CHAPTER II

REVIEW OF LITERATURE

For any research, a review of the past studies related to the subject is useful in several ways. This chapter is devoted to a review of the literature related to the present study. For better exposition, the review has been organized under the following heads:

(i) Studies relating to Cost and Production of Paddy
(ii) Studies relating to Yield Gap and Yield Constraints
(iii) Studies relating to Profit Function Approach

2.1 STUDIES RELATING TO COST AND PRODUCTION OF PADDY

In agriculture, cost of production refers to the expenditure incurred by the farmers on the various inputs (operational and fixed) to obtain final produce. The relationship between cost and income is of vital importance. In agriculture, costs in farming may be classified under two major heads namely, fixed cost and variable or operational costs. Fixed costs include depreciation, taxes, rent, interest, insurance and premium. It results from past commitments of cost already sunk. It exists even in the absence of cultivation. Variable cost includes input like seeds, labour cost, manures and pesticides, tractor fuel and livestock fodder. It varies with the changes
in the level of output. It does not exist in the absence of cultivation. It is an important factor which determines how much and what is to be produced. Fixed cost is important in making decisions on the amount to be produced and different practices to be adopted. In the long run, all costs become variable costs.

In the short run, it is profitable for a farmer to produce a gross income greater than or equal to the variable cost. But in the long run, the return must cover the total cost, comprising both variable cost and fixed cost.

In agricultural operations, the farm cost of production refers to the expenses incurred on the various inputs (both operational and fixed) to obtain the final produce. The cost of production consists of two parts, namely fixed cost and variable or operational cost. In Farm management studies, Shukla\(^1\) has categorised cost into Cost A1, Cost A2, Cost B and Cost C. Cost A1 includes the cost of seeds, manures and fertilisers, plant protection, livestock expenses, hired human labour, irrigation charges, land revenue, interest on working capital, depreciation of fixed assets and miscellaneous expenses. Cost A2 covers Cost A1 plus rent paid for leased in land. Cost B includes Cost A2 plus rental value of owned land plus

interest on fixed capital minus land revenue on owned land. Cost C includes Cost B plus imputed value of family labour.

Rajagopalan\textsuperscript{2} et al., make a study on the cost of production of crops in Tamil Nadu during the year 1978.

**Cost A**

i) Value of human labour including family labour  
ii) Value of bullock labour  
iii) Value of machinery charges  
iv) Value of seed  
v) Value of insecticides  
vi) Value of manures and fertilizers  
vii) Cost of irrigation and  
viii) Interest on working capital

**Cost C**

Cost A plus rent (including actual rent paid by the tenant or rental value of owned land) interest on fixed capital, land revenue, cesses, taxes and depreciation of implements and machinery.

The cost individually includes.

i) **Cost A1**

1. Value of hired labour (permanent and casual)  
2. Value of owned bullock labour

\textsuperscript{2} V. Rajagopalan et.al. Studies on Cost of Production of major crops in Tamil Nadu, \textit{Department of Agricultural Economics}, Tamil Nadu Agriculture University, Coimbatore, 1978, pp.2-3.
3. Value of hired bullock labour
4. Value of owned machinery
5. Hired machinery charges
6. Value of fertilizers
7. Value of manure (owned and purchased)
8. Value of seed (with farm produced and purchased)
9. Value of insecticides and pesticides
10. Irrigation charges (both owned and hired machineries)
11. Canal water charges
12. Land revenue, cesses and other taxes
13. Depreciation on farm implements (both bullock drawn and used by human labour)
14. Depreciation on farm building, farm machinery and irrigation structure.
15. Interest on working capital and
16. Miscellaneous expenses (artisans, so far and repairs to small farm implements)

ii) **Cost A2**

It includes Cost A1 and

17. Rent paid for leased in land

iii) **Cost B**

It includes Cost A2 and

18. Imputed rental value of owned land (less land revenue paid there upon)

and
19. Imputed interest on fixed capital (excluding land).

iv) Cost C

It includes Cost B and

20. Imputed value of family labour.

When a farmer is the owner and has contributed land and other resources, he incurs Cost A1. In case all the land is leased in and rent has to be paid, Cost A2 is incurred. It is also known as tenant cost. In addition to it if the imputed interest is paid on owned fixed capital, Cost B is incurred. Cost C is incurred if the imputed cost of family labour is also considered. Cost C is a very comprehensive cost.

