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Yield Gap and T.E. in Rice Production:
A Comparative Study of Two Districts in Manipur

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Abstract

The productivity of rice would depend on various factors, viz. fertility of the land, rice variety, methods of cultivation, applications of chemicals and fertilizers, level of farm mechanization, irrigation facilities, rainfall, etc. A relationship between production and inputs used is developed in this study at the farm level by using cross section data of 160 farmers in the state from Bishnupur and Thoubal districts of Manipur based on the Field Survey data collected during 2016. A farm specific production model is used to examine the relationship between the actual and potential production of rice in these districts.

Translog Production Function model is selected for the farm specific production function. Stochastic Frontier Production Function is derived, and estimated the potential levels of yield of rice for the farmers included in the observation. The estimated potential levels of yield lying along the frontier function were compared with the actual production levels. The stochastic frontier production function is also used for the estimation of Technical Efficiencies. Majority of the farmers in the sample survey were operating at a moderately high level of Technical Efficiency, i.e. 53(33.12%) and 43 (26.88%) out of the 160 farmers are operating at an efficiency class of (0.7, 0.75) and (0.75, 0.8) respectively. Yield gap was highest in the case of villages in Bishnupur district at an average of 1096 kg per hectare. The average yield gap for the villages in Thoubal district was found at 995 kg per hectare. The maximum yield gap in the survey of 160 farmers was found at 1572 kg per hectare. The overall yield gap stood at around 1045 kg per hectare.

***Keywords: Stochastic Frontier Production Function, Translog production function, Technical Efficiency, yield gap**.*

Introduction

Agriculture provides employment and livelihood to the majority of the rural masses of Manipur and it is indeed, the mainstay of the state's economy. The most outstanding feature of the cropping pattern in the state is its heavy preponderance of food crops over non-food crops. Cultivation of food crops is almost mono-culture in rice, which is the staple food of the people in this state. Predominance of rice over other crops in respect to cropped area and production is seen in both the hills and the valley of the state.

The present study attempts to explore how the farmers in the state are using their inputs in rice cultivation. Such type of study will be useful for matter of policy implications, and address the immediate necessities of the farmers in the state and help in achieving the potential output in this sector. The productivity of rice would depend on various factors, viz. fertility of the land, rice variety, methods of cultivation, applications of chemicals and fertilizers, level of farm mechanization, irrigation facilities, rainfall, etc. But, how efficiently the farmers were using these inputs in rice cultivation? It would be worth investigating whether the level of output depends on the quantity of chemicals and fertilizers applied or right use of certain inputs or combination of the available inputs or some other factors. This is a crucial area needed to be explored since majority of the people got employment in this sector.

Cost of cultivation is an important component for determination of profitability of the crop cultivated. Therefore, farmers have to account the costs of various inputs used in cultivation. If the increase in productivity is due to the increase in quantity of fertilizers and chemicals applied, then, profitability will be cut down at the rate of the increase in cost of fertilizers and chemicals applied. There may be a situation where profitability of rice production per unit of area with less fertilizer application is the same or greater than that of more quantity of fertilizer application in the same area. Such conditions may equally be applied to other inputs too. Keeping aside the random factors like flood, drought, or quantity of rainfall during the season, it will be necessary to know whether the available inputs were utilized at its best level. Thus, an understanding of technical efficiency of the inputs used in rice production would provide the desired answers.

The farmers in Manipur adopted HYV of paddy and new technologies in cultivation for the last decades. In spite of high rate of fertilizer application and new technologies, productivity of rice in the valley of Manipur has been fluctuating over the years. Thus, the study of the levels of technical efficiency could help productivity gains if there are opportunities to improve socio-economic characteristics and management practices.

A relationship between production and inputs used is developed in this study at the farm level by using cross section data of 160 farmers in the state from the Field Survey data. For this purpose, the most appropriate farm production function model is selected for analysis from among the commonly used production function models in agriculture. After selecting the best model for the analysis, a stochastic frontier production function is developed by the method of Corrected Least Squares (COLS). Recent works in production economics seek to define the best practice frontier production function and to measure the distance of the individual rice cultivator from this frontier. This distance is interpreted as a measure of the level of technical inefficiency of that farm. The stochastic frontier production function developed from the selected model is used for the estimation of technical efficiencies of the farmers included in the Field Survey.

