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Technical efficiency in finger millet and paddy crop in Southern Karnataka: Application of data envelop analysis and stochastic frontier approach

Hamsa KR, Umesh KB, Veerabhadrappa Bellundagi and Suman L

Abstract
This study, conducted in the Southern Karnataka specifically focus on progressive (Tumakuru district) and less progressive (Ramanagara district) areas with an objective of understanding the technical efficiency of the farms. Two major crops (paddy and finger millet (Ragi)) were selected considering the cultivation of crops in both progressive area and less progressive areas and to compare the technical efficiency of farm. The popular technical efficiency benchmarking tool within agricultural research are parametric (Stochastic Frontier Analysis, SFA) or non-parametric (Data Envelopment Analysis, DEA) were employed to assess the efficiency. The study indicated that about 29 per cent of progressive farms had technical efficiency above 0.9 technical efficiency score as against none in less progressive area. There were no differences in mean scores of technical efficiency of paddy in progressive (0.86) and less progressive area (0.85). But in case of finger millet, progressive area farms (0.76) were technically efficient than the less progressive farms (0.57). Eighty-three and seventy-seven percentages of obtained yield and potential yield was primarily due to factors which are under the control of farmers, respectively. This clearly indicates the importance of agriculture extension in promoting adoption of technologies and its potential in improving yield and income of farmers.

Keywords: Technical efficiency, data envelopment analysis, stochastic frontier analysis, finger millet, paddy
JEL Codes: D, D24, C, C1, C14

1. Introduction

A commonly used measure of efficiency is stated in the ratio of output to input (Cooper *et al.*, 2007) [9] and is widely used in benchmarking procedures to identify best-practice management for a given farming system (Fraser and Cordina, 1999) [12]. Such procedures, henceforth referred to as 'efficiency benchmarking', are instrumental for guiding farmers on how to reduce costs and resource use, increase profitability and minimize environmental impacts of production (Fraser and Cordina, 1999) [12]. Estimating technical, allocative and economic efficiencies can offer important policy insights on improving the agricultural production and profitability through optimum allocation of resources. In this paper, we examine the efficiency in production of rice and finger millet using data from a detailed survey in Tumakuru and Ramanagara district of Karnataka, India.

Estimation of the current level of technical efficiency of agricultural producers will reveal the potential for growth through increasing the productivity of existing resources without increasing their volume (Margarita and Lerman, 2005) [17]. With increasing food demand due to population growth and shrinking agricultural land, meeting the demand for food require intensification of agriculture (Hamsa, *et al.*, 2017a) [13]. At the same time, making agriculture sustainable in terms of resource use is equally important considering the stress on natural resource base. Resource use efficiency in agriculture has the potential to indicate the efficiency gaps and how to optimize the resource use which has implications for production and income.

Rice is an important staple crop and integral part of south Indian diet. Rice is a water intensive crop, grown both under rainfed and irrigated conditions. Though, Rice is a major crop in terms of gross area sown, the production has not reached its optimum level in terms of total as well as average productivity, when compared to global productivity (Hamsa *et al.*,2017b) [24]. vessels.

Improving efficiency in rice production is not only important from the perspective water footprint, but also has bearings on food security, as rice is the major staple in India. Finger millet is another staple food consumed mainly in South Karnataka (Anonymous, 2014B) [1]. It is mainly used as a substitute for rice among the diabetic patients and also the diet conscious people (Anonymous, 2014B) [1]. Finger millet has several nutritional benefits and resource friendly as it is frugal in terms of resource requirement for cultivation. We examine the efficiency in production of these two important crops from different concepts of efficiency documented in literature.

