COST AND RETURN STRUCTURE OF FERTILIZER USE IN PADDY CULTIVATION: A CASE STUDY OF VADIPATTI VILLAGE IN MADURAI DISTRICT OF TAMIL NADU

Dr. A. Marimuthu* and K. Meenatchi Sundaram**

*Head, PG and Research Dept of Economics, Raja Doraisingam Govt. Arts College, Sivagangai.
**Ph.D., Research Scholar in Economics, PG and Research Dept of Economics,
Raja Doraisingam Govt. Arts College, Sivagangai

Abstract

India is the seventh largest by area and the second most populous country in the world. According to the information available, more than 70 percent of the country lives in rural areas and there has been a rapid irrigation of the masses of people depending on the rural push and urban pull. The net area sown is nearly 140-142 million ha. The net irrigated area is only 33 percent and the gross area is around 180 million ha. From a level of 50.8 million tons during 1950-51, the food grains production has reached 198 million tons by 2000-01. Rice is the biggest crop in the country in terms of area and production. In 1950-51, it was grown on 30.8 million hectares, which amounted to 31.6 percent of total area devoted to food grains. In 1999-2000, it was grown on 45 million hectares, which amounted to 36.6 percent of total area under food grains.

The rice based cropping system is prevalent in the states of Andhra Pradesh, Assam, Bihar, Kerala, Madhya Pradesh, Orissa and Tamil Nadu. Agricultural helps to sustain the live hood of about 70 percent of the population. Increasing the agricultural production will increase the demand for the output of other sectors viz. fertilizer, pesticides, machinery, transportation and communication, varying with the level of technology used in agriculture. Without agriculture sector no other sector can survive.

Keywords*: Fertilizer Use Efficiency, food production, optimum population, weed control, water management, post-harvest technology*

Fertilizer Use Efficiency

Fertilizer Use Efficiency (FUE) holds the key to productivity for two vital reasons, since fertilizer and input prices have raised faster than fertilizer demand and the price of rice, increasing Nitrogen (N). Fertilizer efficiency will be a major challenge for rice researchers and farmers. Fertilizer use-efficiency depends not only on sources, rate, time and method of application but also on the soil and crop management factors such as proper land preparation, choice of fertilizer variety, timely sowing and planting, optimum population, timely and proper weed control , proper water management, need based plant protection and suitable pro and post-harvest technology. In India we are using 7 million tones of plants nutrients through fertilizers. If we can increase its use efficiency by 10 percent we can save 7,00,000 tones of nutrients and this will provide us about 70,00,000 tones of additional food grains. This shows the magnitude and urgency of fertilizer problems in food production.

The following statistics will call for the compelling and urgent need to conserve this input. In the present context of high-energy cost, the manufacture of 1kg of fertilizer Nitrogen consumes 2 kg of fossil fuel by 0.33 kg of phosphorus and 0.22 kg .of potash respectively. The utilization efficiency will ensure a favorable and profitable input-output price relationship to the farmer.

Review of Literature

Nidhi Dwivedy (2001) in her paper on "Challenges faced by the Agriculture Sector in Developing Countries with Special Reference to India", published in international Journal of Rural Studies, Makes an attempt, through the reveiew of literature, to understand the history and characteristics of the Indian agriculture sector, its transition from traditional to commercial agriculture sector, its transition from traditional to commercial agriculture and the problems it faces. Modern agricultural practices and the relationship with environmental depletion have also been assessed.

Kumar (2008) in his book Indian Agriculture and the Globalization, points out that the globalization agreement on agriculture provides for new opportunities for increased international trade in agriculture. In the wake of globalization, it was felt that the disciplines of GATT, which traditionally focused only on import access problems, should be extended to measure affecting trade in agriculture, including domestic agricultural policies and the subsidization of agricultural exports.

Ranjith Mathew Abraham and Michael Raj M.(2015) in this paper on "Principle of Comparative Advantage and the Change in Cropping Pattern in Kerala" published on Southern Economist an attempt on the agricultural development of Kerala is characterized by the process of increasing transformation of agriculture from subsistence crops like paddy and tapioca to commercial crops like coconut and rubber. Subsistence farming is the production mainly for own consumption and the output is less responsive to favorable changes in price. On the Other hand commercial farming is production for the market and the output is highly responsive to favourable changes in price.