David Groenfeldt\(^3\) in his study stated that paddy cultivation forms the basis of traditional Southeast Asian societies and the livelihoods of the people who comprise those societies. Historically speaking, paddy cultivation has always (at least for several millennia) been multi-functional – providing not only the raw material for subsistence and trade, but also serving as the central focus for family and community life as well as spiritual and religious expression. While times have certainly changed, this paper suggests that the multi-functional nature of paddy cultivation

\(^3\)David Groenfeldt, “Appreciating the Hidden Values of Paddy Cultivation Towards a New Policy Framework for Agriculture”, \textit{INWEPF/SY}/2004(03).
continues to be important, and that our concept of rural “livelihood” should incorporate these cultural dimensions.

Kumar et al., in their study on “Technical Efficiency of Rice Farms under Irrigated Conditions of North West Himalayan Region – A Non-Parametric Approach” stated that hill agriculture is practiced under tough conditions because of its unique character. The hill and mountain ecosystem is unique because of topographical features and climatic variations along the gradient. In general, hills receive 750 to 1250 mm precipitation; however, only about 10 per cent of the area is under irrigation in Uttaranchal hills, that too confined to the lower valleys. Sub-optimal hydro-thermal regimes and shallow soil depths thwart further extension of cultivated land. Small and scattered land holdings and limited land use is also the main feature of hill agriculture. Therefore, the food produced is not sufficient to sustain for the whole year. These biophysical and socio-economic constraints result in low technical efficiency as well as discourage farmers from taking the risk. In this context increasing technical efficiency assumes significance. Improving efficiency levels under these conditions is a big challenge for farmers in the NWH region. Rice being the most

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important staple food in NWH region, improvement in efficiency levels is one of the major means of sustaining their staple food production and thereby ensuring food security.

This study was taken up to determine the efficiency of rice cultivation under irrigated conditions in NWH region. Moreover, the study also explores the possibility, if any, of the difference in technical efficiency levels between the local and improved technology (i.e., variety) in rice growing farms. The factors associated with inefficiency are also analysed.

The overall technical efficiency in the case of improved rice growing farms is higher than that of rice farms growing local varieties. The results also indicate that in case of local rice growing farms, the scale inefficiency contributes more to the overall technical inefficiency. From the policy point of view, increasing the share of rice cultivation under irrigated situation in the total farm area can bring about improvement in the overall technical efficiency. With regard to farms growing improved rice varieties, pure technical inefficiency makes the greatest contribution to the overall inefficiency. By emulating the best practices of relevant efficient farms, less efficient farms growing improved rice varieties can eliminate pure technical inefficiency under irrigated conditions.
A. Suresh and T.R. Keshava Reddy\textsuperscript{5} in their study on “Resource-use efficiency of Paddy Cultivation in Peechi Command Area of Thrissur District of Kerala: An Economic Analysis” undertaken in the Peechi Command Area of Thrissur district in the Kerala state, have examined the resource productivity and allocative as well as the technical efficiency of paddy production. The study has used the primary data collected from 71 rice farmers of the command area using the stratified random sampling. The cost of cultivation of paddy in the command area has been found as Rs.21603/ha, resulting in a BC ratio of 1.34. The elasticity coefficients for chemical fertilizers, farmyard manure and human labour have been observed significant and positive. The allocative efficiency has indicated that marginal return per one rupee increase under these heads would be Rs.2.83, Rs.1.57 and Rs.1.17, respectively. The average technical efficiency of the paddy farmers in the command area has been found as 66.8 per cent. Education of the farmer and supplementary irrigation provided during the water-stress days have been identified as the factors which could enhance the technical efficiency. The study has called for an equitable distribution of

canal water and enhanced extension services for resource management in the area.

Ansari and Ismail\(^6\) in their investigations that were conducted at the farms of Uttar Pradesh Bhumi Sudhar Nigam at Shivri, Lucknow during the Kharif season in 1998-99 assessed the impact of organic amendment vermicompost in comparison to chemical fertilisers on paddy (variety-Sarju-52) in sodic soil and in relation to soil fertility, yield parameters and economics. Results indicated an increase in soil organic matter from 0.38 to 0.96 per cent, organic carbon from 0.22 to 0.56 per cent, available nitrogen (N) from 499.52 to 1245.44 kg/ha, carbonate iron from 0.20 to 0.23 meq/100 g of soil, calcium iron from 0.89 to 1.09 meq/100 g of soil and decrease in pH from 8.74 to 8.25, electric conductivity (EC) from 0.86 to 0.69 dSm-1, sodium ions from 11.85 to 1.47 meq/100 g of soil and exchangeable sodium percentage (ESP) from 67.51 to 57.42, suggesting qualitative improvement of soil, in the plots amended with vermicompost. Paddy yield of 4975 kg/ha was recorded from plots amended with vermicompost while 4900 kg/ha, from plots amended with chemical fertilizers, as control. Cost benefit ratio was found to be 1:1.5 for cultivation

of paddy using vermitech where as in case of chemical fertilisers, it was 1:1.06 suggesting that by the application of vermicompost in paddy, the cost of production could be reduced without compromising on harvest.