The study examines three forms of efficiency: technical efficiency (TE), allocative efficiency (AE) and cost/ economic efficiency (CE/EE). Technical efficiency measures show how efficiently the farm uses the available inputs to produce a given output (Coelli *et al*., 2005) [8]. In other words, technical efficiency indicates whether the farm achieves maximum output using a given bundle of factors of production. Allocative efficiency measures show how far the farm is from the point of efficient input combination and levels which maximises the profits given the input and output prices (Farrell, 1957) [11]. Thus, allocative efficiency determines whether the factors of production are used in proportions that ensure maximum output at given market prices. Cost/economic efficiency is the product of TE and AE. Thus, a farm is economically efficient if it is both technical and allocative efficient. We examine all three efficiencies in production of rice and finger millet.

However, recently, DEA has been used in agricultural production sectors following the pioneer works of De Koeijer *et al.* (2002) [10] and Reig-Martínez and Picazo-Tadeo (2004) [19]. Studies by Umesh and Bisaliah (1991) [25], Shanmugam (2001, 2002) [20-21] have indicated that it is possible to raise the productivity of crops without raising the input application. The study would help in identifying the levels of inefficiency, distribution of technical efficiency scores and output variations with the help of SFA and also in formulating the policy to improve the efficiency of the farm households.

The paper has two important contributions. Firstly, we asses technical efficiency of major crops and compare between progressive and less progressive area using data driven Data Envelopment Analysis. This will help in identifying the efficiency gap in the two areas. Secondly, the paper also highlights the possibility of increasing the production and farm income with the same level of input use. With Government aiming to Double the income of farm income, the study results underscore the potential of adoption of scientific agricultural technology to enhance farm income.

2. Methodology

2.1 Data base

In Southern Karnataka, the study was conducted in Tumakuru and Ramanagara districts based on proportion of agricultural gross domestic product criteria for the purpose representing progressive and less progressive districts, respectively. Tumakuru and Gubbi taluks of Tumakuru district and Ramanagara and Magadi taluks of Ramanagara district were selected using the progressiveness criteria.

Random sampling technique was employed for the selection of sample respondents. A total sample of 120 farmers were collected from each district, comprising 60 from each taluk. Thus, the total sample size was 240. For the present study, two major crops (paddy and finger millet) were selected considering the cultivation of crops in both progressive area and less progressive areas (Appendix I and II) to compare the technical efficiency of farms.

2.2 Technical, allocative and cost efficiencies

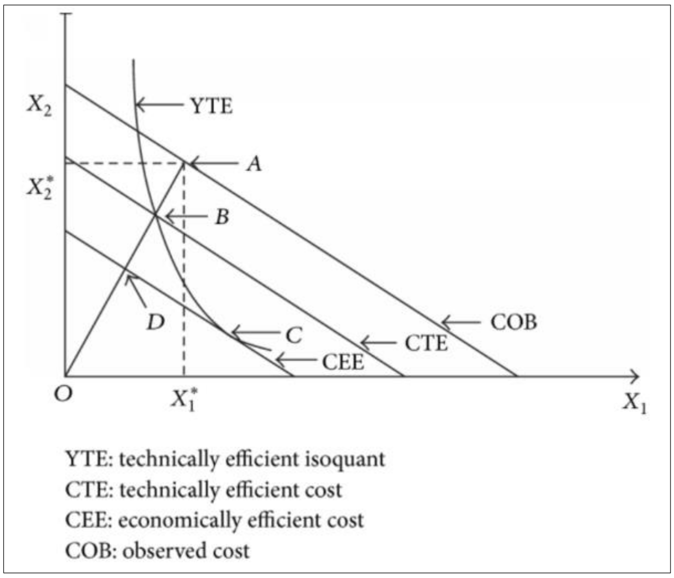

Fig 1: Graphical Representation of observed and technically and economically efficient cost Measures. Technical efficiency (TE), allocative efficiency (AE), and economic efficiency (EE) are equal to the following: TE = OB/OA = CTE /COB, AE = OD/OB = CEE/ CTE, and EE = TE ∗ AE = OD/OA = CEE/COB.

