

Resource Use Efficiency of Sorghum and Maize in Namakkal District of Tamil Nadu

P. Bharathi^{1*}, A. Daniel Viswasam Samuel² and P. Masilamani³

¹Dept. of Agricultural Economics, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai

²Professor (Agrl Economics), Dept. of Social Sciences, Anbil Dharmalingam Agricultural College and Research Institute, Tamil Nadu Agricultural University, Trichy

³Dean, Anbil Dharmalingam Agricultural College and Research Institute, Tamil Nadu Agricultural University, Trichy

*Corresponding Author E-mail: danny_india_2004@yahoo.co.in

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ABSTRACT

The study was carried out in Namakkal district of Tamil Nadu with 87,403 hectares of area under sorghum and maize during the year 2018-2019. Namakkal district is famous for poultry farms as it is properly known as “Egg City”. Most of the farmers in this district cultivate sorghum and maize mainly for poultry feed. Probability Proportional to Size (PPS) sampling technique was used to select the villages having major area under sorghum and maize. Thus, the samples of 80 farmers were chosen for the present study. Cobb-douglas production function was used in the present study to analyse the resource use efficiency. The results of the marginal value productivity analysis conclusively showed that other than farm yard manure, all the variables were used inefficiently in the maize and sorghum farms. . The major constraint in the cultivation of sorghum and maize was found to be higher labour cost, higher incidence of pest and diseases, high fertilizer cost and the high cost of seed.

Keywords: *Probability Proportional to Size, Resource use efficiency, Marginal value productivity, Constraints.*

INTRODUCTION

Agriculture is the prime source of livelihood for about 58 % of India's population. Cultivation of different crops has been encouraged by high proportion of land and diverse agro climatic regions. The most important food crops cultivated in the world are rice, wheat, maize, barley and sorghum. Both the maize and sorghum were cultivated

in wide geographical area in America, Africa and in Asia. The area, production and productivity of sorghum in India is 4.09 M ha, 3.47 MMTs, 849 kgs/ ha during the year 2018-2019. Similarly, the area, production and productivity of maize during the year 2018-2019 is 9 M ha, 27.7 MMTs, 3070 kgs/ha respectively. (<https://www.indiastat.com/>).

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Sorghum is one of the traditional coarse cereal grains in India and it is consumed from the ancient times. It can also be used as a substitute for wheat in pastas, bread, etc., Over 90 percent of the world's sorghum area is roughly accounted by the developing countries and 25-30 percent of global production is from Asia and Africa. Most of the crop is grown by small-scale farming households operating at the margins of subsistence. Production in Africa remains characterized by low productivity and extensive, low-input cultivation. Production is generally more intensive in Asia, where fertilizer and improved seed are used far more widely. On both Asia and Africa, sorghum is grown primarily for food. In contrast, in the developed countries, almost all sorghum production is used as feed for animals. (FAO, 2020) The researchers found that sorghum will help in weight loss and it is used as a substitute for wheat-based value-added products. (O.S.K Reddy., 2017). Sorghum can grow well in high temperature as it has high water holding and absorption capacity. Sorghum which is gluten free can also help in reducing the problem of celiac diseases. (Dayakar Rao et al., 2013). Maize is a staple food in most of the countries which is rich in carbohydrates, proteins, lipids and Vitamin B1. With the practise of mulching and crop rotation, maize growers can reduce the cost, boosting the yields and conserving natural resources. Maize can also be used as food for human, poultry and cattle. Value added products of maize improves the nutritional and food security and employment level of women and unemployed youth with diversification in food choices (Murdia et al., 2016). More than 3500 value added products of daily application are prepared from Maize and 50 per cent of its produce is being used as animal feed, which enhances its marketability

and price and is having a promising option for diversifying agriculture in hilly ecosystem of India (Singh et al., 2003).

Objectives:

1. To determine the resource use efficiency associated with the cultivation of sorghum and maize.
2. To identify the constraints in sorghum and maize production.

MATERIALS AND METHODS

As millet cultivation was spread over three taluks of the district, four blocks from these taluks namely Puduchatram, Rasipuram, Erumaipatty and Namagiripet were selected purposely considering the maximum area. Concomitantly ten villages from these four blocks selected based on Probability Proportional to Size (PPS) sampling technique. From each village 8 farmers were chosen randomly (4 sorghum farmers and 4 maize farmers). Totally 80 farmers were selected for this study. The analytical tools used in this study are as follows.

