-
2	Hired labour	6.00	1684.14	162.50	10.36
3	Family labour	8.75	1010.68	211.57	4.77
4	Fertilizers and manures	28.06	123.84	401.15	0.31
5	Plant protection chemicals	2.27	1.27	49.39	0.64

Conclusion

From the study it is evident that banana was more profitable compared to tapioca. The farm business income was substantially higher in the case of banana enterprise. For banana there was increasing returns to scale, but for tapioca it was constant returns to scale. Both banana and tapioca showed the scope for increasing the profit by optimum utilization of resources.

Application of research: The results of the study could be considered and suitable measures can be taken by the researchers so that it leads to further prosperity of the farmers in the form of better resource use efficiency leading to increasing the yield and there by the income of the famers.

Research Category: Production Economics

Abbreviations:

B:C ratio-Benefit Cost ratio
MFC-Marginal Factor Cost
MVP-Marginal Value Product
VIF-Variance inflation factor

Acknowledgement / Funding: Authors are thankful to College of Agriculture, Vellayani, Thiruvananthapuram, 695522, Kerala Agricultural University, Thrissur, 680656, Kerala, India

***Research Guide or Chairperson of research: Dr Santha A.M.**
University: Kerala Agricultural University, Thrissur, 680656, Kerala, India
Research project name or number: MSc Thesis

Author Contributions: All author equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Study area Parassala block of Neyyattinkara taluk in Thiruvananthapuram district

Cultivar / Variety name: Banana and Tapioca

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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