Objectives

- To identify socioeconomic characteristics and management practices that influences technical efficiency in rice production,
- To examine yield gap among the farmers in rice production with the help of technical efficiency analysis, and
- To suggest appropriate policies derived from the empirical results.

Methodology

The present investigation is based mainly on primary sources of data collected from the farmers in the study area by *multi-stage stratified random sampling method.*

Primary sources of data on related aspects of cultivation method and various inputs used in rice cultivation by the farmers are collected with the help of survey method in a specially designed questionnaire. In the first stage, four villages from each of Thoubal and Bishnupur districts were selected *purposively*. The selected villages were:

1. Charangpat Mamang Leikai (Maklang), Thoubal,
2. Khongjom Sibnagar, Thoubal,
3. Purna Heituppokpi Wangjing Sorokhaibam Leikai, Thoubal,
4. Yairipok Bamon Leikai, Thoubal,
5. Kakyai Mayai Leikai, Nambol, Bishnupur,
6. Keinou Thongthak Maning Leikai, Bishnupur,
7. Toubul Awang Mamang Leikai, Bishnupur, and
8. Heinoubok, Oinam, Bishnupur.

By using Electoral Roll of the respective villages, 50 rice farmers from each village were *randomly* selected. There are, altogether 400 (50 x 8) farmers, 200 each from the two districts in the randomized selection. In the second stage, 20 respondents out of 50 farmers from each village were picked up *randomly*. Altogether, 160 respondent farmers, 80 from each district were selected for the study.

Yield rate and production of paddy is in the form of 'clean rice'. Weight of green paddy is converted into clean rice by using the standard conversion factor (i.e. 1kg of green paddy=0.667kg of clean rice) as given by the Driage Experiment for all the sample villages.

Measure of Technical Efficiency:

With the measurements of technical efficiency indices from the Field Survey data, an attempt is made to understand the extent to which the rice farmers in Thoubal and Bishnupur Districts of the state are exploiting their resources in the production of rice. Various socio-economic and other geographical factors determine the variations in the efficiency level of the farmers, and thus, it is difficult to assess the level of efficiency of a farmer in his production process unless one is sure of the prevailing condition in which he operates. A farmer may be using all the available inputs in required quantities, but may not be realizing the potential output due to improper management. To capture the ability of the farmers in achieving the maximum realizable crop output with minimum level of inputs under the existing resource environment and given technologies, a careful examination of farm specific technical efficiency is necessary. A comparison of output in relation to the level of inputs used reveals the true picture of the farmer's efficiency level. Therefore, an analysis at the farm level is desirable to get a clear understanding of the existence of gap between actual and potential output of rice in these two districts. This gap can be studied with the help of technical efficiency measures.

The conceptualisation of agricultural growth suggests two channels of impact for extension in terms of production agriculture. The first channel is to assist in the dissemination of new technologies to farmers as a way of increasing agricultural productivity, thus speeding up the adoption or use of new technology and practices. The second channel is the role of extension in improving human capital and the management skills of farmers, thus assisting individual farmers to improve their level of technical efficiency. In a static context, both channels would have the effect of moving farmers closer to the frontier. In a dynamic context, where the frontier itself is moving, the role of extension in diffusing innovation is underestimated by focusing solely on changes in technical efficiency. When the growth in output for a farm over two periods is taken as the distance between Y_1 and Y_2 this growth has occurred due to changes in its three separate elements, that is;

Output Growth = change in inputs + change in technical efficiency + technical progress

The change in the patterns of input use and improvement in the levels of technical efficiencies will have the combined effect on technological progress.

The empirical model of Translog Production Function considered for the present study consists of two stages. In the first stage, the Stochastic Frontier Function is estimated and in the second stage, Technical Efficiency indices for each farmer are estimated.

