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Resource use efficiency of coconut in Coimbatore district of Tamil Nadu

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Abstract
The study was attempted to examine the relationship of the yield of the Coconut and its various inputs used in the production of the coconuts by the coconut farmers in Coimbatore district of Tamil Nadu during the year 2019-2020. Four blocks namely, Anaimalai, Kinathukadavu, Pollachi (North) and Pollachi (South) were selected in the Coimbatore district for this study. Respondents were selected through Multistage sampling with 40 samples in each block. In all, 120 respondents were selected for the study. Cobb-Douglas production function was employed in the present study to analyze the resource use efficiency in the coconut farms. The analysis of the marginal productivities of the factors inferred that the all the inputs namely farmyard manure, fertilizers, irrigation and labour man days were used inefficiently in the study area. For the identification of the constraints in the production of the coconut, Garrett's ranking technique was used. The major constraints in the study area were pest and disease incidence, limited availability of labour and scarcity of water.

Keywords: resource use efficiency, coconuts growers, marginal value productivity, constraints

Introduction
Acquaintances of agriculture to the global economy and the entire biodiversity pave the way for its conservation among the most important frontiers in the globe. Sustainable resource use and management helps in hand for the resource conservation of the agriculture. Coconut palm is eulogized as "kalpa vriksha" (Tree of Heaven) considering the versatile nature of the crop. Coconut resilience helps the world growers by adapting to a wide variety of soils and rainfall to make a profitable income with the available amount of resources.

Coastal areas are the primal habitat of coconuts and hence it is mostly found in areas of South-East Asia, probably Malaysia, India, Indonesia, Philippines and Papua New Guinea (Chan and Elevitch, 2006) [2]. Coconut is a tropical palm and distributed mainly in humid tropical regions of the world across Asia, Africa, America and Oceania. Coconut is cultivated in more than 80 countries of the world. Among them, three countries (viz., Phillippines, Indonesia and India) were the pioneers in the coconut plantation development. They dominate in area (72%) and production (73%) of coconut in the world.

India is the third largest producer of coconut in the world. India contributes a share of 17 and 19 per cent to the area and production respectively. The area of the Coconut cultivation in India is 2,178 million ha and production is 21,384 million nuts and productivity is 9,815 nuts/ha (Coconut Development Board, 2017-18). The major producers of the Coconut are Kerala, Karnataka and Tamil Nadu together accounting for 84 percent to the country's production. Tamil Nadu contributes 21 percent to the country's production. Tamil Nadu had produced an output of 5,311 million nuts.

Objectives
- To estimate the resource-use efficiency in Coconut farms.
- To identify the constraints in production of Coconut.

Review of Literature
Balamurugan and Rubini (2016) [1] studied the problems faced by the farmers in production and marketing of Coconut in Theni district of Tamil Nadu using Garrett's Ranking Technique. The results indicated that the major problem in Coconut cultivation was the incidence of pests

and diseases with a mean score of 56.36. Other problems were the high cost of input, Shortage of tree climbers and lack of scientific knowledge among the cultivators with a mean score of 54.67, 42.00 and 39.92 respectively.

Kolambkar (2017) [4] used Cobb-Douglas Production function in his study to identify the resource use efficiency in Coconut production in South-Goa district of Goa State. There was scope to increase the use of nitrogen, hired human labour and machine labour in coconut production on orchard farm.

Priolkar *et al.,* (2017) [5] studied the resource use efficiency in Coconut production of Ratnagiri district of Maharashtra. Cobb-Douglas Production function was used to study the resource use efficiency. The ratio of MVP/MFC is greater than unity in case of phosphorous, potash and irrigation cost (1.537, 1.038 and 6.580 respectively) indicated that these resources were underutilized. These resources must be optimally allocated to increase the yield of coconut plantation.

Sony and James (2018) [6] have analyzed the problems in marketing of Eathamozhi tall Coconut in Kanyakumari district of Tamil Nadu. The results were ranked by using Garrett's Ranking Technique. Lack of quality seeds was ranked first as it was the main problem faced by respondents (62.15). The second rank was assigned to failure of monsoon (60.88) and the third rank was assigned to shortage of manure (58.10).