Resource use efficiency

Cobb-douglas production function analysis and marginal value productivity analysis was used to analyse the resource use efficiency.

The production function model is as follows:

$$Y = AX_n^{b_1}e$$

Where, Y = Yield (in kg), A = constant term, X_n= Seed (in kg), N (in kg), P (in kg), Farm yard manure (in kg), Machine labour (in hrs), Human labour (in man days), b_i= parameter to be estimated or regression coefficients (i=1 to 6), e = random error term.

Marginal value productivity

The estimated coefficients of significant independent variables were used to compute the marginal value products (MVP) and the resource use efficiency ratio as follows:

$$r = MVP/MFC, MVP = MPP \times P_y, MPP = \beta_i$$

Here, MVP_i = Marginal value product of the ith input,

β_i = Estimated co-efficient (or) elasticity of the ith input, and

P_y = Price of output

The magnitude of the marginal value product was compared to marginal factor cost (MVP / MFC ratio) and this indicates the scope of resource adjustment necessary to attain economic optimum. A ratio greater than one implied that the output could be raised by using more of a given resource. A ratio less than one implies the return to additional input is negative and output could be raised by using less of a given resource. A situation where the MVP equals the MFC or price per unit input implied an economic optimum and the resource is being utilized efficiently.

2. Constraints

Garrett ranking method was employed to study the constraints faced by sorghum and maize growers.

RESULTS AND DISCUSSION

Resource use efficiency of Sorghum

Cobb-douglas production function was used to estimate the resource use efficiency and the result is presented in Table 1. The results of Cobb-douglas production function showed that the values of multiple determination (R^2) was 0.93. It implied that 93 percent of the total variation in the dependent variable was explained by variation in the independent variables included in the model. It was evident from table that, the independent variables farm yard manure, nitrogen, machine hours were positive and significantly influence the yield. Hence one percent increase in the use of farm yard manure, nitrogen and machine hours increased the yield of sorghum by 0.12, 0.14, and 0.16 percent respectively. Labour man days were positively related to the production of sorghum even though their influence was found to be non-significant. The phosphorous fertilizer was negatively influenced the yield of sorghum and was found non-significant. Seed was found to be negatively influenced the yield which implied that the efficiency ratio of seed was less than one indicated that the seed was over utilized in the study area.

The ratio of marginal value product and marginal factor cost determines the

resource use efficiency of sorghum. It was observed from the table that, the efficiency ratio of phosphorous fertilizer, input seed, labour man days were found to be less than one indicated that these resources were over utilized and have to be reduced to increase the yield optimally. Likewise, the efficiency ratio of the inputs like nitrogen fertilizer and machine hours were found to be more than one indicating that these resources were underutilized in the study area and need to be increased in their usage to enhance the production of sorghum. Whereas, the efficiency ratio of farm yard manure was found to be one indicated that farm yard manure was used efficiently in the study area. Thus, the results showed that other than farm yard manure, all the variables were used inefficiently in the study area.

Resource use efficiency of Maize

The results of the Cobb-douglas production function showed that the values of multiple determination (R^2) was 0.91. It implied that 91 percent of the total variation in the dependent variable was explained by variation in the independent variables included in the model., the independent variables nitrogen, potassium fertilizer, machine hours and labour man days were positive and significantly influence the yield. Hence one percent increase in the use of nitrogen, potassium fertilizer, machine hours and labour man days increased the yield of maize by 0.103, 0.104, 0.202, 0.284 percent respectively. The independent variables such as farm yard manure and input seed were negative and significant at ten percent and five percent respectively. Thus, these resources were negatively related to the production of maize. Hence, one percent increase in the use of farm yard manure and seed would decrease the yield by 0.086, 0.174 percent respectively. Phosphorous fertilizer was positively related to the production of maize even though their influence was found to be non-significant. It was found that the farm yard manure and the seed was negatively influenced the yield which implied that the efficiency ratio of these inputs

were less than one indicated that these resources were over utilized in the study area.

The estimated coefficients of the independent variables from the Cobb-douglas production function were used to examine the efficiency ratio of each variable. It was observed from the table that, the efficiency ratio of nitrogen, phosphorous, potassium fertilizer, machine hours, labour man days were found to be more than one indicated that these resources were underutilized in the study area and need to be increased in their usage to increase the production of maize Whereas, the efficiency ratio of farm yard manure and seed were found to be less than one indicated that these resources were over utilized in the study area and need to be reduced in their usage to increase the production of maize. Thus, the results showed that all the variables were used inefficiently in the study area.