The methodological framework to measure economic efficiency (EE), technical efficiency (TE), and allocative efficiency was introduced by Farrell (AE; by definition, EE is equal to the product of TE and AE). According to Farrell, TE is associated with the ability to produce on the frontier isoquant, while AE refers to the ability to produce at a given level of output using the cost-minimizing input ratios (Figure 1)

A farm is said to be technical efficient (TE) if it produces larger quantities of output from a given level of measurable inputs. Allocative efficiency (AE) or price efficiency refers to proper choice of input combinations by a technically efficient farm. AE arises when the input mix is in consistent with the cost minimization. A farmer is said to be allocatively efficient if he maximizes the profit. Allocative efficiency is worked out as the ratio of the least cost required to produce a particular level of output and the actual costs incurred in the farm which is adjusted for TE. Product of both technical and allocative efficiency gives raise to Economic Efficiency (EE). Hence, the economically efficient firm is both technically as well as allocatively efficient. Data Envelopment Analysis (DEA) as suggested by Charnes *et al.* (1978) [5] was employed.

2.3 Data Envelopment Analysis

The DEA method is a frontier method that does not require specification of a functional form or a distributional form, and can accommodate scale issues. DEA was applied by using both classic models CRS (constant returns to scale) and VRS (Variable returns to scale) with input orientation, in which one seeks input minimization to obtain a particular product level. The basic approach to estimating allocative efficiency is through the value of marginal product (VMP). The value of marginal product is calculated from econometrically estimated production functions. The use of an agricultural input is allocative efficient if the value of marginal product is equal to its price. Efficiency benchmarking is a wellestablished way of measuring and improving farm performance (Soteriades *et al.*, 2018) [23]. An increasingly popular technical efficiency benchmarking tool within agricultural research are parametric (stochastic frontier analysis, SFA) or non-parametric (Data envelopment analysis, DEA) (Lee *et al.*, 2009) [16]. DEA initially *em*erged as a practical technique of measuring efficiency and sustainability of industrial production systems (Ullah and Perret, 2014) [24]. Under assumption of constant returns to scale, the linear programming model used for measuring the efficiency of farms (Coelli, *et al.*, 1996) [6].

Estimation of technical efficiency

Min α λ α

Subject to $-yi + Y\lambda \geq 0$

$\alpha Xi - X\lambda \geq 0$

$\lambda \geq 0$

Where,

y*i* is a vector ($m\times 1$) of output of the i*th* Producing Farms (TPF)

Xi is a vector ($k\times 1$) of inputs of the i*th* TPF

Y is an output matrix ($n\times m$) for n TPFs

X is an input matrix ($n\times k$) for n TPFs

α is the efficiency score, a scalar whose value will be the efficiency measure for the i*th* TPF. If α =1, TPF (Total productivity factor) will be efficient; otherwise, it will be inefficient.

λ is a vector (*nx1*) whose values are calculated to obtain the optimum solution. For an inefficient TPF, the λ values will be the weights used in the linear combination of other, efficient, TPFs which influence the projection of the inefficient TPF on the calculated frontier.

Estimation of allocative efficiency and cost efficiency (Economic efficiency)

If one has price information and is willing to consider a behavioral objective, such as cost minimization or revenue maximization, then one can measure both technical and allocative efficiencies. One would run the following cost minimization DEA for estimation of cost efficiency (or economic efficiency) as follows:

$\text{Min}_{\lambda, Xi^*} \, Wi\, Xi^*$,

Subject to $-yi + Y\lambda \geq 0$, $Xi^* - X\lambda \geq 0$, $N_1 \lambda \geq 1$ $\lambda \geq 0$,

Where,

Wi is a vector of input prices for the i^{th} Total Productivity Factor (TPF), Xi is the cost minimizing vector of input quantities for the i^{th} TPF (which is calculated by the LP), Given the input prices Wi and the output levels Yi. The total Cost Efficiency (CE) or Economic Efficiency (EE) of the i^{th} TPF would be calculated as.