The general form of the Translog Production Function considered for the present study is given as:

$$\log Y = \beta_o + \sum_{i=1}^{n} \beta_i \log X_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{k=1}^{n} \beta_{ik} \log X_i \log X_k + \varepsilon_i \quad (1)$$

The three explanatory variables are fitted in the above Translog Production Function (1) , the fitted model is specified as follow:

$$\log(YD)=\alpha_o+\beta_1\log(AA)+\beta_2\log(MD)+\beta_3\log(FM)+(\beta_4\log(AA)^2)/2+(\beta_5\log(MD)^2)/2+(\beta_6\log(FM)^2)/2+\beta_7\log(AA)\log(MD)+\beta_8\log(AA)\log(FM)+\beta_9\log(MD)\log(FM)+\epsilon_i \quad (2)$$

Where α_o is the intercept and β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8 and β_9 are the parameters to be estimated, and
YD = production of rice in kg,
AA = area under rice in hectares,
MD = human labour in man-days, and
FM = cost of fertilizers, chemicals and hiring farm machineries.

The estimated equation is given as:

$$Log(YD)=-10.2-7.5\log(AA)+4.3\log(MD)+4.9\log(FM)+(-2.0\log(AA)^2)/2+(-0.2\log(MD)^2)/2+(-0.1\log(FM)^2)/2+1.1\log(AA)\log(MD)+0.9\log(AA)\log(FM)-0.9\log(MD)\log(FM) \quad (3)$$

The Stochastic Frontier Production Function is given by:

$$\log(YD_F)=\beta_o+\beta_1\log(AA)+\beta_2\log(MD)+(\beta_3\log(FM)+(\beta_4\log(AA)^2)/2+(\beta_5\log(MD)^2)/2+(\beta_6\log(FM)^2)/2+\beta_7\log(AA)\log(MD)+\beta_8\log(AA)\log(FM)+\beta_9\log(MD)\log(FM)+\epsilon_i \quad (4)$$

Where YD_F is the potential rice production at the farm level and β_o is the adjusted intercept term. The estimated equation is given as:

$$\log(YD_F)=-9.89-7.53\log(AA)+4.30\log(MD)+4.95\log(FM)+(-2.02\log(AA)^2)/2+(-0.23\log(MD)^2)/2+(-0.11\log(FM)^2)/2+1.13\log(AA)\log(MD)+0.94\log(AA)\log(FM)-0.98\log(MD)\log(FM)$$

The estimated Frontier Production Function indicates that the elasticity of rice production with respect to area is highest among the other inputs used in production. It means that area under rice has the highest influence on production, and at the same time, human labour has the least impact on production.

Technical Efficiency indices for each farmer can be found out by using either the relations TE = Actual Production/potential production or TE = exp (residuals)/Max (exp(residuals). The estimated technical efficiencies are tabulated into efficiency class indices as presented in Table 1. For comparative purpose, frequency distribution for each efficiency classes is sorted out.

Table 1:

Distribution of Technical Efficiency Indices among the 160 Farmers

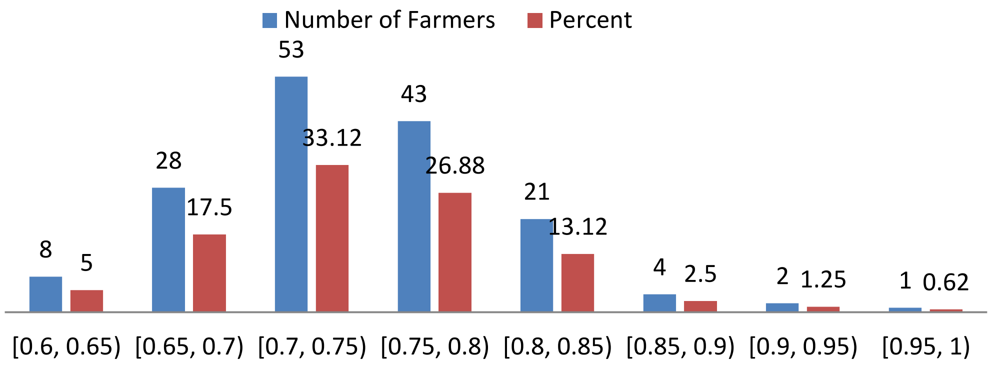
Tabulation of TE Included observations: 160 Number of categories: 8

