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Economic Analysis of Pearl Millet Cultivation in Rainfed Ecosystem of Thoothukudi District, Tamil Nadu, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The Pearl millet is the staple and nutritive diet of farm households in developing and underdeveloped countries. It is grown as dual-purpose; grain and forage in drylands, marginal lands, and unirrigated lands of the Indian subcontinent. This study analysed the cost and returns, profitability, and resource productivity of the pearl millet growing farmers in a rainfed ecosystem of Thoothukudi District. Primary data were collected in selected blocks namely Vilathikulam and Pudur, based on the maximum area under pearl millet cultivation. The sampling design used in the study was Purposive random sampling. Totally 61 farmers were personally interviewed using a well-structured questionnaire. The Cost-C was Rs. 41115.65 per hectare. The proportionate

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expenditure of Hired Human Labour was 19.05 per cent to total costs. The net income was Rs. 4974.2 per hectare. The BCR was higher in small followed by medium and large farms. The partial regression coefficient of hired labour and fertilizers was 0.103, and 0.793 respectively, which were positive and highly significant. It indicated that gross return was increased by 0.793 per cent by increasing one per cent of expenses on fertilizers. The summation of all partial coefficients was 0.656 which indicated a decreasing return to scale. When the production function's returns to scale decrease, the average cost of production rises. Input prices have a significant impact on the economic profitability of farmers' crop cultivation. Rainfed pearl millet cultivation is unprofitable at market values in the Thoothukudi district. The current scenario requires the revising of minimum support prices and regulation in input market, particularly for crops grown in rainfed ecosystems.

Keywords: Economic analysis; costs; returns; resource productivity and pearl millet.

1. INTRODUCTION

The global millet production accounted for 27.80 million tons. India, Nigeria, and China are the leading producers in millet, where India shares about 41.00 per cent of total millet production, and African countries are the largest consumers of millets globally [1]. Rajasthan, Uttar Pradesh, Gujarat, Madhya Pradesh, Haryana, Maharashtra, Karnataka, Tamil Nadu, Odisha, and Kerala are the top ten millet producers in India [2]. In India, millet is used as staples because of increased awareness about nutritional values such as rich sources of minerals like Iron, Calcium, Phosphorus, Zinc, and Magnesium and increased income [3]. Food and Agriculture Organisation announced the year 2023 as the “International Year of Millets” [4]. The millets are grown in a wide range of climatic conditions and also in stressed conditions. They are cultivated in farms where maize and wheat are not grown [5]. The pearl millet is grown as dual-purpose grain and forage in drylands, marginal lands, and unirrigated lands of the Indian subcontinent [6]. It is tolerant to difficult situations such as moisture stress, low soil fertility, and high temperature. By the distribution of cheaper rice through the Public Distribution System (PDS), the consumption of pearl millet grain was reduced. In the case of the demand for millet grains in dairy and poultry enterprises, alcohol, food, and starch industries was increased. It was cultivated about 0.50 lakh of hectares of area with an annual production of 1.00 lakh tonnes with the productivity of 2085 kg/ha of grains in Tamil Nadu [7, 8]. Rainfed agriculture occupies around 70.77 million hectares which accounts for 50.76 per cent of the net sown area in India [2]. It supports nearly half of the total food production of India. The characteristics of rainfed agriculture are low productivity and irregular pattern of Input usage due to the vagaries of monsoon. The problem statement was acknowledged that rainfed cultivation with low input use, non-effective use of recommended inputs particularly fertilizers and plant protection chemical and low producer’s sale price prevalent in the study area. The farmers faced inefficient product marketing practices. The potential income generation through rainfed crops is questionable. Hence it is imperative to study the profitability and resource productivity of pearl millet in rainfed ecosystem of Thoothukudi district. Therefore, the current study was undertaken with the following objectives,

1. To analyses the cost and returns of the pearl millet growing farmers in the rainfed ecosystem of Thoothukudi district, and
2. Resource productivity of the pearl millet cultivation.

2. METHODOLOGY

Thoothukudi district is categorized under the southern zone of the Seven Agro-climatic zones in Tamil Nadu, India. The majority of the gross cropped area in the Thoothukudi district follows rainfed agriculture which depends predominantly on the northeast monsoon. The farmers used to cultivate pearl millet (Cumbu), sorghum (Solam), maize (Makkasolam), and pulses as major crops in rainfed areas of the district. The primary data was collected using Purposive random sampling in Thoothukudi District. Vilathikulam and Pudur blocks were selected using area wise maximum pearl millet growing blocks in Thoothukudi District. Totally 61 farmers were personally interviewed using a well-structured questionnaire. The size of landholding or area under crop cultivation influences the cost of cultivation and income generation. Thus, Respondents were divided into three categories