Bassvaraja et al.,\textsuperscript{7} in their research notes stated that the quantitative analysis of agricultural production systems has become an important step in the formulation of agricultural policy. A number of empirical studies have attempted to investigate producer responsiveness to product and input price changes, to estimate economies of scale, to assess the relative efficiency, and to measure the impact of technological change. In particular, there has been a considerable amount of theoretical and applied econometric research on the measurement of the impact of technological change. As knowledge of new and more efficient methods of production (cultivation in agriculture) becomes available, technology changes. The adoption of new or improved method of production / cultivation can shift the production function. In other words, production can be increased with new technology by using same quantities of resources that were used in old technology or alternatively, the production level in old technology can be attained with new technology by using fewer quantities of inputs. The recent

breakthrough in rice cultivation known as System of Rice Intensification (SRI) method is one such case which may be considered as disembodied technology.

The study was based on the input-output data obtained from sample paddy growing farmers in Andhra Pradesh selected through multi-stage sampling design. At the first stage, four major paddy growing districts, namely Prakasam, East Godavari, West Godavari and Guntur districts following both traditional and SRI methods of rice cultivation were purposively selected. From each district, three major paddy growing mandals following both the methods of rice cultivation were selected purposively at the second stage. Then at the third stage, four major paddy growing villages following both methods were purposively chosen from each mandal. In the final stage, ten farmers were randomly selected from each village such that they included five farmers in SRI method and five farmers in traditional method of rice cultivation. Thus, 480 farmers (240 farmers growing paddy by traditional method and 240 farmers growing it by SRI method) spread over four districts of Andhra Pradesh were interviewed during kharif season of 2005-06. The data on various inputs used in paddy cultivation like chemical fertilizers, plant protection chemicals, seed materials and human labour, and cultivation practices such as land
preparation, transplanting, irrigation, inter-cultivation and harvesting along with labour requirement for these operations were collected from the sample farmers.

The findings of this study demonstrate the superiority of SRI in terms of yield and returns advantage. However, it is worth mentioning here that the actual adoption rate of SRI among paddy growers is very low, which appears to be a puzzle given the encouraging performance of the new technology. There are several reasons for this kind of poor response of farmers to SRI method. First, the farmers, particularly in the head reaches of command areas, where paddy is grown extensively, have not fully realised the importance of water in view of market and policy failure in pricing the resource appropriately; second, intensive care particularly during transplanting of seedlings and higher weed infestation demands more labour and hence farmers in labour scarce areas are hesitant to adopt SRI; third, only soils with good drainage facility and low clay content are suitable for SRI cultivation and finally, there is not enough awareness among farmers about its superiority.
M. Shivamurthy et al.,\textsuperscript{8} in their study stated that rice growing situations prevailing in different regions of India largely determine the system of rice cultivation. The two principle systems of cultivation in Karnataka are dry and wet. The dry system of cultivation is mainly confined to tracks which depend on rains only. Upland rice, which is predominantly cultivated in the arid and semi-arid zones has noticed a gradual decline in its area and quantum of production in the recent years. The factors attributing to this decline are lack of suitable high yielding varieties and drought resistant varieties, decline in relative profitability of rice cultivation and shifting from food crops to cash crops etc., The present study was conducted to identify the constraints faced by farmers cultivating rainfed paddy in Eastern Dry Zone of Karnataka.

The study was conducted in Bangalore Rural, Tumkur and Kolar districts under Eastern Dry Zone of Karnataka State during 2005. Out of 24 taluks belonging to these three districts, six taluks (Kanakapura, Channapatna, Tumkur, Gubbi, Kolar and Bangarpet) were selected based on the highest area under paddy cultivation. From among these six taluks, 25 villages were selected randomly. In each of the 25 so selected villages, a list

of farmers growing rainfed paddy during 2003-04 khariif season was prepared. From each village four rainfed paddy growers were selected by adopting simple random sampling technique. Thus, 100 rainfed paddy growing farmers, spread over 25 villages, were selected for the study. The data was collected from 100 rainfed paddy growing farmers with the help of a pre-structured interview schedule.

