PRODUCTIVITY OF CAPITAL AND ROLE OF FINANCE IN TECHNOLOGICAL CHANGES IN AGRICULTURE IN TRIVANDRUM DISTRICT

By

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THESIS

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DECLARATION

I, hereby declare that this thesis entitled "Productivity of capital and role of finance in technological changes in agriculture, in Trivandrum district" is a bonafied record of research done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other university or society.

Vellanikkara,
31st December, 1987.

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CERTIFICATE

Certified that this thesis entitled "Productivity of Capital and role of finance in technological changes in agriculture in Trivandrum district" is a record of research work done independently by Sri. Jayan, K., under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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To my parents

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Introduction

INTRODUCTION

During the last two decades, there were rapid transformations in Indian agriculture and this has let to the use of improved farming techniques. Since the improved technology requires the application of costly inputs like high yielding variety seeds, chemical fertilizers, pesticides and assured irrigation conditions, for all of which the farmer has to pay from his pocket, the capital and credit requirements of farmers have increased many fold. In the traditional agriculture on the contrary, all the inputs like manures, bullock power, traditional variety seeds etc. are farm produced and for none of this the farmer is required to pay from his pocket.

The new agricultural technology, according to Panse and Singh (1966) "consists of application of farming techniques developed through research and calculated to bring about diversification and increase of production and greater economic returns to the farmer".

Chadha (1979) has classified the technological change in agriculture into two broad heads. The first involves the use of new biological-chemical innovations such as high yielding variety seeds, chemical fertilizers, pesticides etc. The second involves the use of mechanical innovations like tractors, threshers, harvestors, pumpsets etc. The biological-chemical innovations are generally labour absorbing, land saving and neutral to scale of operation. Mechanical innovations are generally human and bullock labour displacing and biased to scale. More over biological-chemical innovations call for a high dose of working capital, while mechanical innovations need substantial amount of fixed capital. So invariably the adoption of any one or both of these innovations need higher capital investment either in the form of fixed or working capital. This highlights the importance of capital and credit in the adoption of the new farm technology.

Kerala agriculture is distinct from Indian agriculture in many respects. The cropping pattern of Kerala is predominated by perennial-commercial crops. During 1983-'84, 60 per cent of the total cropped area in Kerala was under non-food crops and food crops occupied only 40 per cent of the area. During the same period the corresponding figures for India were 22 per cent and 78 per cent (Farm Guide 1987). Predominance of very small holdings also make Kerala agriculture distinct from Indian agriculture. During 1980-81, athe average holding size in Kerala was 0.43 hectares when compared to 1.82 hectares in India (Farm Guide 1987). Atleast in the case of paddy, which is a seasonal food crop, subsistance farming is of common occurance in Kerala, due to the very small size of holdings and the low profitability of the crop. The very small size of holdings itself is a constraint, which made even a lower degree of mechanization, unsuccessful. (Mechanized farming was found to be successful in many other parts of India.) High labour intensity caused by low degree of mechanization and increased labour charges have reduced the profitability of agri-business and increased the requirement of capital, signifying the importance of external finance in agriculture in the state.

There are a multitude of agencies involved in financing agriculture in the state. The institutional agencies involved are commercial banks, RRBs, Land Development banks, co-operative credit societies and government departments. They extend short, medium and long term loans for different agricultural purposes. Year after year crores and crores of rupees are disbursed as loans for the development of agriculture. Whatever be the type of the loan, the finance provided by these agencies are invariably pumped into the agricultural sector. This study was conducted to assess, how these financing programmes have assisted the farming community to increase, the production, productivity and the adoption of the new farm technology. The specific objectives of the study are as follows:

1) To assess the existing pattern of credit extended to farmers, including institutional and organizational arrangements

2) To study the productivity of capital among farmers under varying size holdings and crop mixes

3) To estimate the credit gap for existing and improved technologies

4) To analyse problems relating to credit supply and use of capital and to suggest remedial measures

The study is presented in six chapters including introduction. In the second chapter a review of relevant literature is given. The third chapter contains a brief description of the study area. In the fourth chapter, the materials and the methods of the study are discussed. The results and discussion are presented in the fifth chapter and the summary of findings are given in the sixth chapter.