$CE = WiXi^* / WiXi$.

i.e., the ratio of minimum cost to observed cost. To calculate the allocative efficiency residually as.

$AE = CE/TE$.

It is to state here that all the models presented above should be solved *n* times, *i.e.*, the model is solved for each TPF in the sample. To analyse the technical efficiency, inputs variables are human labour (Man-days), bullock labour (Pair days), machine labour (hours), seed (Kg), FYM (tonne), fertilizers (Kg), water (per acre inch) were considered. Similar inputs with their cost were considered to check the allocative and cost efficiency using data envelopment analysis. The models were solved using the DEAP version 2.1 taking an input orientation to obtain the efficiency levels.

2.4 Stochastic Frontier Analysis (SFA)

The stochastic frontier analysis (SFA) was employed for estimating the technical efficiency in both progressive and non-progressive area. This is a parametric method of SFA which accounts for the random shock while non-parametric data envelopment analysis assumes the deterministic frontier (Bravo-Ureta and Evenson, 1994; Bravo-Ureta and Rieger,1997) [4, 3]. The SFA allows the deviations from frontier to represent both inefficiency and inevitable statistic noise approach the reality given the random walk of the observation (Koop and Diewert, 1982) [15]. The model treats technical efficiency and represents the random shocks beyond the control of farmers affecting the production. Thus, in this model impact of random shock on the product can be separated from the impact of technical efficiency (Aigner *et al.*, 1977) [2]. Furthermore, this approach considers TE as a multiplicative shift variable within a production function framework which implies input coefficient of conventional production function. In frontier production function, only the intercept changes however, in cross sectional data the distribution of TE must be indicated as half-normal, truncated normal or otherwise. In this study data follows the half normal distribution. Most of previous studies used this method to estimate the TE of farmers in crop sector (Shanmugan and Venkataramani, 2006) [22]. The frontier production defines potential output that can be produced by a farm with given level of resources and technology. The SFA function can be written as:

$$Qi = f(Xi; \alpha) \exp(-ui) \text{ and } 0 \leq ui < \infty; \; i = 1, 2, 3…., n. \quad ….(1)$$

Where, Qi represents the total agricultural production for the i^{th} sample unit; X_i is a vector of inputs and β is a vector of parameters implies the transformation process; f (.) is the frontier production function and u_i is a one-sided (non-negative) residual term. If production unit is efficient, its output is equal to potential output indicating that farmers adopting the good agricultural practices. Therefore, TE is the ratio of the actual output Q_i and the potential output f (.) given the level of inputs and technology.

By equation (1) above, we can write this measure as:

$$TE = Q_i / f(X_i; \alpha) = \exp(-u_i) \quad …. (2)$$

Notice that, u_i is zero, if the production unit produces equals to potential output and is less than zero when production is below the frontier. A random noise variable v_i (independently and identically distributed normal with mean 0 and variance σ_v^2) can be incorporated in the equation (1) to capture the effect of other omitted variables that can influence the output as:

$$Q_i = f(X_i; \alpha) \exp(v_i - u_i)$$

The maximum likelihood estimation (MLE) method can be used to measure parameter of the model is: $\sigma = \sqrt{(\sigma u^2 + \sigma v^2)}$, $\lambda = \sigma u/\sigma v$ (> 0) and $\gamma = \sigma u^2/\sigma^2$). A significant λ would indicate the significant variations in the output levels. The λ with more than one would indicate that output variations due to inefficiency are higher than that due to random factors. A zero value of γ would indicate that the deviations from the frontier are due entirely to the noise or not under control of the farmers it may be due drought, flooding or other natural calamities.