Statement of the Problem

Since the introduction of the Green Revolution in 1965, rice cultivation in India has traveled a long way. It has to have varying impact on different crops and its varieties, in different areas, and also on different classes of farmers within the same area. With the widespread use of high yielding varieties and modern technology, input use has also been increasing with rising yields. This calls for a study of input application and monetary returns accruing to the farmers cultivating of rice in the study area.

Fertilizer consumption varies due to the variation in farm size. This calls for a study of relationship between farm size and fertilizer use. On the demand sides, the study identifies the determinants of fertilizer use at micro level and various constraints of fertilizer use. So this study analyzed economics of fertilizer use in paddy cultivation in Vadipatty Panchayat for a period 2009-10.

Objectives

- To study the cost and return structure of paddy cultivation among small and large farmers.

- To study the relationship between farm size and fertilizer use and to identify various determinates of fertilizer use.

Data and Methodology
Sample Design

In the study area, Vadipatty Panchayat, there are about 1132 farmers. Out of 1132, nearly 9.4 percent that is 120 farmers have been selected for the present study. They were selected randomly for primary data collection. Further, the sample farmers were past stratified into small and large farmers group based on their land-holdings. According to the farm management studies in India, the farmers who are holding less than five acres and more than five acres are group as small and large farmers respectively.

Collection of Data

A preliminary survey of the study area was conducted to understand its physical and economic situation. Information relating to climatic conditions, farming systems, population, land area etc., were gathered from the various records of the district. The primary data collected pertain to the agricultural year 2009-10. The required information was elucidated from the farmers by administering a well-structured schedule. The respondents were conducted in personal interview method.

Study Area

The study area for this work is Vadipatty Panchayat in Madurai Dirstrict. It consists of three hamlets namely Pottalupatti, Sivanathapuram and Hihanattayam. The total population of the village is 5,210. Population engaged in agriculture is nearly 2000. The reason for choosing this area is that it is situated on the canal of Periyar- Vaigai. All this area is favourably placed in terms of irrigation, paddy varieties and other such factors.

Measurement of Variables
(i) Land

Actual area cultivated in acres by the farmers was considered. Rental value was calculated at the prevailing market rate, pertaining to the duration of crop.

(ii) Human Labour

Human labour was measured in terms of man days worked. It was classified in to male labour and female labour. Only hired labour was included in the analysis. The payments in cash at the prevailing market price constituted their wages.

(iii) Seeds

It was calculated by the quantity of seeds purchased in kilograms multiplied by the price of seeds per kilogram at the prevailing market price.

(iv) Fertilizer

Value of fertilizer was obtained by multiplying its quantity used in kilos by the price per kilograms. Dividing the total amount spent on fertilizer by the total quantity used arrived at the average price per kilo.

Dividing the total amount spent on fertilizers by the total quantity used arrived at the average price per kilogram.

(v) Organic Manure

Number of kilograms used is multiplied by its price per kilo gave the value of organic manure.

(vi) Pesticides

It was obtained by multiplying is quantity used in ml by the price per ml.

(vii) Capital Flow

It was calculated as the sum of depreciation maintenance and opportunity cost of capital.

(viii) Yield

It was measured in terms of both physical and monetary unit.

(ix) Net Revenue

Total income minus cost 'C' gave net revenue. Cost 'C' represented Cost 'A' plus and capital flow.