based on the area under Pearl millet cultivation namely small (Less than 1 ha), medium (Between 1 and 2 ha), and large (Greater than 2 ha). Cost concept includes Cost-A, cost –B, and Cost-C were used to analyze the data investigation [9, 10]. Cost-A covers the working capital includes hired labour, machine labour, costs of seeds, fertilizers, plant protection chemicals, depreciation of farm assets, and Interest on Working Capital. Cost-B includes Cost-plus land revenue, the rental value of land, and interest on fixed capital. Cost-C includes Cost-B plus imputed value of family labour. Farm business income includes Cost-A subtracted from gross revenue, Farm labour income includes Cost-B subtracted from gross revenue and net income includes Cost-C subtracted from gross revenue was analyzed. Cobb-Douglas production function was used for estimating Resource productivity [11, 12]. In various production functions, it measures the marginal productivity of each independent variable or inputs to the aggregate output. It is more flexible in functional form. The fitted equation was as followed,

$$Y = AX_1^{b_1}X_2^{b_2}X_3^{b_3}X_4^{b_4}X_5^{b_5}X_6^{b_6}.e^a$$

Where, Y = Gross revenue of pearl millet cultivation in rupees per ha, X_1= costs of Family labour in rupees per ha, X_2 = costs of Hired labour in rupees per ha, X_3 = costs of machine labour in rupees per ha, X_4= costs of seeds (mostly preferred Pioneer 86M38) in rupees per ha, X_5= costs of fertilizer in rupees per ha, X_6= Plant protection chemicals in rupees per ha. The equation was transformed into log-linear as

$$\log Y = \log A + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + a \log e$$

The Cobb- Douglas Production function allows us to estimate the elasticity of production of selected independent variables and returns to scale i.e., summation of elasticity of all the variables.

3. RESULTS AND DISCUSSION

The findings of the study were discussed as sub-headings namely, Cost of cultivation of rainfed pearl millet, Profitability of the Pearl millet growing farmers in the Rainfed ecosystem and Resource productivity of the pearl millet cultivation.

3.1 Cost of Cultivation of Rainfed Pearl Millet

Per hectare, input-wise expenditure of rainfed pearl millet growing farmers was estimated and given as Table 1. The results revealed that Cost-A, Cost-B, and Cost-C were found as Rs. 32,588.68, Rs. 38,569.26, and Rs. 41,115.65 respectively. Working capital was highest at Rs. 21,069.06 on small farms followed by Rs. 20,767.46 on large farms and Rs. 20,225.95 on medium farms. Depreciation of farm assets, hired human labour, and threshing has the highest proportionate expenditure was found to be 28.44, 19.05, and 12.85 per cent respectively. The expenditure on hired labour was increased with farm size. Hired labour, threshing, plant protection chemicals have a higher proportionate to total costs. Expenditure on machine labour was estimated highest as Rs. 4,132.23 in small farms followed by Rs. 1,285.71 in medium and Rs. 456.93 in large farms. It was due to the own machinery and implements. It was revealed that the predominant proportionate expenditure was the rental value of the land and its share was 15.20 per cent. It was found that the rental value of land was increased with farm size. Deshmukh [9] reported that cost concepts of pearl millet as Rs. 11,629.35 of Cost-A, Rs. 14,673.26 of cost-B, Rs. 15,990.13 of Cost-C. Sundar [13] was reported that cost-A, cost-B, and cost-C was Rs. 10,255.00, Rs. 22,961.13 and Rs. 26,361.13 respectively. The results are in line with findings of previous works [13-15].

3.2 Profitability of the Pearl Millet Growing Farmers in the Rainfed Ecosystem

In Table 2, the Profitability per hectare of rainfed pearl millet cultivation was estimated. The gross revenue per hectare was found to be Rs. 49,398.41 in large farms followed by Rs. 47,357.00 in medium farms, Rs. 41,514.15 in small farms. It showed that gross revenue was increased with farm size. The farm business income was estimated to be Rs. 11,944.70 in small farms, Rs. 13,158.67 in medium farms, Rs. 15,212.60 in large farms and on average, Rs. 13,501.23 per hectare. It was found that the larger the farm size, the higher the farm business income. The farm labour income was found to be Rs. 7,118.23 in small farms followed by Rs. 7,013.49 in medium farms and Rs. 8,242.33 in large farms. It showed that farm labour income was increasing with an increase

in farm size. On average, it was estimated as Rs. 7,520.59 per hectare. The net income was estimated as Rs. 4,820.71 in small farms, Rs. 4,901.88 in medium farms and Rs. 5,012.37 in large farms. It was found that the larger the farm size, the higher the net income. The present study revealed that the Benefit-cost ratio (BCR) was 1.12 on average and 1.13 in small farms, 1.12 in medium farms, and 1.11 in large farms. It was found that higher in small followed by medium and large farms. This result was in line with [9] Deshmukh who was reported that the BCR was 1.18 in small followed by 1.17 in medium and 1.16 in large farms. The results were in accordance with the results of [16], [17].