Srinivas (1989) [3] used Cobb-Douglas production function in his study on Economic analysis of Coconut cultivation in East Godavari District of Andhra Pradesh to identify resource use efficiency in Coconut farms. The study revealed that excessive usage of bullock labours and manures were observed in Coconut farms and they have to be reorganized for achieving higher productivity.

Materials and Methods

In this study, primary data was collected from the sample farmers by the use of structured questionnaires. Multistage random sampling technique was used for the selection of the samples. Since Coimbatore is one of the largest coconut growing districts in the state, it was selected for the present study in the first stage. In the second stage, four blocks viz., Pollachi North, Pollachi South, Anaimalai and Kinathukadavu were purposively selected because nearly 70 percent of coconut production of the district is concentrated in these four blocks. Three villages were purposively selected from each block for the study. Then ten coconut growers from each of the selected village were selected by random sampling technique. Thus, the total sample of 120 farmers was made for the present study. The analytical tools used in this present study are as follows:

Resource use efficiency

Cobb-Douglas production function was selected to estimate the resource use efficiency in Coconut production for the study.

The production function model is as follows:

$$Y = AX_n^{bi}e$$

Where, Y = Yield (in nuts/ha),
A = constant term,
X_1 = Age of the garden,
X_2 = Farm yard manure (in kg/ha),
X_3 = N (in kg/ha),
X_4 = P (in kg/ha),
X_5 = K (in kg/ha),
X_6 = Human labour (in man days),
X_7 = Irrigation cost (in Rs. /ha) and
X_8 = Trees per hectare (in Numbers)
b_i = parameter to be estimated or regression coefficients (i=1 to 8),
e = random error term

Marginal Productivities of factors

The marginal products to the resources were derived from these elasticity coefficients. The marginal value products of significant inputs were worked out at its geometric mean level by using the formula

r = MVP/MFC,
MVP = MPP x P_y and MPP = β_i

Here, MVP_i = Marginal value product of the i^{th} input,
β_i = Estimated co-efficient (or) elasticity of the i^{th} input, and
P_y = Price of output

Marginal value product (MVP) of each input was compared with marginal input cost (MFC) i.e. (MVP/MFC ratio) in order to estimate the efficiency of resources. MVP indicates the changes to be made in the resource use to obtain the economic optimum situation. A ratio of value one infer that the resources are used efficiently and it is the economic optimum level. A ratio of greater than one showed the resource usage is below the optimum level, which implies under utilization of resources. A ratio of less than one infer that the level of the resource use is above the optimum level implying that over utilization of resources.

Garrett's ranking technique

Garrett's scoring technique was employed to rank the factors or problems of coconut production by the coconut growers and these ranks were converted into percent position by using the formula

$$\text{Percent position} = \frac{100 \text{ x } (R_{ij} - 0.5)}{N_j}$$

Where
R_{ij} = Ranking given to the i^{th} attribute by the j^{th} individual
N_j = Number of attributes ranked by the j^{th} individual

Results and Discussion

Resource use efficiency of Coconut

Cobb-Douglas production function was used to estimate the resource use efficiency in Coconut cultivation. The results of Cobb-Douglas production function indicated that the values of multiple determination (R^2) was 0.84 implying that 84 percent of the total variation in the dependent variable was explained by variation in the independent variables included in the model. The coefficients of farm yard manure, Phosphorous, Potassium and Irrigation cost were positive and statistically significant at one percent level of significance. These variables increase the yield of coconuts with the increase in these inputs. Hence one percent increase in the use of farm yard manure, Phosphorous, Potassium and Irrigation cost influence the yield by 0.31, 0.87, 0.19 and 0.11 percent respectively. The regression coefficient of age of the garden was found to be negative and statistically non-significant. Trees per hectare (-0.45) can significantly influence the Coconut production negatively at five percent level of significance. Nitrogen fertilizer (0.249) influences the yield of

Coconut positively and was found significant at ten percent level of significance. Labour man days (0.007) were positively related to the production of Coconut even though its influence was found to be non-significant.