Tools of Analysis

Cost and Return Structure

For carrying out the cost and return structure of paddy cultivation in Vadipatty Panchayat various tools of farm management analysis such as, output-input ratio, cost-benefit ratio, gross income per acres, farm income and net income have been worked out.

$$\text{Output-Input Ratio} = \frac{\text{Total Yield Per Acre}}{\text{Total cost Per Acre}}$$

$$\text{Cost -Benefit Ratio} = \frac{\text{Net Income Per Acre}}{\text{Total Cost Per Acre}}$$

Gross income from paddy cultivation was calculated by considering the yield at its farm harvest price. Farm business income was obtained by deducting the variable (labour cost, fertilizer, pesticides, seeds, organic manure and interest on working capital) from the gross income. Net income was computed by deducting both variable cost and fixed cost from gross income. In the fertilizer consumption analysis the consumption pattern was estimated on farm wise i.e. small farmers and large farmers.

The consumption of fertilizers was expressed quantitatively in terms of NPK the major plant nutrients essential for paddy cultivation N,P and K stand for Nitrogen, Phosphorus and Potassium respectively.

The relationship between farm size and quantity of fertilizer used was also examined to understand the impact of increase in farm size on the level of input used.

A log linear model, based on the principle of least squares was used for the purpose. A multiple linear regression model was used to identify the major factors that influence fertilizer use by the farmers in rich production.

Total area under cultivation is 1620.11 acres. Total wet area under cultivation is 455.41 acres and total dry area under cultivation is 914.70 acres and total gardening area is 250 acres.

The following table 1 furnishes information on the village

Table 1: Proforma of Vadipatty

Sl. No	Particulars	Information
1	Total Population	5320(numbers)
2	Total household	1120(numbers)
3	Average size of family	4.72(%)
4	Total literacy	29.85 (%)
5	Total geographical area	3182.76(acres)
6	Total cultivable land	1973.31 (acres)
7	Area under rice production	927.45 (acres)
8	Total number of farmers	1132(numbers)
9	Average size of land holdings	2.67 (acres)
10	Co-operative credit society	1 (number)

Source: Village Administrative Office, Vadipatty.

Vadipatty Panchayat has a geographical area of 3182.76 acres. The Total population in the village is 5.320 persons. It comprises 1120 households, with an average number of almost five persons per family. About 29.85 per cent of the people are literate. Total cultivable land in the village extends to 1973.31 acres of which 927.45 acres is under rice cultivation. The average size of land holding in Vadipatty is 2.67 acres. The village is provided with a co-operative society. The agricultural sector depends on rainfall in this village. Thanks and wells are secondary source of irrigation for the agriculture sector in this village. There are 100 ordinary wells in wet and dry lands, which are also used for irrigation. Mattayankulam tank, Periakulam tank, Periyar-Vaigai canal and Solamalai Uttu are used for irrigation. There are nearly 60 carts and 260 ploughs.

Tractors mainly do ploughing and bullock teams are also used for this. Tractors and bullock team in this village mainly do ploughing.

Characteristics of ADT 39 Variety of Paddy

The characteristics of ADT 39 Variety of paddy are presented in table 2.

Table 2: Details about ADT 39 Variety of Paddy

Percentages	IR-8/IR-20
Duration (Days)	120-125
Average yield (kg./ha)	5000
1000 grain wt (g)	18
Grain L/B ratio	2.9
Grain type	Medium slender
Husk colour	Straw
Leaf Sheath	Green
Lingual	Papery white
Length (mm)	7.6
Breadth (mm)	2.3
Thickness (mm)	1.9

Source: Agricultural Office, Madurai (2005-06).

In vadipatty Panchayat nearly 75 percent of the population cultivated the ADT 39 variety of paddy. This is high yielding variety type. So the researcher has chosen this variety for the research analysis.

Cost and Return Structure

This chapter deals with an analysis of cost and return structure of paddy cultivation in Vadipatty Panchayat during the agricultural crop year 2006-07. Tabular and percentage analyses have been carried out for studying cost and returns.

The farm size and number of farmers coming under different categories among the sample respondents is represented in Table 3

Table 3: Distribution of selected farms in paddy production

Farm Size	Number of Respondents	Percentage of respondents
Small (less than 5 acres)	84	70
Large (5 acres and above)	36	30
Total	120	100

Source: Survey data

The above Table 3 reveals that there is 70 percent of the respondents belong to small farms and 30 percent of the respondents come under large farmer's category by their farm size.

