CHAPTER II

REVIEW OF LITERATURE AND CONCEPTS

This chapter is devoted to review the literature related to the present study. For any research, a review of the past studies related to the subject is useful in several ways. It helps in defining concepts and operational definitions, in formulating testable hypotheses, specifying test conditions, choice of analytical tools as empirical models and in evaluating the findings of the research in the light of the results of earlier studies so as to explain the differences if any.

2.1 REVIEW OF LITERATURE

For better exposition, the review has been organised under the following heads:

(i) Studies relating to Cost and Production
(ii) Studies relating to Yield Gap and Yield Constraints and
(iii) Studies relating to Profit Function Approach
(iv) Studies relating to Pulses
2.1.1 Studies Relating to Cost of Production

In agriculture, cost of production refers to the expenditure incurred by the farmers on the various inputs (operational and fixed) to obtain the final produce. The relationship between cost and income is of vital importance. In agriculture, costs of 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 is contrast over time and does not vary with the changes in output. It exists even in the absence of cultivation. Variable cost includes input like seeds, labour cost, manures and pesticides, tractor fuel and livestock fuel. 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 as long as gross income in greater than or covers the variable cost. But in the long run, the return must cover the total cost, comprising of 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\(^2\) et al., in their study on the cost of production of crops in Tamil Nadu during the year 1978,

---


\(^2\) V. Rajagopalan et.al. Studies on Cost of Production of major crops in Tamil Nadu, *Department of Agricultural Economics*, Tamil Nadu Agriculture University, Coimbatore, 1978, pp.2-3.
**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
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 thereupon) 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.

In a study conducted by Tamil Nadu Agricultural University, Coimbatore, on the cost of production of mango in Tamil Nadu, Cost A and Cost C alone were used.\(^3\)

They include the following cost components.

1) **Cost A:**

1. Value of human labour including family labour
2. Value of bullock labour
3. Value of machinery charges
4. Value of seed
5. Value of insecticides
6. Value of manure and fertilizer
7. Value of irrigation and
8. Investment on working capital.

---

2) Cost C:

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

Cost A was computed from Cost C, on the assumption that Cost A accounted for 70 per cent of the Cost C. But the assumption is highly arbitrary.

In the survey of cost of production of raw cotton conducted by the International Cotton Advisory Committee, Memphis, U.S.A., costs were divided into direct cost and indirect cost. Direct cost was the cost associated with physical production. It included on-farm production and harvesting cost and off-farm cost like transportation and gearing charges. Indirect or overhead cost included management and land cost. These two kinds of costs formed the gross cost for producing seed cotton.

In the present study, Cost A (operational cost) and Cost C (fixed cost) were conducted to arrive at the cost and return structure of paddy cultivation.

---

in the study area. The following items formed the components of the two costs:

1. Cost A:
   1. Human labour
   2. Bullock labour
   3. Chemical fertilizer
   4. Pesticides
   5. Seed cost
   6. Farm manures
   7. Cost of irrigation and
   8. Interest on working capital.

2. Cost C:
   1. Rent and
   2. Interest on fixed capital, land revenue, cesses and taxes,

   depreciation of implements and machinery.

David Groenfeldt\(^5\) 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 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 to bear 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 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, 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\(^7\) 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, has examined the resource productivity and allocate 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 allocate 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\textsuperscript{8} in their investigations were conducted at the farms of Uttar Pradesh Bhumi Sudhar Nigam at Shivri, Lucknow during the Kharif season in 1998-99 to assess 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 \%, organic carbon from 0.22 to 0.56 \%, available nitrogen (N) from 499.52 to 1245.44 kg/ha, carbonate ions from 0.20 to 0.23 meq/100 g of soil, calcium ions 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\textsuperscript{-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., 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)

---

become 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.,10 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 the 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 rain fed 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 belongs 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 rain fed paddy during 2003-04 *kharif* season was prepared. From each village four rain fed 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.

2.1.2. **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 on the poorest farm.  

\[ \text{Poduval, loc.cit.} \]
the experiment station yield and potential farm yield. Yield Gap II corresponds to the potential farm yield and actual farm yield. The maximum yield obtainable from a variety under particular situation is called ‘potential yield’, which 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 farmer’s condition.\footnote{V. Rajagopalan et.al., Studies on Cost of Production in Tamil Nadu, Department of Agricultural Economics, Tamil Nadu Agricultural University Coimbatore, 1978.} 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 farmer’s condition.
Davidson and Martin\textsuperscript{13} in their study, “The Relationship between Yields on Farm and in Experiments Station” was observed to vary according to the cultivation season. During good years, the yield at 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{14} in his study estimated the yield gap ratios in rice production during kharif season in the year 1975-76 the deserved farmers technical competence to be 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 farmer was generally produced under rainfed conditions.