Efficiency Class	Count	Percent	Cumulative Count	Cumulative Percent
[0.6, 0.65)	8	5	8	5
[0.65, 0.7)	28	17.5	36	22.5
[0.7, 0.75)	53	33.12	89	55.62
[0.75, 0.8)	43	26.88	132	82.5
[0.8, 0.85)	21	13.12	153	95.62
[0.85, 0.9)	4	2.5	157	98.12
[0.9, 0.95)	2	1.25	159	99.38
[0.95, 1)	1	0.62	160	100
Total	160	100	160	100

Source: Estimated from the Field Survey Data

As revealed in the Table 1, efficiency levels of the farmers in this study are concentrated to 0.7-0.8., i.e. 60 percent of the farmers are operating within this efficiency level. Yield of rice in this efficiency level is around 3000 kg/ha to 3400 kg/ha. Farmers operating within the lowest efficiency level of 0.6-0.7 comprised of 22.5 percent of the 160 farmers investigated. These farmers are getting a yield of around 2300kg/ha to 2800kg/ha with the available inputs they employed. 13.12 percent of the farmers are operating at the efficiency level of 0.8-0.85, i.e. with a yield rate of around 3300kg/ha to 3400kg/ha. Farmers operating the efficiency level of 0.85-0.95 is 3.75 percent with a yield rate of around 3400kg/ha to 3600kg/ha.

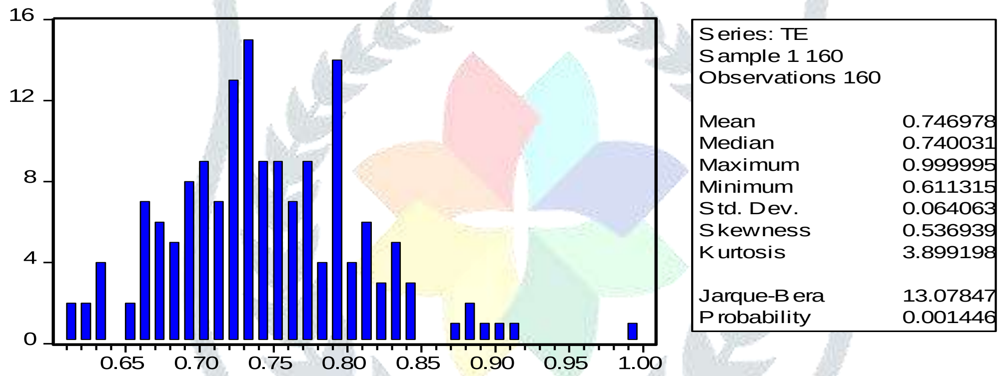
Figure1: Technical Efficiency Class of 160 Farmers



Source: Field Survey Data

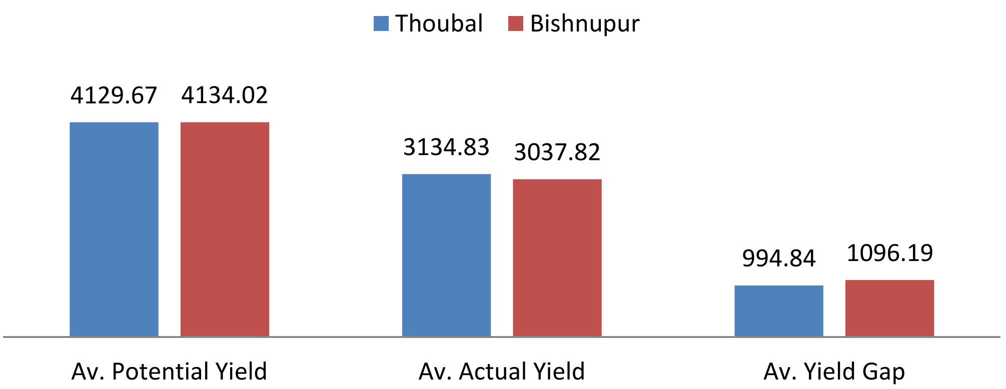
The above figure (1) shows that 53(33.12%) and 43 (26.88%) out of the 160 farmers are operating at an efficiency class of (0.7, 0.75) and (0.75, 0.8) respectively; i.e. the majority of the farmers used their inputs at a moderately high efficiency level. Whereas, 36(22.5%) farmers use the inputs at a very low efficiency level, and only 7(4.37%) farmers can employed the inputs at a high efficiency level. A look into the histogram and stats of technical efficiency (figure 2) for the farmers depict similar situation as discussed above, except the gap between the maximum and minimum values of technical efficiency. The most efficient farmer operated at an efficiency level of 0.999 whereas the most inefficient farmer operated at the level of 0.611, i.e. there is a large gap of 0.388. Mean and median of the efficiency levels show the dominance by the technically inefficient farmers.