Categories of Farmers

The cultivators in general can be grouped into two different categories such as owner cultivators and tenant cultivators. The sample respondents are divided in two different groups based on their relationship with land.

Table 4: Categories of selected farmers in Vadipatty Panchayat

Ownership Category	Total Area Cultivated (in Acres)	Percentage of Area (in Acres)	Number of Respondents	Percentage of Respondents
Owner	202	61.59	75	62
Tenant	126	38.41	45	38
Total	328	100.00	120	100

Source: survey data

As seen from the above table ownership cultivation is practiced on a large scale in the study area. Out of the sample respondents as many as 75 are owner cultivators and 45 are tenant cultivators. Tenant cultivators are less in the selected sample of farmers.

Cost Components

The total cost in this study consists of cost 'A' and cost 'C' components. Cost A is composed of the costs toward human labour, in-organic fertilizer, pesticides, seeds, organic manure, interest on working capital. Components of cost C are cost A plus interest and depreciation of fixed capital and rent. Human labour cost is calculated at the daily wages rate of Rs. 60 per male labourers and Rs. 20 per female agriculture labours.

No distinction was made between hired labour and family labour. The labour cost included all types of labour charges like ploughing, planting, manuring and applying pesticides.

Cost of fertilizer and manures is at the actual price paid by the farmers at the price paid. The cost of interest on working capital is evaluated at 12.5 percetn on owned capital and borrowed capital at the actual rate of borrowing. Interest of fixed capital is evaluated for agricultural assets of farm in investment at the rate of 11.5 percent. Rent is evaluated at the rates actually paid by the farmers to the village officials.

Cost Structure

Table 5 presents the details of different cost incurred by small, large and all farms of paddy in vadipatty panchayat. The table reveals that the total cost of cultivation. Increases the size of land holding cost is also increasing.

For the large farmes the total cost was Rs. 7092.01 per acre while for small farms and all farms it is Rs. 6500.5 and Rs. 6677.94 respectively.

The estimated parameters co-efficient are presented in the following table

Table 5: Determinants of Fertilizer Use

Variable	Estimates
Intercept	430.538688
Relative price	-126.150 (-1.116)
Tenurial status	-57.785 (-1.537)
Organic manures	0.0151 (3.890)*
Farm size dummy	-101.8220 (-1.391)
Irrigation system dummy	97.9018 (2.094)*
R^2	0.78591
F-value	32.30335
Number of observations	120

*Significance at 1 percent level Figures in brackets represents t-values

This analysis revealed that tenurial status dummy statistically insignificant with fertilizer use. But the negative sign of the tenurial status dummy which indicates that owner use more fertilizer than tenants. The organic manure is positively and significantly related to fertilizer use. This indicates that organic manure require relstively more fertilizer.

It is observed that the irrigation dummy is positively and significantly related to fertilizer use. This result indicates that the availability of better irrigation facilities will facilitate the application of fertilizer in paddy cultivation.

Major Findings

- The cost and return structure of paddy for the three farm sizes revealed that yield per acre in monetary terms was the maximum for large farms, followed by all farms and small farms. The respective monetary return was Rs. 1600 for large farms, Rs. 14600 for all farms and Rs. 14000 for small farms.
- The pattern of net income per acre over Cost A and Cost C of the farm sizes trend are different to that of the yield. The net income over the two costs was the maximum for small farms, followed by all farms and large farms. The respective net return was Rs. 74955.50 for small farms, Rs. 7922.06 for all farms and Rs. 8907.99 large farms.
- The share of human labour cost was the maximum in total cost, followed by inorganic fertilizer and organic manure in all three farms. This highlights the labour intensive nature of the farms and the high responsiveness of hybrid varieties to fertilizer input. The total cost of cultivation per acre was the highest for large farms (Rs. 7092.01) and the least for small farms (Rs. 6500.50).
- Total cost for all farms worked out to be Rs. 6677.94 per acre. Cost benefit ratio was estimated by dividing net return per acre over total cost per acre.
- The input-output and cost- benefit ratio was also the maximum for small farms followed by all farms and large farms. However, the cost of production was highest of large farms and the least for small farms. The input-output ratio revealed that

each rupee expended in terms of total cost yield on output worth Rs. 2.15, Rs. 2.25 and Rs. 2.28 in the case of small, large and all farms respectively. The cost-benefit ratio shows that on every rupee spent, the respective farms fetch a benefit of Rs. 1.15, Rs. 1.25 and Rs. 1.18. Thus the economics of cultivation of three farms clears indicates that the cultivation of paddy in small farms is economically more beneficial.