Satya Paul and Rajesh Mehta (1991)\(^9\) have attempted to analyse the structure of agricultural technology in India using demand, elasticities of substitution and biases of technical change for the period 1960-61 to 1982-83. No study of an under developed agriculture has so far appeared which attempts such estimates based on aggregate data using a flexible form of the cost function. The cost function was tested for homotheticity, homogeneity and Cobb – Douglas structure. The rejection of these properties led to the retention of the full (non-homothetic) model which is also found to describe a well-behaved production structure. The results based on this Model reveal that the agricultural technology has been biased towards the use labour and capital and towards the saving of fertilizer and other inputs. Since the prices of all the inputs have increased, albeit at different rates, the labour and

capital using biases of technology seem to be the outcome of biased innovation possibilities. There exist strong substitution possibilities between labour and capital and between capital and fertilizer. This is of great importance for India and other less developed countries. Instead of Massive use of capital (such as tractors, etc.,) these countries can make extensive use of chemical fertilizer and human labour in order to increase agricultural production. Again, the decomposition of changes over time in the factor input demand reveals that technological change has contributed significantly to the per year increase in labour and capital demand. The output effect has contributed most to the annual changes in demand for fertilizer and other inputs in Indian agriculture.

Salik Ram\textsuperscript{10} (1994) has pointed out that adoption of new rice technology lowers the unit cost of production and offers countries and opportunity to reconcile the inherently conflicting food policy objectives of providing low and stable price to the consumers, it results in increased farm income and achieving self sufficiency in rice production. But the new rice technology being highly location specific, large scale adoption has been constrained by environmental condition.

M. Muthamil Selvan\textsuperscript{11} (2006) has observed some facts from his research on Farm Mechanization. His research has exhibited that there is a positive relationship between power available and the productivity. He also advocates that India has to increase the total food grain production in the coming decade by as much quantity of grains as it produced in the last two decades. India has to focus on new redirection and potential agricultural production and growing population in the coming years. Today, there is need to mechanize Indian farming not only to increase production but also to reduce production cost, drudgery involved in farm operations and making prosperity in farmer’s live.

2.2 STUDIES RELATING TO YIELD GAP AND YIELD CONSTRAINTS

There are two common ways of defining the concept of yield gap. First, directly comparing the experiment station yield to the yield at farm. Second, comparing yield of the best farm with that of the average or the poorest farm.\textsuperscript{12} Thus, yield gap may be classified into two kinds - Yield gap I and Yield gap II. The Yield Gap I represents the difference between the experiment station yield and potential farm yield. Yield Gap II


\textsuperscript{12} Poduval, \textit{loc.cit}.
corresponds to the potential farm yield and actual farm yield. The maximum yield obtainable from a variety under particular situation is called ‘potential yield’, while, the average yield attained under farm condition is known as ‘actual yield’.

Yield gap analysis becomes instrumental in measuring the magnitude of gap in the yields and in identification of constraints responsible for it. It is not proper to consider Yield Gap I in a study, as experiment station rarely encounters the constraints experienced by the farmers. Such estimates would be biased and larger than what it is actually under the farmers condition.\(^{13}\) Hence, Yield Gap II has been examined in the study. It was defined as the difference between the highest yield obtained by the most efficient farmer in the sample and the average level of yield achieved under farmers condition.

Davidson and Martin\(^ {14}\) in their study, “The Relationship between Yields on Farm and in Experiments” observed that the variation was according to the cultivation season. During good years, the yield at

\(^{13}\) V. Rajagopalan et.al., *Studies on Cost of Production in Tamil Nadu*, Department of Agricultural Economics, Tamil Nadu Agricultural University Coimbatore, 1978.

experiment station was found to increase more rapidly than the yield on farm within the same district. This was mainly because the farmers were more interested in measuring their profit by limiting their input investments, while the experimenters only aimed at measuring yield and had no cost restraints.

Mokheyi\textsuperscript{15} in his study estimated the yield gap ratios in rice production during kharif season in the year 1975-76. The observed farmers technical competence was high when the gap ratio was low and vice versa. High yield gap was reported in states like Bihar and Orissa. This was attributed to the fact that while the demonstration plots were situated in irrigated areas, rice at the farm was generally produced under rainfed conditions.

Tripathy\textsuperscript{16} in his study, “A Study of Technological Crop in Adoption of New Rice Technology in Coastal Orissa and Constraints Responsible in the same”, concluded that, about 17 per cent of the gap in the yield was caused by technology gap. The different package of practices individually accounts for the technological gaps. There are 20.34 per cent, 17.92 per

\textsuperscript{15}K.K. Mokheyi, Gap Analysis-An Effective Production Increase Concept in Rice, \textit{Summary of a Lecture Delivered at the State Leaven Training Meeting on Rice}, held at Purila Department of Agriculture West Bengal, India July, 1977.

cent and 12.37 per cent of the gaps which were caused by water management, disease and pest control, and nitrogen application respectively. Nearly 20 per cent of the gap was due to the ecological factors like temperature, soil, rainfall and sunshine intensity.