Figure 2: Histogram and Stats of Technical Efficiency for 160 Farmers



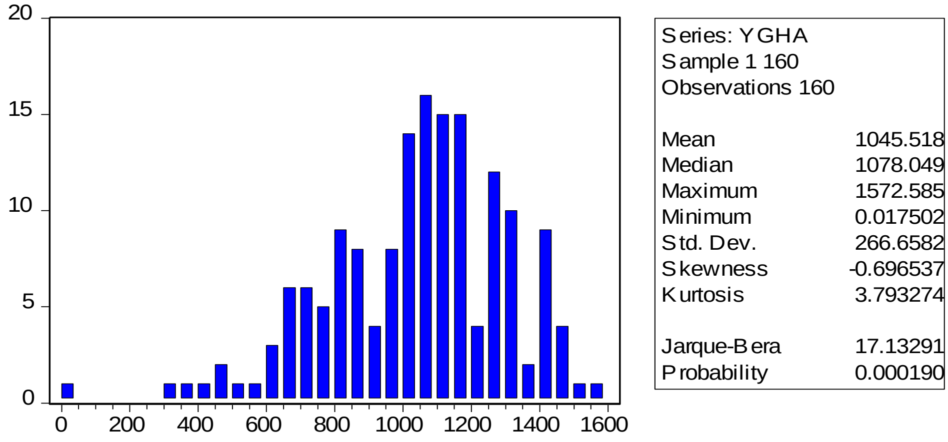
Source: Field Survey Data

Figure 3: Average Yield Gap of Thoubal and Bishnupur



Source: Field Survey Data

Figure 4: Histogram and Stats of Yield Gap/ha for 160 Farmers



Source: Field Survey Data

A look into the histogram and stats of yield gap per hectare show that maximum yield gap per hectare is 1572.585 kg and minimum yield gap per hectare is 0.0175 kg. The average yield gap is 1045.5 kg per hectare for the 160 farmers covered in the survey. Number of farmers concentrated in the yield gap 1000-1200 is seen highest in the histogram.

Conclusion:

The production function selected for the purpose was estimated by taking yield of rice in kg (YD) as dependant variable, and area under rice in hectare (AA), human labour in man-days (MD) and cost of fertilizers, chemicals and farm machineries (FM) as the explanatory variables. The above explanatory variables were statistically significant when applied to Translog Production Function. Other agricultural production function models were also tested and in which the variables are statistically insignificant were discarded from the study.

The present study found that most of the farmers were employing their inputs inefficiently in rice production; there is sufficient room for increasing yield of rice with the same amount of inputs used. There is a large gap between average actual production per hectare and average potential production per hectare. It means that there is sufficient room to increase efficiency of the currently employed inputs so as to narrow down the yield gap.