\textsuperscript{14} 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.
Tripathy\textsuperscript{15} 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 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{16} 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

\textsuperscript{15} A. Tripathy, \textit{A Study of Technological Gap in Adoption of New Rice Technology in Coastal Orissa and Constraints Responsible for the Same}, (Unpublished Ph.D Thesis, Indian Agricultural Research Institute, New Delhi, 1977).

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{17} 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-efficient 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.

\textsuperscript{17} D. David Rajarekan, \textit{Yield Gap Analysis: A Study of Selected Crops in Madurai District (Paddy, Cholam, Cumbu, Groundnut)} (Unpublished M.Sc. (Agri) Thesis Submitted to Tamil Nadu Agricultural University, Coimbatore 1984), pp.148-149.
Suryawanshi and Gaikward\textsuperscript{18} 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{19} in his study examined the relationship between yield gap and the associated input gap by fitting a linear function. The coefficient of gap is nitrogen, phosphorous and potash were 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


\textsuperscript{19} C.M. Chandrasekaran, Yield Gap Analysis in Sugarcane Crop in Awanashi Taluk, Coimbatore District (Unpublished M.Sc., (Agri) \textit{Thesis Submitted to Department of Agricultural Economics}, Tamil Nadu agricultural University, Coimbatore, 1985), pp. 96-97.
marginal cost of the respective and be concluded that even at the existing product and factor prices, the yield gap could be reduced.

Fale et al\textsuperscript{20}, in their study “An Economic Analysis of Yield Gap in Rice in Ratnagiri District” argued that yield obtained at the experimental station cannot 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{21} 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{22} 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.


\textsuperscript{22} 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.
Subramaniyan and Nirmala\textsuperscript{23} 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 qtl per acre). Further, Garretts ranking technique was used to identify the important constraints to potential yield in the study area. The main constraints observed were shortage, insects, credit, tradition, weeds and non-availability of seeds.

Lakshmanan\textsuperscript{24} 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\(^{25}\), 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 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 farmer’s 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.

2.1.3 Studies Relating to 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\textsuperscript{26}, 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

\textsuperscript{26}L.J. Lau and P.A. Yotopoulos, “Profit Supply and Factor Demand Functions”, \textit{American Journal of Agricultural Economics}, Vol.54, No. 1, February 1972, pp.11-18.
endowments of factor inputs. To avoid limitations Lau and Yotopoulos applied the profit function concept to the analysis of relative efficiency of Indian agriculture. 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

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

where

*n* = Normalised restricted profit

---


A = Normalised shift parameter

\( p_i = \) Normalised prices of inputs in the production process

\( z_j = \) Fixed inputs

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.\(^{30}\) From the equation the variable input demands function\(^{31}\) are derived as

\[
\frac{-p_i x_i}{\sum x_i}^* = \beta_1
\]

Where \( X_i = \) levels of variable inputs

\( i = 1 \ldots m \)

The above equations are to be estimated jointly by using Zellner’s\(^{32}\) 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.


Kalirajan and Flinn\textsuperscript{33} 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 Coimbatore 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-Yolnopoulus 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\textsuperscript{34} 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\textsuperscript{35} 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\textsuperscript{36} studied the economic efficiency of farmer groups (small and large) using Lau-Yotopoulos 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 decision is making. The major findings of this study were:

1) There was equal relative economic efficiency is 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.
The methodology adopted to test the difference in various relative efficiencies was as follows:

i) **Test for Equal Relative Economic Efficiency:**

\[ H_0 : \delta^*_L = 0 \]

If this hypothesis is rejected at appropriate level of significance (they used 10 per cent level). One may infer that the groups of farms (small and large) differ with regard to economic efficiency.

ii) **Test for Equal Relative Price Efficiency:**

\[ H_0 : \alpha^*_1 = \alpha^*_1 \]

If this hypothesis is accepted at appropriate level of significance, one can accept that the two groups of farms (small and large) do not have different price efficiency parameters that is they both succeed to the same degree in maximising profit.

iii) **Test of Equal Relative Technical and Price Efficiency:**

\[ H_0 : \delta^*_L = 0 \]

\[ H_0 : \alpha^*_1 = \alpha^*_1 \]

If this hypothesis is accepted at appropriate level of significance, one can infer that the two groups of farms (small and large) are equal in
technical and price efficiency, not otherwise. If hypothesis (i) is rejected then the rejection of this hypothesis (ii) may be anticipated.

iv) Test for Absolute Price Efficiency of Small Farms:

\[ H_0 : \alpha_1^{*L} = \alpha_1^{*S} \]

If this hypothesis is accepted at appropriate level of significance, one can say that small farms have maximized profits.

v) Test for Absolute Price Efficiency of Large Farms:

\[ H_0 : \alpha_1^{*L} = \alpha_1^{*S} \]

If this hypothesis is not rejected at appropriate level of significance, one can infer that large farms have maximised profits.