Gomez\textsuperscript{17} defined the factors responsible for yield gap constraints. Yield Gap I was hypothesised to be caused by other environmental differences between experiment station and farmer’s field or by non-transfer of technology. Yield Gap II was caused by biological and socio-economic constraints. Biological constraints referred to the uncontrollable natural factors and socio-economic constraints to the social and economic factors that prevented the farmers from using the recommended technology. The author developed the conceptual model of yield gap. The farmer corresponded to the difference between experiment station yield and potential farm yield and the latter corresponded to the difference between the potential farm yield and actual farm yield.

David Rajasekar\textsuperscript{18} studied the relationship between yield gap and the associated input gaps by fitting linear yield gap functions for paddy, irrigated cholam and irrigated cumbu separately and log linear yield gap function for irrigated groundnut. In the case of paddy, the co-efficients of nitrogen gap, human labour gap and technology index were significant which indicated that the yield gap between demonstration plots and farm holdings would be bridged physically by increasing the inputs such as labour, nitrogen and technology level in the sample farm. In the case of groundnut, the coefficient of phosphorous gap, potash gap and pesticides gap was significant. So, the economic optima derived revealed that there existed potentialities for increasing the groundnut yield by bridging the gaps in phosphorous, potash and pesticides.

Suryawanshri and Gaikward\textsuperscript{19} in their study found that there was a wide gap in yield when new technology was adopted. The yield was 2.12 quintals/ha. under traditional method of cultivation but it was 3.42 quintals/ha. when there was a partial adoption of technology. It was 7.02


quintals/ha. when it was fully adopted as in demonstration plot. Multiple regression analysis showed that not only sowing had increased yield of jowar but also contributed to increase productivity of the resource. Recommended varieties, fertilizers and timely sowing were found to be important ways to reduce the yield gap.

Chandrasekaran\textsuperscript{20} in his study examined the relationship between yield gap and the associated input gap by fitting a linear function. The coefficient of gap in nitrogen, phosphorous and potash was significant which included that the yield gap between demonstration plots and the farm holdings could be bridged by increasing the input such as nitrogen, phosphorous and potash in the sample farm. He found that the marginal value product of nitrogen, phosphorus and potash was higher than the marginal cost of the respective items and concluded that even at the existing product and factor prices, the yield gap could be reduced.

Fale et al\textsuperscript{21}, in their study “An Economic Analysis of Yield Gap in Rice in Ratnagiri District” argued that yield obtained at the experimental

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\textsuperscript{20} C.M. Chandrasekaran, Yield Gap Analysis in Sugarcane Crop in Awanashi Taluk, Coimbatore District Unpublished M.Sc., (Agri) Thesis Submitted to Department of Agricultural Economics, Tamil Nadu agricultural University, Coimbtore, 1985, pp.96-97.

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station could not be advanced on farm because of differences in environment, input use and management. Therefore, they defined yield gap on the difference between the potential yield, that is, yield obtained in demonstration plots and the actual farm yields. They defined potential yield that could be obtained in farmer’s field by adopting improved technology. They observed that the gap between yields, in experimental station and those obtained in national demonstration plots (Gap 1) was quite misnomer (2 q/ha. or 3.82 per cent). However, the gap between potential yield and the actual yield on farmers fields was very wide (that is, 27 q/ha. or 52 per cent). There existed differences in utilisation of improved inputs such as fertilizer and labour. Higher level of input was used on national demonstration plots as compared to farmer level.

Flinn and Ali\textsuperscript{22} studied the yield gap in two villages of Gujranwala district, Pakistan, using data collected from a random sample 115 farmers. The mean yield of Basmala variety was found to be 1.8 tonnes per hectare over the sampled farm during 198.2 rice crop. The yield of rice in the study ranged from 0.6 to 3.0 tonnes per hectare. Thus, a yield gap of over one tonne per hectare was identified between the average and the highest farm

yield. This suggested that given current technology, there were opportunities for increasing rice yields in the study area.

Yadav and Gangwar\textsuperscript{23} in their study, “Rice Production and Constraints in Bihar State” stated that, high yielding variety rice yield was 35.56 quintals per hectare which was about 160 per cent higher than that of local varieties. Yield gap between potential farm yield and the actual realised yield was quite high indicating factor potential for increase in production of rice in state. The reason for this yield gap was only the partial adoption of new technologies. The author remarked that there was a need to strengthen the extension and input supply services in Bihar immediately.