Review of Literature

REVIEW OF LITERATURE

This chapter briefly reviews some of the previous studies which are relevant to the present study. The studies are discussed in four sections. Section one contains the studies relating to the capital and credit requirements of farms. Section two reviews the studies relating to the impact of credit on farm income. Studies on optimization of use of capital and other resources are reviewed in section three and the studies relating to production function analysis are reviewed in section four.

2.1 Studies on capital and credit requirements of farms under varying size groups and technological conditions

There are many studies conducted to estimate the demand for capital and credit under varying size groups and technological conditions.

Almost all the studies had indicated, capital deficiency in the farms under study and revealed that capital is the most important constraint that hinder the full exploitation of all the other resources. According to them even under the existing level of technology there exist great potential for increasing income, if adequate capital is made available.

The studies also showed that the most important bottleneck in the popularization of the new farm technology is the lack of sufficient capital and the farmers will be able to bear the risk involved in the switch over from the traditional to the modern technology, only when they are supported with adequate external finance.

Many studies had indicated that the largest credit gap in relation to the existing capital under the existing and new farm technologies was experienced by the small and marginal farmers. So the studies had emphasised the need for giving increased importance for small and marginal farmers in all the institutional credit programmes. A few selected studies are reviewed here.

Quantum and farm of credit needs of farmers in Basti district of U.P. were studied by Bhatia *et al.* (1971) using budgetting technique and they infered that there was an increase of 130 per cent in the credit needs of farmers over the existing level; when optimum cropping pattern was adopted. To change the cropping patterns from the existing to the optimum level with the adoption of new technology, necessitated a higher level of capital use, that is 390 per cent increase over the existing level.

Sharma and Prasad (1971) studied the requirement of production credit at different levels of technology in U.P. state and concluded that the credit need at the improved technology was 195 per cent higher than the credit need at the current technology. This increase was different in various farm size groups, highest (349 per cent) on large farms, followed by the small farms (115 per cent) and least in the case of medium size farms.

Singh and Jha (1971) investigated about the demand for short term credit in farms of Delhi and the study revealed that the inadequacy of capital is a great bottle-neck in the full exploitation of the potential productivity of available resources. The capital scarcity was more acutely felt by the progressive high income farmers, implying that under the current technology the provisions of required amount of credit would enable the high income farmers to reap greater relative increased income as compared to the respective low income farmers.

Studies of Subramanian <u>et al</u>. (1971) had shown that about 78.89 per cent of farmers required credit and on an average 40 per cent of the farm expenses were met by borrowed funds. Total requirement of credit increased with size of farm and the percentage of credit to the total spending was the largest in the case of small farmers.

A study on the credit needs and availability to farmers was conducted by Moorthy et al. (1972) in the Madurai district of Tamil Nadu and they showed that on an average 40 per cent of the farm expenses were met by credit. The total requirement of credit increased with increase in size of the farms. But the percentage of credit to total spending was the largest for the smallest group. Compared on a per acre basis, it was observed that the requirement and supply were the highest for the small farms, creating also the widest gap. The study also showed that the co-operative societies were helping only the large farmers and that the small farmers who require large credit in relation to farm expenses were able to get only the least benefit from the institutional finance. So the problem of providing adequate credit to small farmers deserves adequate and immediate attention.

The empirical findings of the study conducted by Pandey (1972) for assessing the credit needs in Deonia and Varanasi districts of U.P. indicated that even at the current level of technology, there existed a large potential for credit which was expected to be almost double as a result of further technological development in agriculture. The introduction of improved technology without any credit facility had no significant impact on the income of the farmers. Therefore, efforts have to be made to extent credit facilities to harvest the fruits of improved technology.

Subrahamanyam and Patel (1973) studied about the demand for short term credit in West Godavari district of A.P. and they concluded that among the different size groups of farms the small farmers borrowing was to the extent of 33.96 to 201.07 per cent of the available capital as compared to 2.01 to 124.37 per cent by medium farms and 9.11 to 73.05 per cent by large farms. This clearly shows that the credit requirements of small farms were higher and warrants that the small farmers should be given preferential treatment in credit facilities.