Model estimation for technical efficiency

In this study, equation (1) for estimating the TE at given level inputs and technology for this, Cobb –Douglas production function is specified as given below:

$\ln Y_i = \beta_1 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + \beta_6 \ln x_6 + \beta_7 \ln x_7 + V_i - U_i$

Where, Ln indicates the natural logarithm base e

Yi = Total crop production (in qtl) for i^{th} farm per farm

β_1 = constant

x_1 : Total human labor (in mandays)

x_2 : Quantity of fertilizer (Kgs of NPK)

x_3 : Irrigation expenditure (in Rs.)

x_5 : Area under crops (in acres)

x_6 : Machine hour expenditure (in Rs.)

x_7 : Seed rate (kg ha^{-1})

V_i is the symmetric component of error term which captures randomness which is not under the control of farmer such drought, floods and hailstorms etc.

U_i is Non negative random variable which is under the control of farmer.

3. Results and discussion

In the section to follow we discuss the main findings of the study. Technical, Allocative and Cost efficiency for both the regions are given in Table 1. The finger millet (ragi) mean technical efficiency in progressive area was 0.76, whereas, allocative efficiency and cost efficiency was 0.46 and 0.31, respectively. Thus, ragi in progressive area scores remarkably in mean TE as compared to less progressive area (0.57). Twenty-three and twenty-six per cent of ragi farmers lie in the range of 0.9 to 1 score and were technically efficient in progressive and less progressive area, respectively. The CE of ragi in less progressive area (0.44), which was higher than that of in progressive area (0.31). However, the results pointed that, there is still some considerable level of inefficiencies in the use of inputs for the corresponding output levels. Similar results were obtained in the study conducted by Hamsa, *et al.*, 2017 [13]. The allocative efficiency was higher in less progressive farmers than progressive farmers implying that, less progressive farmers were quite price-sensitive to the input prices. Therefore, overall economic or cost efficiency in ragi was quite high for less progressive farmers.

Table 1: Technical, allocative and cost of finger millet (ragi) farms in progressive and less progressive areas

Crop	Progressive area			Less progressive area		
TE/AE/CE score	TE	AE	CE	TE	AE	CE
<0.5-0.6	23 (37.70)	39 (63.93)	55 (90.16)	48 (63.16)	13 (17.11)	63 (82.89)
0.6-0.7	3 (4.92)	4 (6.56)	1 (1.64)	8 (10.53)	13 (17.11)	3 (3.95)
0.7-0.8	1 (1.64)	8 (13.11)	2 (3.28)	5 (6.58)	13 (17.11)	3 (3.95)
0.8-0.9	6 (9.84)	5 (8.20)	2 (3.28)	8 (10.53)	17 (22.37)	4 (5.26)
0.9-1.00	28 (45.90)	5 (8.20)	1 (1.64)	7 (9.21)	20 (26.32)	3 (3.95)
Total	61	61	61	76	76	76
Mean efficiency score	0.76	0.46	0.31	0.57	0.78	0.44

Note: Figures in Parentheses are percentages

TE: Technical Efficiency, AE: Allocative Efficiency, CE: Cost/Economic Efficiency

The results on technical efficiency (TE), allocative efficiency (AE) and economic or cost efficiency (EC/CE) of farmers in paddy production under progressive and less progressive areas are elaborated (Table 2). The TE of paddy in progressive area was 0.86, AE was also impressive (0.60) and CE was 0.54. The paddy crop in less progressive area has a lower level of efficiency compared to progressive area as the TE was 0.85 and AE was 0.75. In progressive area, 58 per cent of farmers lie in the range of 0.9 to 1 and were technically efficient where as in less progressive area, 57 per cent of farmers were technically efficient. In both areas, there was no difference in mean TE score of paddy cultivating farms. But similar to ragi, the CE of paddy crop in less progressive area (0.64) was higher than that of in progressive area (0.60).