References:

1. Amaza, P. S., Bila, Y., Iheanacho, A. C. (2006). 'Identification of Factors that Influence Technical Efficiency of Food Crop Production in West Africa: Empirical Evidence from Borno State, Nigeria'. In Journal of Agriculture and Rural Development in the Tropics and Subtropics, Vol. 107, No. 2, Nigeria, pp139–147
2. Amaza, P. S., Maurice, D. C. (2005), 'Identification of Factors that Influence Technical Efficiency in Rice-Based Production Systems in Nigeria'. In the paper presented at Workshop on Policies and Strategies for Promoting Rice Production and Food Security in Sub-Saharan Africa, November 2005, Cotonou (Benin), pp.6-8
3. Anuradha, N., Zala Y.C. (2010), 'Technical Efficiency of Rice Farms under Irrigated Conditions in Central Gujarat'. In *Agricultural Economics Research Review*, Vol. 23, pp 379-380
4. Aigner, D.J., Lovell, C.A.K., Schmidt, P., (1977). 'Formulation and Estimation of Stochastic Frontier Production Function Models'. In Journal of Econometrics (vol. 6).
5. Christopher, M, Cornwell, Jens-Uwe Wachter.(1999). In 'Productivity Convergence and Economic Growth: A Frontier Production Function Approach', Working Paper, Center for European Integration Studies, Germany, (http://www.zei.de, accessed on 22-12-07)
6. Battese, G. E.(1991). 'Frontier Production Functions and Technical Efficiency: A Survey of Empirical Applications in Agricultural Economics'. In the 35th Annual Conference of the Australian Agricultural Economics Society, University of New England, Armidale, 11-14 February, 1991, pp-13-28
7. Bele´n Ira´ izoz, Manuel Rapu´ n, Idoia Zabaleta, (2003). 'Assessing the technical efficiency of horticultural production in Navarra, Spain'. In Agricultural Systems 78, pp.387–403 (www.elsevier.com/locate/agsy, assessed on 14 July, 2014)
8. Basnayake, B.M.J.K. et al (2002). 'Estimation of Technical Efficiency and its Determinants in the Tea Small Holding Sector in the Mid Country Wet Zone of Sri Lanka'. In Sri Lankan Journal of Agricultural Economics, Volume 4, Part-1, p-137
9. Battese, G.E., and Coelli, T.J. (1995), 'A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function for Panel Data'. In Empirical Economics, 20(2), (as referred by Jaume Puig-Junoy andJosep M. Argiles (2000): 'Measuring and Explaining Farm Inefficiency in a Panel Data Set of Mixed Farms'Pompeu Fabra Univ., Barcelona, Spain, P. 5
10. Dina, P., Fernandez, M., and Peter L. N. (2009). 'Technical Efficiency in the Production of Sugar Cane in Central Negros Area, Philippines: An Application of Data Envelopment Analysis'. In *J. ISSAAS Vol. 15 No. 1: 77-88*
11. Damodar, N. Gujarati (2004), 'Basic Econometrics'. Fourth Edision, Tata McGraw-Hill Publishing Company Limited, New Delhi, pp. 536-38
12. David, L. Debertin (1986), 'Agricultural Production Economics', Macmillan Publishing Company, New York, p. 190
13. GoM, Directorate of Economics & Statistics, (2012), 'Report on Crop Estimation Survey, Manipur 2011-12', pp-25-26
14. Huynh, V.K., Misuyasu, Y, (2011). 'Technical Efficiency Analysis of Rice Production in Vietnam'. In J.ISSAAS, Vol. 17, No. 1, pp.135-146
15. Jayaram. H. Et al (1992), 'An Economic Analysis of Technical Efficiency in Rice Cultivation in Mandya-Some Issues in Resource Pricing'. In Indian Journal of Agricultural Economics, Vol. 47 No. 4 Oct. – Dec. 1992, p. 671
16. Jaume, P. J. et al (2000), 'Measuring and Explaining and Farm Inefficiency in a Panel Data Set of Mixed Farms'. Pompeu Fabra University, C/Ramon Trias Fargas pp. 25-27,Barcelona
17. Lyubov, A. K., Helen, H. J.(2000). 'Technical Efficiency of Grain Production in Ukraine'. In Working Paper 00-WP 250, Center for Agricultural and Rural Development, Iowa State University, Ames, IA 50011-1070(www.card.iastate.edu, assessed on 10th March 2015), pp-17-19
18. Klacek J. (2007), 'KLE Translog Production Function and Total Factor Productivity'. In Statistika 4/2007, p. 2