Dahia (1975) developed optimum farm plans with existing resources and with borrowed funds under existing and improved technology in Haryana State and worked out the capital requirement for each situation for small, medium and large farms. The results showed that there was an increase of 26.3 per cent, 6.5 per cent and 0.9 per cent in the capital requirement of small, medium and large farms, respectively for the optimum crop plan with the existing level of technology. When the improved agricultural technology was adopted, the capital requirement increased to a higher level i.e.

44.7 per cent, 9 per cent, and 11.8 per cent respectively for small, medium and large farmers over the existing level of capital requirement.

Venkataram (1975) studied about the effects of external finance on farm returns in Mandya district of Karnataka and concluded that the average farmers in Mandya district can not meet their food grain and family expenditure requirement without the support of external finance, whether farmers use existing or new technology crops.

Gangwar and Gakhar (1976) using variable capital programming, estimated the requirements of capital and credit at varying levels, for the optimization of resource use in Haryana. They estimated the requirement of capital for the optimum plan using the existing level of technology as Rs. 309.82 per acre and the credit requirement as Rs. 211.73 per acre. For the optimum plan with the improved technology the capital and credit requirements per acre were worked out as Rs. 608.58 and Rs. 510.29 respectively.

Saini and Sidhu (1976) studied about the impact of improved technology on credit management and farm incomes in Malekotla development block in Sangrur district. They had shown that, with the adoption of the improved technology there was an increase of 191.8, 270.2 and 215.1 per cent on credit needs in small, medium and large farms respectively.

Crop loan requirements of farmers in Hoskote Taluk of Bangalore district was estimated by Murthy et al (1977) for different crops and the cash requirement for paddy cultivation per acre was estimated as Rs. 1,082/- When the recommended package of practices were adopted the cash requirement increased to Rs. 1,275/-per acre.

While studying about the impact of optimal allocation of supervised production credit on different farm size groups in Western U.P., Arora and Prasad (1978) concluded that for the optimum farm production, external credit was essential and the additional credit needs would be the highest on small farms followed by medium and large farms. On the basis of these findings, they have suggested that, more emphasis may be given by the government in its credit policies to small and marginal farmers.

Ray and Maji (1980) estimated the normative demand for borrowing under both traditional and modern technologies on tube well irrigated small farms in West Bengal. The findings indicated a rise in demand for credit on small farms as a result of the introduction of high yielding technology. Given the interest rate, the demand for credit was found to be more than double under modern technology as compared to that under traditional technology. The introduction of new technology in agricultural production, resulted in a less elastic demand for borrowing, implying that the need for credit in modern farming has increased appreciably in recent years.

Singh and Dhillon (1980) estimated the credit gap in the I.R.D.P area of Punjab by developing optimum plans with (1) existing level of technology and (2) improved level of technology. The increase in capital requirement of the second plan over the first was worked out as the credit gap for the adoption of the improved technology and it was 88.62, 64.75 and 54.85 per cent higher, respectively for small, medium and large farmers, indicating that the target groups for all farm financing programmes should be the small and marginal farmers.

Madhavaswamy and Rajamane (1981) studied the short term credit requirements and impact of new technology, in Kurnool district of A.P and they concluded that the total credit requirement at existing and improved technology were the highest for large farms followed by medium and small sized farms.

Kadian and Singh (1983) studied the capital and credit requirement of different sized farms for optimization of agricultural production and concluded that there was demand for agricultural credit on all types of farms, to adopt advanced techniques in agricultural technology. The short term credit requirement at improved level of technology was highest on medium farms due to more intensive crop plan and non availability of adequate capital followed by large and small farms. However, the short term capital requirements at existing level of technology was the highest on large farms followed by medium and small farms.

Reddy (1985) studied about the credit requirement, availability and its adequacy on farms in the Upper Krishna Project command area of Karnataka and unlike many other studies, indicated that the existing short term loans were adequate for small, medium and large farmers. The programming revealed that increase in funds over the existing level did not show any impact on the cropping patterns, borrowings and net farm returns.