Table 2: Technical, allocative and cost efficiency of paddy farms in progressive and less progressive areas

Crop	Progressive area			Less progressive area		
TE/AE/CE score	TE	AE	CE	TE	AE	CE
<0.5-0.6	4 (12.90)	15 (48.39)	18 (58.06)	4 (28.57)	2 (14.29)	6 (42.86)
0.6-0.7	3 (9.68)	7 (22.58)	2 (6.45)	0 (0.00)	1 (7.14)	0 (0.00)
0.7-0.8	5 (16.13)	3 (9.68)	3 (9.68)	1 (7.14)	6 (42.86)	4 (28.57)
0.8-0.9	1 (3.23)	4 (12.90)	4 (12.90)	1 (7.14)	4 (28.57)	3 (21.43)
0.9-1.00	18 (58.06)	2 (6.45)	4 (12.90)	8 (57.14)	1 (7.14)	1(7.14)
Total	31	31	31	14	14	14
Mean efficiency score	0.86	0.60	0.54	0.85	0.75	0.64

Note: Figures in Parentheses are percentages

TE: Technical Efficiency, AE: Allocative Efficiency, CE: Cost/Economic Efficiency

Distribution of farmers according to technical efficiency in progressive and less progressive area: The frequency distribution of technical efficiency (TE) showed in the table 3 pointed out that, about 29 per cent of progressive farmers had

TE above 0.9 technical efficiency score, as against none in less progressive farmers. In progressive area, 10 per cent of farmers lie in the range of 0.6 to 0.7 and 4 per cent of farmers lie in the range of 0.7 to 0.8 and 0.8 to 0.9 TE score each. Whereas, in less progressive area, 20, 36 and 31 per cent of farmers lie in the range of 0.6 to 0.7, 0.7 to 0.8 and 0.8 to 0.9 TE score, respectively. However, it could be observed that 52 per cent of the farmers lie in the range of 0.5 to 0.6 TE score in progressive as compared to only 12 per cent of the farmers in less progressive areas implying that there is a greater opportunity to increase farm efficiency with given level of inputs and technology in both areas.

In fact, the highest mean TE of 0.72 was observed in progressive area as against 0.64 less progressive area. Thus, this difference in technical efficiency in two areas could be attributed to level of capital formation on farms and it had a strong bearing on the farm productivity in progressive area. This showed an increase in crop production in progressive area by 28 per cent and in less progressive area by 36 per cent with an improvement at the farm level with same amount of inputs and technology. The higher technical efficiency was observed in in progressive area due to their higher farm level investment Thus, there is scope for enhancing farm incomes by infusing additional capital on their farms. Similar outcomes was observed by Venkataramana (2010) [26].

Table 3: Farmers distribution in progressive and less progressive area relating to technical efficiency (In Percentage)

TE score	Progressive area		Less progressive area	
	Number	Percentage	Number	Percentage
<0.5-0.6	46	52	11	12
0.6-0.7	9	10	18	20
0.7-0.8	4	4	32	36
0.8-0.9	4	4	28	31
0.9-1.00	26	29	-	-
Total	89	100	89	100
Mean efficiency score	0.72		0.64	

Note: TE: Technical Efficiency

As the estimated parameter for the variance parameter (γ) was significantly different in both progressive and less progressive areas (Table 4). As the estimated parameter for the variance parameter (γ) was significantly different from zero in both progressive and less progressive area thus, inefficiency effects were significant in influencing the variability of total crop production. The estimate of λ is 0.83 for progressive, and 0.77 for less progressive areas.

Table 4: Output variations due to random variables using maximum likelihood methods

Random variables	Progressive area			Less progressive area		
	Coefficient	Std. error	Z value	Coefficient	Std. error	Z value
Sigma v	0.35	0.00	214457.83	0.58	0.00	334659.09
Sigma u	0.29	0.04	6.43	0.45	0.04	9.89
$sigma^2$ (γ)	0.38	0.05	6.67	3.45	0.05	60.44
Lamda (λ)	0.83	0.04	18.08	0.77	0.04	16.62
Chi square	29.12			32.12		
Pro > chi-square	0.00			0.00		

In other words, 83 and 77 percentages of inefficiency were due to the factors which are under the control of farms for progressive and less progressive area respectively. This clearly indicates that there is scope for enhancing yield and income without increasing the input use. This calls for extension functionaries to focus on disseminating good agricultural practices and adoption of new technologies to farmers as an important strategy to enhance farm incomes.