19. Olorunfemi, O., Ogundele, Okoruwa, V. O. (2006). 'Technical Efficiency Differentials in Rice Production Technologies in Nigeria'. In AERC Research Paper 154, African Economic Research Consortium, Nairobi, April 2006, (Published by: The African Economic Research Consortium, City Square, Nairobi 00200, Kenya) pp-4-27
20. Omonona, B.T., Egbetokun, O.A., Akanbi, A.T. (2010). 'Farmers Resource – Use and Technical Efficiency in Cowpea Production in Nigeria'. In Economic Analysis & Policy, Vol. 40 No. 1, Nigeria. pp-87-94
21. Panda, R.C. (1996), Efficiency and Productivity – The Case of Sericulture Farms in Tamil Nadu', In Indian Journal of Agricultural Economics, Vol. 51. No. 3 July-Sept. 1996, p. 354
22. Pouchepparadju, A. et al. (2005), An Econometric Analysis of Green Technology Adoption in Irrigated Rice in Pondicherry Union Territory'. In Indian Journal of Agricultural Economics, Vol. 60 No. 4 Oct. – Dec. 2005, pp. 660-675
23. Panchamukhi, V.R. (1978), 'A Survey of Research in Economics', Vol. VII. 1978, Econometrics, ICSSR, New Delhi, pp. 121-130
24. Rubinos, R. et al (2007), "Comparative Economic Study of Organic and Conventional Rice Farming in Magsaysay, Davao Del Sur". In the 10th National Convention on Statistics, University of Southeastern Philippines (USEP), Davao City, October 1-2, 2007
25. Ramanathan, R. (2002), 'Introductory Econometries with Applications'. Thomson Asia Pte Ltd., Singapore, Fifth Edition, pp. 151-152.
26. Sauer, J. et al. (2006), "Stochastic Efficiency Measurement – The Curse of Theoretical Consistency'. In Journal of Applied Economics, Vol. IX, Universidad del CEMA, ISSN, Argentina, p. 139
27. Suzanne O'Neill et al. (1999), 'Farm Technical Efficiency and Extension'. In Paper presented at the Irish Economics Association in April 1999, Dublin, p. 24

ANNEXURE-1

Estimates of Potential Yield of Rice (YDF) and Technical Efficiency (TE)

YD – Actual Production in kg, YDF – Potential Production in kg

	Bishnupur			Thoubal		
Sl.No	YD	YDF	TE	YD	YDF	TE
1	1012	1381.929	0.73231	2100	3091.362	0.679312
2	710	1076.935	0.659278	800	1120.851	0.713743
3	2960	4226.192	0.700394	1254	1677.151	0.747697
4	752	1059.409	0.70983	1540	2143.151	0.718568
5	2276	3105.073	0.732994	2520	3942.724	0.639152
6	1612	2164.63	0.7447	812	1107.472	0.733201
7	1071	1563.14	0.685159	3850	4680.272	0.822602
8	2922	3692.128	0.791414	720	958.9531	0.750819
9	1452	2128.014	0.682326	1140	1516.106	0.751926
10	792	1112.014	0.712221	3960	4678.441	0.846436
11	2326	3062.934	0.759403	3840	3840.018	0.999995
12	794	1188.124	0.668281	5670	7247.818	0.782304
13	782	1130.821	0.691533	1200	1552.405	0.772994
14	2970	4736.474	0.627049	3168	3750.508	0.844685
15	2720	3907.699	0.696062	874	1097.584	0.796295
16	2380	3010.14	0.790661	2160	3129.701	0.690162
17	3400	4671.065	0.727885	2880	4292.272	0.670973
18	2100	3091.362	0.679312	1824	2239.696	0.814396
19	740	1097.947	0.673985	1311	1694.398	0.773726
20	1224	1677.151	0.729809	836	1146.874	0.728938
21	1140	1548	0.736434	684	1077.146	0.635011
22	3024	3780.099	0.799979	760	1041.142	0.729968
23	2310	3103.538	0.744312	1400	2120.727	0.660151
24	2940	4236.627	0.693948	1140	1548	0.736434
25	1824	2239.696	0.814396	3024	3819.372	0.791753
26	1311	1694.398	0.773726	2310	2552.074	0.905146
27	786	1146.874	0.685341	2940	4236.627	0.693948
28	1218	1603.188	0.759736	1672	2189.606	0.763608
29	3740	4776.897	0.782935	3256	3642.557	0.893877
30	5612	7091.007	0.791425	858	1055.181	0.81313
31	1740	2206.37	0.788626	936	1114.85	0.839575
32	2636	3186.587	0.827217	1260	1513.349	0.832591
33	2750	3140.315	0.875708	1672	2171.745	0.769888
34	960	1207.119	0.795282	1584	2255.961	0.70214
35	1214	1582.118	0.767326	1254	1582.118	0.792608