The major finding of their study (Lau and Yotopoulos 1973) was that the test of relative economic efficiency was in favour of small farms. Given the fixed inputs (land and fixed capital), and within the ranges of the observed prices of output and variable input, small farms have higher actual profits. They found that this difference was not due to superior price efficiency but due to superior technical the efficiency of constant returns to scale in Indian agriculture. Therefore, one cannot argue for consolidation of small farms on the grounds of economies of scale.
While using this model in empirical context one has to note the following points:

i) The estimates of parameter $\alpha_1^* L$, $\alpha_1^* S$, $\log A_1^* S \beta_1^*$, $\beta_2^*$ etc are all group level estimates. Therefore, the estimates at the farm level cannot be obtained from them;

**Models to be used in the Present Study:**

Sampath\(^{37}\) has discussed the unreliability of conventional production function approach to evaluate the economic efficiency of farmers due to the elastic assumptions and the econometric problems involved in the estimation of the elasticity parameters.

He has suggested linear programming as an alternative approach to measure and compare the economic efficiency of the multi product farm. But the linear programming approach is not advantageous and it is inappropriate for a single crop study.\(^{38}\) The next alternative approach to measure and evaluate the economic efficiency of farmers is the profit function approach. The profit function presents itself as a superior alternative to the production function for the following main reasons.

---


1. The normalised restricted profit function and input demand function are functions of predetermined variables and estimation of such function avoids possible simultaneous equation bias.\(^{39}\)

2. The hypothesis concerning economic efficiency can be tested directly from profit function without having allocative error function.

3. The profit function approach takes into account differences in technical efficiency, allocative efficiency and efficiency in prices and also permits determination of relative economic efficiency of the different group of farms.\(^{40}\)

In order to measure and examine the relative economic efficiency and its component of technical efficiency and price efficiency, the profit function approach seems to be an ideal tool.\(^{41}\) Hence, in the present study, profit function and input demand functions with and without restrictions have to be estimated for fulfilling the objectives.

---


2.1.4 Studies Relating to Pulses

Mr.K.Seerangan Addl.Director (inputs) in pulses seminar organised at National pulses research centre discusses the various issues related to growth and adoption of technologies to assess the growth rate and to improve\textsuperscript{42}.

Prof. Dr.S.Kanniyan vice Chancellor, Tamilnadu Agricultural University pointed out that the growth rate is affected by various factors such as moisture conditions, lack of proper seed storage facilities and growing lands such as marginal lands, Irrigation prone areas, fertile lands occupied for other purpose etc.

He says that growth rate of 20\% is only possible under irrigation prone and free from pests and diseases\textsuperscript{43}.

Economic growth depends upon its natural resources, human resources capital, enterprise, technology etc.

\textsuperscript{42} State Level Seminar on Increasing Productivity of Pulses in Tamilnadu National Pulse Research Centre 22-9-2000 by Mr.K.Seerangan

\textsuperscript{43} Proceedings and Recommendations on Increasing productivity of Pulses in Tamilnadu-Seminar Proceedings on 22-9-2000 by Dr.S.Kanniyan
Gourou explains about the tropical soils and weeds Mechanization to the increase of Growth rate and helping the increase of yield by the effective use of fertilizers.\textsuperscript{44}

Dr. Subramanian K.V and vasanthi reveals that the growth rate is usually estimated on the basis of different functional forms. Equating method has been used even if the growth rate is accelerating or decelerating, they used semi log functions to find the compound growth rates of Area, production and productivity for six crops, namely paddy, seeds, pulses, vegetables, wheat, maize. They used time series data from 1961 to 1978 and also divided this into two sub-periods, i.e. 1961-1969 and 1970-1978.

They concluded that growth rates in period II (1970-78) were generally higher than those of period I (1961-1969) which indicated the impact of green revolution on all the crops.\textsuperscript{45}

Dr. G. Subramanian computed simple annual growth rates of area, production and products of various pulses. He also describes the state-wise

\textsuperscript{44} Minutes-Paper Submitted by Gouroru on Tropical Soils in TNAV@ National Pulse Research centre.