4. Conclusion and Policy Recommendations

The paper has analyzed the efficiency of rice and finger millet in two districts of Karnataka using both DEA and SFA. The study indicates that the crop production in progressive area by 28 per cent and in less progressive area by 36 per cent with an improvement at the farm level with same amount of inputs. Further analysis revealed that major share of these inefficiencies was due to factors which are under farmers' control. This highlights the potential for increase in efficiency through promotion of good agricultural practices at the field level. This can be an important strategy in doubling farmers income. The agricultural extension system is expected to play an important role in improving the efficiency of farms, which has implications for enhancing farmers welfare.

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Appendix I: Cost of cultivation of paddy in progressive area and less progressive area

Sl. No.	Particulars	Quantity	Per unit cost (Rs.)	Quantity	Per unit cost (Rs.)
I	**Variable cost**	**Progressive**		**Less progressive**	
	Human labour (man days)	30.26	10951.24	28.28	10012.22
	Bullock labour (pair days)	6.00	1789.35	2.00	1300.00
	Machine labour (hours)	4.27	5883.85	3.15	4772.22
	Seed (kg.)	34.89	1382.48	35.17	1215.21
	FYM (Tonne)	5.83	4488.46	3.65	5180.00
	Fertilizer cost		4500.77		4583
	PPC		333.35		481.67
	irrigation charges		1477.48		2646.00
	Marketing cost		1943.08		1068.33
	Interest on working capital @ 7 per cent		2292.50		2188.15
	Total variable cost		35042.55		33447.44
II	**Fixed cost**				
	Total fixed cost		13071.70		11712.13
III	Total cost of cultivation		48114.24		45159.57
IV	Returns				
	Main product (q)	32.13	53714.23	28.20	45822.22
	By product (tractor load)	2.52	6163.46	1.98	4627.78
	Gross returns (Rs.)		59877.69		50450.00
	Net returns (Rs.)		7388.45		5290.43
	Cost of production (Rs./q)		1492.19		1602.83
	Returns per rupee of expenditure		1.23		1.12

Appendix II: Cost of cultivation of finger millet (Ragi) in progressive area and less progressive area

Sl. No.	Particulars	Quantity	Per unit cost (Rs.)	Quantity	Per unit cost (Rs.)
	Variable cost	**Progressive area**		**Less progressive area**	
I	Human labour (man days)	19.59	5590.63	17.90	5063.72
	Bullock labour (pair days)	2.43	1493.11	3.01	1855.59
	Machine labour (hours)	3.15	3761.75	2.85	2267.50
	Seed (kg.)	4.04	110.49	4.70	129.26
	FYM (Tonne)	3.21	1867.48	1.50	2010.71
	Fertilizer cost		1064.18		1742.86
	PPC		121.65		214.36
	Irrigation charges		304.53		310.13
	Marketing cost		727.61		563.76
	Interest on working capital @ 7 per cent		1052.90		991.05
	Total variable cost		16094.33		15148.95
II	**Fixed cost**				
	Total fixed cost		2588.41		4550.06
III	Total cost of cultivation		18682.74		19699.01
IV	Returns				
	Main product (q)	7.48	17807.10	7.95	18543.96
	By product (tractor load)	1.96	4388.10	1.58	3328.14
	Gross returns (Rs.)		22195.20		21872.10
	Net returns (Rs.)		3512.46		2173.08
	Cost of production (Rs. /q)		2508.63		2495.86
	Returns per rupee of expenditure		1.17		1.10