Constraints faced by sorghum farmers

The major constraint faced by sorghum farmers were high labour cost. As there was labour scarcity at a time of sowing and harvesting, the wages of labour was increased. The next major constraint faced by the sorghum growers were lack of knowledge about value addition. The farmers do not aware of value addition of sorghum hence the level of income realised was low as they sell it

as raw product or as a cattle feed. There were *nitty-gritty* constraints owed to low productivity followed by high cost of seed, fertilizer, lack of technical knowledge on production and high incidence of pest and diseases etc.

Constraints faced by maize farmers

The constraints in production of maize was ranked and was observed that the major constraint faced by maize farmers were high incidence of pest and diseases. The attack of armyworm on the cob was the major problem in the study area which leads to low productivity. The next major constraint was non availability of labours at the time of harvesting. Labour is the chief factor used for sowing and harvesting. The farmers in the study area were not in the practice of using machine harvester. The only way to harvest was by labour. Hence, non-availability of labours at the time of harvesting was the major constraint. The next constraint was lack of knowledge on value addition of maize. The maize farmers do not aware of value addition of maize as they used maize as cattle feed. There were constraints of productivity followed by high labour cost, lack of processing industries, lack of technical knowledge and high cost of seed respectively.

Table 1: Resource use efficiency of Sorghum production

Variables	Regression coefficient	Std error	t value	Geo mean	MVP	MFC	$\frac{MVP}{MFC}$	Status
Reg. Constant	6.354 ^{***}	0.252	25.22	2325.10	-	-	-	
FYM (Kg/ha)	0.121 ^{***}	0.014	8.91	4719.12	1.16	1.15	1.01	Optimal
N (Kg/ha)	0.141 ^{***}	0.031	4.57	12.68	502.99	7.05	71.35	Under
P (Kg/ha)	-0.024 ^{NS}	0.023	-1.03	9.96	-119.10	22	-5.41	Over
Seed (Kg/ha)	-0.146 ^{**}	0.059	-2.49	17.87	-371.02	20	-18.55	Over
Machine (hours)	0.160 ^{**}	0.069	2.34	11.46	635.01	500	1.27	Under
Labour (man days)	0.029 ^{NS}	0.034	0.85	32.53	40.10	340	0.12	Over

Note: $R^2 = 0.932$ Adjusted $R^2 = 0.919$ N = 40

** Significant at five percent level, *** Significant at one percent level, NS- Non-Significant

Table 2: Resource use efficiency of Maize production

Variables	Regression coefficient	Std error	t value	Geo mean	MVP	MFC	$\frac{MVP}{MFC}$	Status
Yield	6.639***	0.762	8.71	3329.24	-	-	-	
FYM (kg/ha)	-0.086*	0.047	-1.81	4469.09	-1.18	1.15	-1.03	Over
N (kg/ha)	0.103*	0.055	1.87	131.53	48.17	7	6.88	Under
P (kg/ha)	0.052	0.089	0.58	60.64	52.40	20	2.62	Under
K (kg/ha)	0.104*	0.056	1.86	51.83	123.67	30	4.12	Under
Seed (kg/ha)	-0.174**	0.083	-2.09	18.17	-589.32	15	-39.29	Over
Machine (hours)	0.202***	0.058	3.46	11.06	1126.19	550	2.05	Under
Labour (man days)	0.284***	0.071	3.99	45.27	386.93	300	1.29	Under

Note: $R^2 = 0.91$ Adjusted $R^2 = 0.89$ N = 40

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

* Significant at ten percent level, NS- Non Significant

CONCLUSION

In conclusion, the marginal value productivity analysis showed that other than farm yard manure, all the variables were used inefficiently in the sorghum farms. Whereas, in maize farms all the variables were used inefficiently. The major constraints faced by sorghum and maize farmers were high incidence of pest and diseases, high labour cost, lack of awareness about value addition and lack of processing industries. Thus, the farmers in the study area could efficiently use their resources with minimum cost to further increase their standard of living. The study advances potential for value added millet products in the study area carry with sense of belonging among farmers and young entrepreneurs.

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