3.3 Resource Productivity of the Pearl Millet Cultivation

Table 3 revealed the resource productivity of inputs utilized in pearl millet cultivation. It was found that the partial regression coefficient of hired labour was 0.103 which was positive and significant at a 5 per cent level of significance. (t-value = 2.430). This showed that gross return was increased by 0.103 per cent by increasing one per cent of the expenses on hired labour. The partial regression coefficient of seed was -0.187 was negative and significant with a 10 per cent level of significance. (t-value = 3.075). It could be inferred that the gross return would be decreased by 0.187 per cent if we increase one per cent of the expenditure on seeds. The partial regression coefficients of family labour, machine labour and plant protection chemicals were not significant. It estimated that the regression coefficient of fertilizers was 0.793 which were positive and highly significant with one (t-value = 9.274) per cent level of significance. It indicated that gross return was increased by 0.793 per cent by increasing one per cent of expenses on fertilizers.

Table 1. Cost of cultivation of rainfed pearl millet per ha (In Rupees)

Sr. No.	Particulars	Size of Farm Group			Average	Per cent to Total
		Small	Medium	Large		
A	**Working Capital**					
1.	Seeds	780.99	931.25	877.13	863.12	2.10
2.	Fertilizers	271.69	221.90	307.13	266.91	0.65
3.	Plant protection chemicals	1426.03	1285.71	1467.03	1392.92	3.39
4.	Threshing	5245.99	5268.57	5335.94	5283.5	12.85
5.	Hired Labour	7586.78	7788.39	8128.22	7834.46	19.05
6.	Machine Labour	4132.23	1285.71	459.93	1959.29	4.77
	Sub Total	**21069.06**	**20225.95**	**20767.46**	**20687.49**	**50.32**
7.	Interest on Working Capital @ 10 per cent	229.66	195.17	194.12	206.32	0.50
8.	Depreciation on farm asset	8289.70	13582.39755	13210.67	11694.26	28.44
B	**Cost A**	**29569.45**	**34010.61**	**34185.80**	**32588.62**	**79.26**
1.	Land tax	25.34	32.38	36.89	31.54	0.08
2.	Rental value of land	4752.07	6071.43	6918.55	5914.02	14.38
3.	Interest on fixed capital	49.06	41.37	14.82	35.08	0.09
C	**Cost B**	**34395.92**	**40155.79**	**41156.07**	**38569.26**	**93.81**
1.	Family labour	2297.52	2111.61	3229.97	2546.37	6.19
D	**Cost C**	**36693.44**	**42267.48**	**44386.04**	**41115.65**	**100.00**

Table 2. Cost and returns of the Pearl millet per ha

Sr. No.	Particulars	Units	Size of Farm Group			Average
			Small	Medium	Large	
1.	Cost A	Rupees	29569.45	34010.61	34185.80	32588.62
2.	Cost B	Rupees	34395.92	40155.79	41156.07	38569.26
3.	Cost C	Rupees	36693.44	42267.48	44386.04	41115.65
6.	Gross Revenue	Rupees	41514.15	47357.00	49398.41	46089.85
7.	Farm business income	Rupees	11944.70	13158.67	15212.60	13501.23
8.	Farm labour income	Rupees	7118.23	7013.49	8242.33	7520.59
9.	Net Income	Rupees	4820.71	4901.88	5012.37	4974.2
10.	Benefit cost Ratio	Ratio	1.13	1.12	1.11	1.12

Table 3. Resource Productivity of Pearl millet cultivation

Sr. No.	Particulars	Coefficients	Standard Error	t stat
1	Family labour	-0.026	0.016	1.639
2	Hired labour	0.103**	0.043	2.430
3	Machine labour	0.004	0.015	0.240
4	Seeds	-0.187***	0.061	3.075
5	Fertilizers	0.793***	0.085	9.274
6	Plant protection chemicals	-0.031	0.028	1.099

Intercept (log a) = 6.953
Adjusted R2 value = 0.81
*F value = 43.78****
*N = 61; Note: ***, ** and * indicate significance of value P = 0.01, P = 0.05 and, P = 0.10 respectively.*

The coefficient of multiple determinations (Adjusted R2) was 0.81 which indicated that 82.9 per cent of the variation in dependent variables was explained by variation in independent variables. The F-value of R2 was 43.78 that were highly significant. It was explained that all the independent variables together involved significantly in variation pearl millet production. The summation of all partial coefficients was 0.656 which indicated a decreasing return to scale. The findings are in accordance with [18-20] who found that the regression coefficient of inputs in pearl millet cultivation were 0.330 for the area and 0.112 for family labour which was positive and significant. The previous studies also reported that return to scale was 0.80 which indicated a decreasing return to scale.