Subramaniyan and Nirmala\textsuperscript{24} in their study “Yield Gap Analysis in Rice Cultivation”, analysed the yield gap among IR 20 and CO 37 rice cultivation in Gokilapuram village of Madurai district for khariff 1986. Yield gap under the former variety (3.54 qtls per acre) worked out to be greater than that under the latter (2.81 qtls per acre). Further, Garretts ranking technique was used to identify the important constraints to potential

\textsuperscript{23} P.N. Yadav and A.C. Gangwar, “Rice Production and Constraints in Bihar State”, \textit{Agricultural Situation in India}, Vol.12, No. 1, 1986, pp.9-13.

\textsuperscript{24} G. Subramaniyan and V. Nirmala, “Yield Gap Analysis in Rice Cultivation”, \textit{Southan Economist}, Vol. 27, No.15, 1988, pp.15-16.
yield in the study area. The main constraints observed were shortage, insects, credit, tradition, weeds and non-availability of seeds.

Lakshmanan in his study revealed that the extent of yield gap in groundnut varied from 20.84 per cent in wet zone area to 29.05 per cent in dry zone. The gap was 26.41 per cent and 22.79 per cent in the case of small and big farmers respectively. The reason for the variation was due to low fertilizer dose, irrigation and low perception of attributes.

**Yield Constraints**

The factors that prevent farmers from achieving the potential yield under farmer condition are known as ‘yield constraints’.

There are 3 kinds of constraints, which cause yield gap. They are (1) environmental constraint, (2) biological constraints and (3) socio-economic constraints. Environmental constraints are caused by (i) environmental difference and (ii) non-transferable technology. Experiment stations are usually located in places ideal for farming, whereas the same is not true for farmer’s field. Moreover, there are hardly any cost output

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constraints at these centres, while farmers often encounter such problems at farm level. Above all, some of the technologies adopted at the experiment station may not be transferable to a farmers field. These constraints cause Yield Gap I. Biological constraints include (i) variety, (ii) weeds, (iii) diseases and insects, (iv) problem soil, (v) irrigation facilities and (vi) soil fertility. By and large, these constraints arise from the non-application of the required inputs. Experiment station may not face such problems, while farmers often face them at the farm level.

Socio-economic constraints arise from (i) costs and returns, (ii) credit problems, (iii) tradition and attitudes, (iv) knowledge and (v) input availability of institutional facilities. It is the outcome of these constraints which prevent the farmers from adopting the technology as recommended. A farmer may consider the economic viability of following the new technology in terms of its cost and returns. Some farmers may not like to give up their traditional practices. Moreover, some aspects of the technology may not be understood by them. It also results from lack of institutional facilities like non-availability of inputs and credits. Biological and socio-economic constraints together contribute towards Yield Gap II.
C. Satapathy and R.K. Raj (1983) have made an attempt to study about “Constraints in adoption of Pulse technology” undertaken in Orissa covering four blocks in three districts. The sample for the study consisted of 120 pulse growers comprising marginal, small and big farmers of equal size. The opinion of both categories of farmers were analysed to reveal constraints of pulse cultivation comprising of eleven important packages of practices. The findings reveal constraints in adoption of recommended package of practices in pulses are mostly farmer’s ignorance, non-availability and high cost of inputs, lack of timely technical advice and guidance and poor economic return as perceived by pulse growers.

2.3 STUDIES BASED ON PROFIT FUNCTION APPROACH

Most of the empirical studies discussed in the previous section made use of the Cobb-Douglas production function to evaluate the economic efficiency of the farmers. According to Lau and Yotopoulos, production function approach is not suited to examine the allocative efficiency of farmers, because the prices are not incorporated as exogenous variables nor does the approach allow for different groups of farmers having different

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endowments of factor inputs. To avoid limitations Lau and Yotopoulos applied the profit function concept to the analysis of relative efficiency. They have developed an operation model to measure and compare economic efficiency of farmers on the basis of the following assumptions:

(1) Farms are profit maximizing
(2) Farmers are price takers in both product and factor markets and
(3) The production function, which underlies the profit function, is concave in variable inputs.