The resource use efficiency of Coconut can be determined by the ratio of marginal value product and marginal factor cost. It was inferred from the Table 1 that, the efficiency ratio of farm yard manure, nitrogen fertilizer, phosphorous fertilizer, potassium fertilizer and trees per hectare were found to be more than one which implies that these resources were underutilized and by the efficient increased use of these resources, the yield can be increased optimally (Priolkar, 2017) [5]. Cost for the irrigation was found to be less than one which depicts that it was over utilized and its usage can be reduced to improve the production of Coconut. Thus, the results indicated that all the variables were used inefficiently in the study area.

Constraints in Coconut Production

The farmers in the study area faced several constraints in the production of the coconut. And the constraints were identified by using Garrett's ranking technique. The major constraint identified was the pest and disease incidence with the mean score of 88.48 (Balamurugan and Rubini, 2016) [1]. This was mainly due to the inhibition of the pests, Rugose spiraling whitefly *(Aleurodicus rugioperculatus)* and Rhinocerous beetle *(Oryctes rhinoceros)* and incidence of Thanjavur wilt *(Ganoderma lucidum)*, which leads to the decrease in the productivity of nuts. The second reported constraint was the limited availability of labour with the mean score of 79.38. Coconut palm requires more labour at the time of manuring, weeding and harvesting since these works are intense. Labours are also intended to do work in the employment scheme of 'The Mahatma Gandhi National Rural Employment Guarantee Scheme'-100 days scheme. So there is limited availability of labour in the study area at the time of need. Scarcity of water is the third constraint with the mean score of 75.56. This was due to the low groundwater table in the earth which leads to the establishment of more bore wells in the nearby gardens. This was due to the low groundwater table in the earth which leads to the establishment of more bore wells in the nearby gardens. The other identified constraints were the improper providence of the schemes, high cost of inputs, monsoon failure, lack of technical expertise and scientific knowledge.

Conclusion

The study concluded that the all the inputs namely farmyard manure, fertilizers, irrigation and labour man days were used inefficiently in the production of coconuts. Productivity of coconuts can be enhanced by promoting effective use of manures, fertilizers, irrigation with minimal cost. The major reported constraints in the production of study area were the incidence of pests and diseases, limited availability of labour and scarcity of water. These can be overcome by the use of improved varieties of coconuts, effective labour management and encouraging the farmers to make use of the water in valuable means. These results pave the way for the researchers to develop the resistant varieties for the pests of coconut and the improved varieties to enhance the production with increased profitability by the efficient use of inputs.

Table 1: Resource use efficiency of Coconut production

Variables	Regression coefficient	Std error	t value	Geo mean	MVP	MFC	$\frac{MVP}{MFC}$	Status
Reg. Constant	0.404^{NS}	1.067	0.37	15223.82	-	-	-	
Age of the garden	-0.006^{NS}	0.017	-0.400	25.6				
FYM (Kg/ha)	0.314^{***}	0.116	2.700	8744.69	7.109	2.15	3.31	Underutilized
N (Kg/ha)	0.249^{*}	0.144	1.730	231.06	214.02	9	23.78	Underutilized
P (Kg/ha)	0.878^{***}	0.074	11.731	361.62	480.92	20	24.05	Underutilized
K (Kg/ha)	0.193^{***}	0.070	2.764	357.88	107.04	22.5	4.76	Underutilized
Irrigation cost (Rs./ha)	0.111^{***}	0.026	4.181	9983.27	2.20	5000	0.00	Over utilized
Labour (man days)	0.007^{NS}	0.015	0.45	28.36				
Trees per hectare (in nos.)	-0.450^{**}	0.183	-2.45	175.14	-508.759	185	-2.75	Underutilized

Note: $R^2 = 0.840$ Adjusted $R^2 = 0.829$ N = 120

** Significant at five percent level, *** Significant at one percent level

* Significant at ten percent level, NS- Non Significant

Table 2: Constraints of farmers in Coconut Production

Sl. No.	Constraints	Mean Score	Rank
1.	Pest and Disease incidence	88.48	I
2.	Limited availability of labour	79.38	II
3.	Scarcity of water	75.56	III
4.	Improper providence of schemes	57.43	IV
5.	High cost of inputs	50.41	V
6.	Monsoon failure	46.91	VI
7.	Lack of technical expertise	44.58	VII
8.	Lack of scientific knowledge	40.8	VIII

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