4. CONCLUSION

The study estimated the cost and returns, and profitability of rainfed pearl millet. Farmers and stakeholder can learn about better resource allocation and the profitability of farming rainfed pearl millet based on the findings. It showed that gross revenue per hectare of pearl millet cultivation was found to be Rs. 49,398.41 in large farms followed by Rs. 47,357.00 in medium farms, Rs. 41,514.15 in small farms. It showed that gross revenue was increased with increasing in farm size. The net income was estimated to be Rs. 4,820.71 in small farms, Rs. 4,901.88 in medium farms and Rs. 5,012.37 in large farms. The profitability was higher in larger farms followed by medium farms and small farms. The BCR was higher in small farms than medium and large farms. On average, the BCR was 1.12 which was lower because of rainfed cultivating practices. The partial regression coefficient of fertilizers was 0.793 which was positive and significant and indicated that gross return was increased by 0.793 per cent by increasing one per cent of expenses on fertilizers. The pearl millet cultivation in the rainfed condition showed decreasing returns to scale which indicated an increased cost of production. Input prices have a significant impact on the profitability of farmers' crop cultivation. Rainfed pearl millet cultivation is unprofitable at market values in the Thoothukudi district. The current scenario requires the revising of minimum support prices and regulation in input market, particularly for crops grown in rainfed ecosystems. The research can be conducted for others nutri-cereals.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. APEDA, Millets Report, Agricultural and Processed Food products Export Deveplopment Authoity, Ministry of Commerce & Industry, and G.o. India, Editors; 2020.
2. Agricultural statistics at a Glance, Agricultural statistics at a Glance D.o.A.C.F. Welfare, Editor; 2019.
3. Dayakar Rao B, et al., Nutritional and Health benefits of Millets., I.I.I.o.M.R. (IIMR), Editor. Hyderabad; 2017.
4. Government of India, Agriculture Minister's statement on the FAO endorsement, P.I. Bureau, Editor. Ministry of Agriculture & Farmers Welfare, GoI; 2018.
5. Basavaraj G, et al. Availability and utilization of pearl millet in India. SAT eJournal. 2010;8.

6. Yadav O, Rai K. Genetic improvement of pearl millet in India. Agricultural Research, 2013;2(4):275-292.
7. Agricultural statistics at a Glance, Agricultural statistics at a Glance, Department of Agriculture Cooperation & Farmers Welfare, Editor; 2018.
8. Selvi B, et al. A new high yielding dual purpose sorghum variety CO 32 for Tamil Nadu. Electronic Journal of Plant Breeding. 2021;12(1):1-8.
9. Deshmukh D, et al. Costs, returns and profitability of pearl millet production. International Journal of Commerce and Business Managaement. 2010;3(1):95-99.
10. Hamsa K, Srikantha M, Gaddi G. Comparison of cost and returns of major food crops under Central Dry Zone of Karnataka. IOSR Journal of Agriculture and Veterinary Science. 2017;2319-2380.
11. Zalkuwi J, et al. Resource productivity of sorghum in Maharastra state India. International Journal of Environmental & Agriculture Research. 2015;1:35-43.
12. Bharathi P, A. Daniel Viswasam Samuel, P. Masilamani, Resource Use Efficiency of Sorghum and Maize in Namakkal District of Tamil Nadu. Indian Journal of Pure Applied Biosciences. 2020;8(5): 201-205.
13. Sundar L, Kumar S, Singh V. An Economic Analysis of Production of Pearl Millet (Pennisetum glaucum) in Sikar District of Rajasthan, India. International Journal of Current Microbiology and Applied Sciences. 2020;9(12):1635-1639.
14. Gautam, Y., P. SINGH, and O. SINGH, Economic Analysis of Sorghum Production Under Irrigated Condition in Maharashtra. 2020.
15. Tandel V, et al. cost structure and Profitability of Finger Millet in south Gujarat Region. International journal Of Agriculture Science, ISSN, 2018;0975-3710.
16. Malik DP. Production, Returns and Policy initiatives for nutri cereals (Pearl Millet) in India. ResearchGate; 2020.
17. Ayalew B, Sekar I. Profitability of coarse cereals production in India. International Letters of Natural Sciences; 2015;39.
18. Deshmukh D, et al. Resource productivity and resource use efficiency in pearl millet production. International Journal of Commerce and Business Managaement. 2010;3(1):117-119.
19. Gautam Y, Singh O. Analysis of costs and resource productivity in pearl millet production under solar irrigation system in Jaipur, Rajasthan. Journal of Pharmacognosy and Phytochemistry, 2020;9(6):470-472.
20. Gautam Y, Singh P, Singh O. Financial profitability and resource use efficiency in sorghum production under rainfed condition; 2021.

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