In the Cobb-Douglas production function in the variable inputs with n fixed inputs, the normalized restricted profit function is given by

\[
\log n = \log A + \sum_{i=1}^{m} \log p_i + \sum_{j=1}^{n} r_j \log z_j
\]

where

- \( n \) = Normalised restricted profit
- \( A \) = Normalised shift parameter
- \( p_i \) = Normalised prices of inputs in the production process
- \( z_j \) = Fixed inputs

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The levels of variable inputs can be derived from the above equation by differentiating the normalised restricted profit function with respect to the normalised price for that factor by using Sheppard’s Lemma.\textsuperscript{32} From the equation the variable input demands function\textsuperscript{33} are derived as

\[
\frac{-p_i x_i}{x_i} = \beta_1
\]

Where \(X_i = \) levels of variable inputs

\(i = 1 \ldots m\)

The above equations are to be estimated jointly by using Zellner's\textsuperscript{34} seemingly unrelated regression with an assumption of additive error with zero expectation and finite variance for each of the two equations. The hypothesis of equal relative economic efficiency of two different farms can be tested by using dummy variable in the normalised restricted profit function and examining whether its value is equal to zero.


\textsuperscript{33}M. Fure and D.L. McFaden, \textit{op.cit.}, p.13.

Kalirajan and Flinn\textsuperscript{35} studied allocative efficiency and supply response in irrigated rice production through profit function. The study was confined to two varieties of rice in the kharif season in Coimbature district, Tamil Nadu. The data used were drawn from a larger intensive survey conducted from May 1977 to April 1978. They chose 41 farmers for Exotic Modern Variety (EMV) at random. They estimated Lau-Yolopoulus profit function along with input demand equation by using the restricted Aitten’s estimation, imposing the conditions that the co-efficient of variable input are equal in both profit and relevant factor demand equation. The interest terms of the normalised profit function indicated similar technical efficiency of the EMV and LBV producers. The sum of the elasticities of fixed factors (land and capital) indicated that constant returns to scale prevail in both cases.

The output responses to changing rice price were positive, significant and greater than one. This indicated that the farmers in the study area were responsive to changes in rice price. Besides this, farmers supply response for rice was sensitive to changes in the prices of rice, fertilizer and labour wages.

Junakar\(^{36}\) tested the joint hypothesis of profit maximising behaviour and competitive behaviours of Indian farmers. The study was based on cross sections data pertaining to paddy growing farmers of Thanjavur district in Tamil Nadu, for 1969-70. He estimated Lau-Yotopoulos profit function along with that variable input demand equation by Zellner’s Seemingly Unrelated Regression and tested the restriction implied by theory. Quite contrary to the earlier findings of other studies, assuming competitive conditions, he found that Indian farmers were not profit maximizers. He argued that small and large farmers in India did not operate in the same credit or labour markets, and therefore, they were not competitive. Hence, he emphasised the need for further research to explain the behaviour of farmers in poor countries.

Abhi, Kumar and Mathur\(^{37}\) derived indirect production elasticities for three varieties of cotton (Desi cotton, American cotton and Hybrid cotton) using Lau-Yotopoulos profit function along with variable input demand equation relating to labour. They utilized farm level primary data from Akola district in Maharashtra state, for the year 1979-80, for 200 farmers


growing three varieties of cotton. They estimated profit equation along with input demand (labour) equation jointly by using Zellner’s Seemingly Unrelated Regression. The study showed that the share of land in cotton production was the maximum for all varieties of cotton, ranging from 0.42 for Desi cotton to 0.54 for American and Hybrid cotton. The share of labour decreased substantially as one moved from ‘old’ to ‘new’ technology. The share of capital in Hybrid cotton technology was biased towards land and capital, and was against labour.

Kalirajan\(^{38}\) studied the economic efficiency of farmer groups (small and large) using Lau-Yotopoulas profit function along with four variable input demand equations relating to labour, chemical fertilizer, pesticides and bullock pair. For the empirical estimation of profit and variable factor demand function a random sample of seventy farmers (35 farmers each) growing HYV. IR 20 in rabi (winter) reason 1977-78 was selected from a progressive village in Coimbatore district, Tamil Nadu.

To test the equality of different efficiencies (economic, price and technical) between the two farmer groups, he estimated the profit function along with demand functions, jointly by using Aitken’s generalised least

squares through the Lagragian Multiplier. This way of estimating profit and factor demand functions is different from the method of Lau and Yolopoulus. The advantage of working with this method is that it is possible to identify which elasticities estimated from the factor demand equations differ from those of the profit functions. It helps policy makers to identify which of the factors effect farmer’s decision making. The major findings of this study were:

1) There was equal relative economic efficiency in the cultivation of IR 20 in rabi season between small and large farm groups.

2) There were equal differences between price efficiency parameters of small and large farm groups; and

3) The null hypothesis of equal relative technical efficiency between small and large farm groups could not be rejected.