36	2310	3153.397	0.732543	2310	3153.397	0.732543
37	3028	4139.278	0.731528	3168	4139.278	0.765351
38	5750	7200.448	0.798561	2992	3692.128	0.810373
39	1200	1552.405	0.772994	1452	2128.014	0.682326
40	1900	2145.367	0.885629	792	1112.014	0.712221
41	2640	3953.56	0.667753	1313	1646.252	0.797569
42	3128	3849.975	0.812473	3740	4776.897	0.782935
43	1804	2257.269	0.799196	5712	7091.007	0.805527
44	2228	3074.8	0.7246	1680	2164.63	0.776114
45	794	1085.451	0.731493	840	1037.5	0.809639
46	764	1031.76	0.740482	864	1031.76	0.837404
47	990	1300.064	0.761501	990	1300.064	0.761501
48	1572	2159.697	0.72788	1089	1550.16	0.702508
49	784	1077.146	0.727849	836	1049.616	0.796482
50	760	1041.142	0.729968	2560	4177.753	0.61277
51	1400	2120.727	0.660151	792	1059.409	0.747587
52	1260	1513.349	0.832591	1900	2145.367	0.885629
53	1572	2131.093	0.73765	2376	3105.073	0.765199
54	1584	2255.961	0.70214	1632	2164.63	0.753939
55	2520	3942.724	0.639152	1071	1563.14	0.685159
56	1436	2271.81	0.632095	1496	2271.81	0.658506
57	2856	3952.881	0.722511	2856	3952.881	0.722511
58	2860	4678.441	0.611315	2736	3231.851	0.846574
59	2840	3840.018	0.73958	2850	3130.528	0.91039
60	1540	2143.151	0.718568	960	1207.119	0.795282
61	792	1095.888	0.722701	2970	4736.474	0.627049
62	3250	4910.122	0.661898	2720	3907.699	0.696062
63	780	977.7219	0.797773	2244	3008.352	0.745923
64	1642	2169.823	0.756744	3400	4671.065	0.727885
65	798	1079.962	0.738915	2178	3091.362	0.704544
66	1140	1626.818	0.700755	1672	2169.823	0.77057
67	2828	3783.686	0.747419	798	1079.962	0.738915
68	774	1097.584	0.705185	1140	1626.818	0.700755
69	2160	3129.701	0.690162	2640	3953.56	0.667753
70	2880	4292.272	0.670973	3168	3907.699	0.810707
71	1140	1516.106	0.751926	1824	2176.991	0.837854
72	1112	1544.426	0.720009	1089	1647.772	0.660892
73	2308	3248.446	0.710494	2508	3248.446	0.772061
74	2656	3616.728	0.734365	2376	3062.934	0.775727
75	758	1055.181	0.71836	805	1166.515	0.69009
76	916	1114.85	0.821635	912	1130.821	0.806494
77	1242	1652.973	0.751374	1242	1652.973	0.751374
78	792	1068.512	0.741217	792	1068.512	0.741217
79	762	1130.821	0.673847	912	1130.821	0.806494
80	1248	1620.445	0.770159	1188	1620.445	0.733132

N.B. Estimates are made from the Field Survey data.
The values of AA, MD and FM are not shown here.