\textsuperscript{45} Subramanian K.V Growth of Horticulture Crops in India, Constrains and Opportunities Agriculture Situation in India39 (5), 303, 1984.
production and Growth rate of black gram and other pulses. The growth rate of black gram in Tamilnadu is 1.43 percent after green revolution\textsuperscript{46}.

Dr. Masood Ali Director and Dr. Shivkumar principal scientist of head of improvement division Indian Institute of Pulses Research Kanpur, in a survey of Indian agriculture 2007 says that Domestic production of pulses is 14.94 million tonnes in 2003-04 had declined to 13.38 million tonnes in 2004-05 and to 13.11 million tonnes in 2005-06. The growth rate is decreased 0.56 percent from 2003-04 to 2005-06; whereas in 2005-06 it is declined as 1.83 percent\textsuperscript{47}.

They concluded that compound growth rate of area under pulses cultivation. Production and productivity has been increases due to increase in the yield per unit area\textsuperscript{48}.

Sharma and Sharma employed exponential function form to compute the growth rates for pre and post green revolution periods separately. They concluded that the production of pulses recorded negative growth rate in

\textsuperscript{46} Subramanian G and Vasanthi S.P “Agricultural Trends in Tamilnadu 1961 to 1978 Agricultural Situation in India43 (1); 25-27; 1988.

\textsuperscript{47} Survey of Indian Agriculture-2007

\textsuperscript{48} Jawahar Thakur D.K Singh and MiloRoy “An Analysis of Trends Growth and Technological Development Oilseed in Bihar.
pre-green revolution period. They further concluded that the productivity of pulses was 1.21% and 1.58% during pre and post green revolution period respectively\textsuperscript{49}.

The present study used semi-log and second order semi-log function to find out the compound growth rates of area. Production and productivity of Black gram (pulses) using time series data from 1956-57 to 1989-90 and two of its sub-periods namely per-green revolution period (1956-57) and post-green revolution period (1965-67 to 1989-90)

**RESEARCH GAP**

Most of the studies under review are relating to paddy, and the commercial crops. But the studies on pulses are scanty this is the main reason to choose the topic related to pulses. Hence, the present study is an attempt to study the economics of the pulses cultivation with select crops namely Black gram and Green gram in Thoothukudi district. The researcher has undertaken to analyse cost, return, determinants of yield, yield gap, supply responsiveness and labour observation in the cultivation Black and Green grams in the study area.

\textsuperscript{49} Sharma S.K Sharma H.R and Sharma R.K Trends in Area Production and Yield of Commercial Crops in Indian Agricultural with Special Reference to Oil Seeds Agricultural Situation in India 44 (7); 581-585; 1989
2.2 CONCEPTS

The concepts reviewed in this section relate to production, costs and returns, resource-use efficiency, marketing margin, marketing cost, marketing efficiency, price-spread and the like.

Production

According to Kohls and Damey, production can be defined as the creation of utility in the process of making useful goods and services.\textsuperscript{50} Again production can be defined as the process wherein some goods and services called inputs are transferred into other goods and services called output.\textsuperscript{51}

According to Hanson, production covered the activities of changing the form of goods at any stage from raw material to the finished product, changing the situation of goods, changing the position of goods in time and the provision of some kind of services such as retailing, banking,


entertaining and the like.\textsuperscript{52} Production in the economic sense related to working on raw materials or natural resources in such a fashion that caused them to change their form change their chemical or physical capacities, to store them until their desire for them has become more urgent.\textsuperscript{53}

In the present study, production represents the output of pulses resulting from the application of different inputs.

\textbf{Production Function}

Production function analysis helps to identify the uneconomic use of resources by the farmers. Chand defined production function as an algebraic relationship expressing an output in terms of a number of determinants – inputs or factors of production.\textsuperscript{54} According to Handerson and Quandt, the production function was defined only for non-negative values of the inputs and outputs. It was constructed on the assumption that the quantities of fixed

\textsuperscript{52} J.C. Hanson, \textit{A Text Book of Economics}, Leonard Hill, London, 1972, pp. 21-22.


inputs were at pre-determined level, which the entrepreneur was unable to alter during the short-time period.\(^{55}\)

Klein defined production function as a mathematical expression of technical relationship between input and output, which would remain constant as long as technology remained invariant.\(^{56}\) Samuelson defined production function as one which indicated the maximum amount of output that could be produced by each of the specified inputs or factors of production and it was defined for a given state of technical knowledge.\(^{57}\)

In the present study, production function is defined as the technological relationship between the output of pulses and the inputs, namely, area under pulses, human and bullock labour, seeds, manures and fertilizers and plant protection chemicals and the like.