These findings indicate that given the same acres to input and equal terms, small farmers would respond to economic opportunities in the same way as large farmers. However, in order to achieve this, special institutional arrangements may be necessary to ensure equal access for small farmers to inputs.
Joginder Singh and D.K. Grover (1991) observed that the Punjab state witnessed a rapid technological transformation in agriculture in the sixties. Initially, it was evaluation of high yielding varieties (HYVs) having better response to fertilizers, irrigation, insecticides etc. The Mechanisation of operations such as seed-bed preparation, plant protection, harvesting, threshing, transportation, storage and processing boosted the production further. The economic gain of an area is determined primarily by the nature of shifts in the crop pattern, cropping intensity, relative price, the physical productivity and the farm size. There has been a significant shift in the crop patterns in the state during the study period. The area under rice and wheat has registered a rapid increase from 14.8 and 29.6 percent in 1960-61 to 24 and 42.7 percent of the total cropped area in 1989-90 respectively. The area under coarse cereals, pulses and sugarcane has been declining while that of oilseeds and cotton has been fluctuating. However, the magnitude of shifts in the crop pattern has varied in different zones. Apart from the natural resource restrictions, the comparative economics of different crops, risk in their production and marketing and the requirement of labour and power were the sole reasons for the choice of crops by the farmers.

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S.P. Saraswat et al., (1995)\textsuperscript{40} has done a study about the structural changes in the economy both at the micro and macro levels in farm and non-farm employment in Himachal Pradesh. In this backdrop, it is imperative to promote better skill formation for the jobs offered by the non-farm sector and take other measures to improve their productivity. In the farm sector, more employment opportunities could be generated through introduction of high-value and labour-intensive vegetable crops and this could be supported by increased irrigation facilities, improvement of infrastructural as well as marketing facilities. This research has revealed that non-farm sector employment holds the key to creating remunerative employment in the rural areas. This could be attributed to the increasing population pressure and consequent marginalization of holdings, which are not able to sustain them and simultaneously these compulsive factors force the workers to seek alternative avenues of employment. The proximity has been imposing more on urban areas and structural changes in the economy both at micro and macro levels. Per capital man-days of gainful employment had declined over the three decades, despite occupational diversification.

Savale\textsuperscript{41} (1966), have studied 300 cultivators from ten villages in Maharashtra about the extent of adoption of selected from practices. Innovation may be factor saving, factor using and output increasing. In agriculture, innovation which increases output to a considerable extent but not as much as we expect to increase. A large number of practices recommended did not promise attractive returns over local practices. The new practices should be both output rising and factor saving. If it is factor using the difference between marginal returns and marginal cost needs to be quite substantial so as to attract even the most reluctant cultivators to adopt the new technology. This is true even for output rising technologies.

Pudasaini\textsuperscript{42} (1983) has employed both production and profit function method to test the hypothesis that education enhances the farmer’s allocative efficiency. The data used in the study were obtained by interviewing 156 sugarcane cultivating farmers of Bara District of Nepal for the Crop year 1979-80.

The main finding of the study is as follows:


1. The empirical results from the production function and profit function indicate that education contributes to output most significantly through its allocative effect rather than through the worker effect even in a single output farm characterized by changing technology.

2. The profit function approach is more preferable than production function approach to evaluate the workers effect and allocative effect.

Rajendran.R and et al.,\textsuperscript{43} (2006), in his work on rice is the staple food in Tamilnadu. The Cauvery Delta Zone (CDZ), is popularly know as the rice granary of Tamil Nadu. It is one of the major rice growing tracts in the state. Currently, the man rice yield is 1.6 to 2.0 tons per productivity of rice could be further increased by 0.2 to 0.6 tons per acre (0.5 to 1.5 tons per ha) using a new systems of rice cultivation known as “transformed rice cultivation (TRC).” The key practices of TRC are (1) planting young (14-15 days old) seedlings at 1 to 2 seedlings per hill. (2) square planting with wider spacing (20 x 20cm to 25x25cm) and (3) mechanical weeding and soil stirring by rotating cono rotary weeder. Farmers are obtaining higher profit by adopting the new TRC method. The average net profit was Rs. 1918 per acre (Rs.4794 per ha) for the conventional method and Rs.6722 per acre (Rs. 16806 per ha) for the TRC method. Thus, farmers are adopting TRC

method and obtained an additional profit of Rs.4805 per acre (Rs.12012 per ha) over the conventional method of rice cultivation. The increased profitability under TRC method was achieved by the reduced cost of cultivation by Rs.720 per acre (Rs.1800 per ha) by using the modified rice mat nursery to produce young seedlings.