- The fertilizer use rate is analyzed on the basis of farm size by using the log linear model. The analysis revealed that positive and significant relationship between farm size and fertilizer use with respect to all farms. This result implies that fertilizer use increased with an increase in farm size. It is observed that 10 per cent increase in fertilizer use. This indicates that as farm size increase, fertilizer use also increases at decreasing rate.

- An analysis of the factors determining fertilizer use in rice production was also carried out. The independent variables included in the model were relative price, tenurial status dummy, and quantity of organic manure, farm size dummy and irrigation dummy.

- This analysis revealed that tenurial status dummy statistically insignificant with fertilizer use. But the negative sign of the tenurial status dummy which indicates that owner use more fertilizer than tenants. The organic manure is positively and significantly related to fertilizer use. This indicates that organic manure require relatively more fertilizer. It is observed that the irrigation dummy is positively and significantly related to fertilizer use. This result indicates that the availability of better irrigation facilities will facilitate application to fertilizer in paddy cultivation.

References

1. Gunwant M. Desai, "Fertilizer Use in India: The Next Stage in Policy", *Indian Journal of Agricultural Economics,* Vol. 41, No. 3, September, 1986.
2. Kalita D.R. and R.N. Phukan, "Fertilizer Utilization in Assam Agriculture", *Indian Journal of Agricultural Economics,* Vol. 41, October, 1986.
3. Luhach V.P., R.L. Khatkar and D.S. Nandel, "Fertilizer use Pattern in Haryana", *Fertilizer Marketing News*, February, 1989.
4. Mahendra Sing and D.S. Yadav, "Nitrogen Use-Efficiency in Rice", *Fertilizer News*, March, 1985.
5. Padma, B., Shakya and J.C. Flinn, "Adoption of Modern Varieties and Fertilizer Use on Rice in the Eastern Tarai of Nepal", *Indian Journal of Agricultural Economics,* Vol. 36, No. 3, September, 1985.
6. Pant S.P., "Impact of Fertilizer Price Increases on Fertilizer Consumption and Agricultural Output", *Agricultural Situation in India*, October, 1980.

7. Parthasarath G. and B.Chinna Rao, "Determinants of Fertilizer Use Andhra Pradesh", *Agricultural Situation in India*, October, 1986.

8. Ramasamy C., "Sustaining Rapid Growth in Fertilizer Use in Rice Regions", *Indian Journal of Agricultural Economics,* Vol. 41, October and December, 1996.

9. Sheety N.S, "A Factor Analysis of Use of Fertilizers by Farmer", *Indian Journal of Agricultural Economics,* Vol. 24, No. 53, April, 1969.

10. Sing D.V. and R. Swarap, "Determination of Fertilizer Use in Himachal Pradesh", *Indian Journal of Agricultural Economics,* Vol. 41, September, 1986.

11. Singh R.I and Prasad, "Trends in Fertilizer Prices-Fertilizer Consumption an Productivity of Crops on Farms", *Fertilizer Marketing News*, December, 1977.

12. Sunitha Anand Raj, D., "Farm Size and Fertilizer Use in Andhra Pradesh", *Indian Journal of Agricultural Economics,* Vol. 41, No. 5, December, 1986.

13. Simth J. and Others, "Risk and Fertilizer Use on Rainfed Rice in Bical Phillipines", *Agricultural Economics Department, IRRI, Philippines*, October, 1983.

14. Timmer C. Pater, "The Demand for Fertilizer in Developing Countries", *Food Research Institute Studies*, Vol. 13, Stanford University, California, 1974.