\(^{56}\)Lawrence R. Klein, *An Introduction to Econometrics*, Prentice-Hall of India Private Limited, New Delhi, 1973, p.84.

Productivity

Heady defines productivity as the quantity of output turned out in a farm.\textsuperscript{58} Bhattacharjee defined the term productivity to denote the output per unit of input in farm business.\textsuperscript{59} Kargoanker indicated productivity as the ratio of output to input.\textsuperscript{60} According to Gowar, productivity measures the efficiency with which the inputs are transferred into output.\textsuperscript{61}

In the present study productivity is used as the quantity of output turned out per acre in the study area.

Cost

The cost of production is classified into variable (operational) costs and fixed costs.

\textsuperscript{58}Earl O. Heady, “Returns to Scale and Farm Size, Economics of Agricultural Productivity and Resource-use”, \textit{Journal of Farm Economics}, 34(2), 1952, pp.348-351.


Variable Cost (Operational Cost)

Variable cost or the operational cost is the cost incurred by a farmer on factors of production such as seeds, human labour, fertilizers, pesticides, bullock labour, livestock feed, tractor fuel and the like.

According to Tandon and Dhondyal, the variable costs are the prime costs, related to the variable resources.\(^{62}\)

Shyamsundar et.al., included the cost of seeds, farm yard manure, fertilizers, plant protection chemicals, covering material, cost of irrigation, human labour, bullock labour and interest on working capital in the variable cost.\(^{63}\)

In the present study, the variable cost or operational cost includes the expenses incurred in cash and kind. It includes the value of human labour, bullock labour, cost of irrigation, seeds, farm yard manure, fertilizers, plant protection chemicals, covering material and interest on working capital.


\(^{63}\)M.S. Shyamsundar, *op.cit.*, p.40.
Rajagopalan has included the following components in his study on the cost of production of crops in Tamil Nadu during the year 1978:

Cost A consists of the value of human labour including family labour, values of bullock labour, machinery charges, seeds, insecticides, manures and fertilizers, cost of irrigation and interest on working capital.

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

In the present study, the cost of cultivation of pulses is classified into Cost A (Operational Cost- Cost A) and Cost C (Cost A plus fixed cost) which is generally adopted in farm management studies in India.

Cost A includes the following items:

i) Human labour,
ii) Bullock labour,
iii) Chemical fertilizers,
iv) Pesticides,
v) Seed bulbs,
vi) Farm yard manures,
vii) Irrigation,
viii) Interest on working capital,
ix) Storage, packaging and transportation.

---

64V. Rajagopalan, Studies on Cost of Production of Major Crops in Tamil Nadu, Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore, 1978, pp.2-3.
Cost C includes the following items:

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

Fixed Costs

Fixed cost is the cost incurred on rent, tax, depreciation of implements and machinery, interest, insurance premium and the like. Fixed cost represents the total expenses incurred even when no output is produced but production has been committed in. It is often called overhead cost and usually includes contractual commitments for rental, maintenance, depreciation, overheads, salaries and wages. It is a sunk cost because it is quite unaffected by any variation in the level of output, during the period of time in which it is sunk.65

Lavanya et.al., included the depreciation of implements, machinery, buildings, interest on capital invested on owned land and rent on leased land under fixed cost.66

---


Kahlon and Sandhu included the depreciation on the value of capital assets and the interest on the value of capital investment under fixed cost. An additional item of rent paid or payable was also taken into account while working out the fixed cost.\(^67\) Shyamsundar et.al., included the depreciation, interest on investment, land revenue and rental value of land in the fixed cost, for the production of rice.\(^68\)

In the present study, fixed cost includes the rental value of land, land revenue, depreciation and interest on capital.

**Returns**

The estimation of returns from farm enterprises in its proper perspective is essential as it helps in assessing the efficiency of farm business as a whole and also the efficiency of resource-use in farms.

Kaul and Mehta defined gross income as the value of cash, the value of produce actually sold and the value of produce remaining in stock, all valued at harvest prices prevailing in that village.\(^69\)

---


Tandon and Dhondyal defined net income as the gross income minus total expenses of production, namely, cost of seeds, manures, irrigation charges, wages of hired labourers and imputed value of unpaid family labour, depreciation, rent, interest on owned and working capital and marketing cost.\textsuperscript{70}

Gupta explained net income as the income to the operator of land after deducting all items of expenditure such as paid out costs both in kind and cash, depreciation charges, land rent, interest on capital and imputed value for family labour from the total income of the farm.\textsuperscript{71}

In the present study, gross returns are worked out by multiplying the value of produce by their respective market price. The net income is worked out from the gross returns minus the total cost (Cost C) which includes both fixed and operational costs.