2.2 Studies on the impact of credit on farm income

All the studies reviewed; have shown an increase in farm income by the use of borrowed funds, in all size groups of farms. Farm incomes of borrowers were significantly higher than non borrowers. All the studies indicated the importance of financial assistance to farmers for the adoption of improved technology. When the new farm technology was adopted without any additional financial support, the farm income was found to decrease. Appreciable increase in farm income was noticed when the new technology was adopted coupled with sufficient credit support.

A few selected studies are reviewed here.

Mann et al. (1968) estimated the potential of the new agricultural technology in Punjab and their study had shown an increase of 314 per cent in farm income by the adoption of high yielding varieties and by additional borrowing. When the high yielding variety technology alone was adopted without additonal borrowing the income had decreased by 56 per cent over the existing level.

Sirohi and Gangwar (1968) studied about the economic optima in resource allocation in Kanjhawala Block and noticed; 52 per cent increase in returns by the removal of the capital restriction.

While studying about the productive use of credit in the I.A.D.P. district Shahabad, Srivasthava et al. (1970) found that in all size groups of farms the per hectare value of gross output of farmers receiving credit was significantly higher than that of farmers not receiving credit.

Pandey (1972) studied about the credit needs for agriculture in U.P. and he concluded that adequate use of credit increased the farm income substantially even at the prevailing state of technology. A situation of adoption of improved technology without any credit did not increase the incomes of the farms significantly.

But a situation of adoption of improved technology with adequate credit facilities increased the incomes of the farmers at substantial levels.

Dahia (1975) studied about the impact of cash availability on farm income in Haryana using optimization techniques. On an average there was an increase of 30 per cent in net income just by removing the capital constraint under the existing level of technology. Capital borrowing coupled with the adoption of improved technology had shown an increase of 42 per cent in net income.

While studying about the productivity of crop finance in agriculture in the blocks of U.P., Misra (1975) revealed that there was an increase in farm income by 44 to 128 per cent among different crops, by the use of loans from co-operative societies.

Venkataram (1975) studied about the effect of external finance on farm returns in Mandya district of Karnataka and he observed that maximum net returns were obtained when new technology was adopted with additional credit facility. Fifty per cent increase in loan funds over the present level facilitated favourable conditions for the adoption of new technology crops and also provided about 62 per cent increase in net income.

Optimum crop plans developed by Gangwar and Gakhar (1976) for the Palwal block of Gurgaon district of Haryana had shown that by additional borrowing and by the use of optimum crop plan, net farm income could be increased by 232.43 per cent even at the existing level of technology.

Vijayakumar (1976) studied about the impact of credit and technology on the farm incomes in Bangalore South block of Karnataka. He found that farmers could increase net farm returns with re-allocation of resources. He also indicated that the adoption of improved technology coupled with capital, further enhanced the net farm returns.

Arora and Prasad (1978) studied about the impact of supervised production credit on farm income in Western U.P. and found that there was an increase of 20.7, 13 and 10.6 per cent in the net farm returns, over the existing level by additional borrowing and optimum use of the borrowed funds.

Venkateswarulu and Bhalerao (1980) assessed the impact of co-operative finance in Guntur district of A.P. It was observed that crop yields and farm income were more in the case of borrowers than non borrowers.

2.3 Studies on the optimization of use of capital and other resources under existing and improved technologies

All the studies on optimization of resource use indicated an increase in income by the optimum allocation of resources. Even under the existing technology the net income of the farmers were found to increase by the optimum plans. Optimum plans developed with the adoption of improved technology had shown many fold increase in farm income, but the capital requirement also had increased significantly.

Some of the relevant studies are reviewed here.

Ramanna (1966) explored the possibilities of increasing income and employment potential on subsistant and commercially oriented farms in Bangalore district using Linear programming. Programmes were run under existing and improved technologies under limited and unlimited capital situations with recommended practices. The results indicated a substantial potential for increasing income with the use of presently available capital by planning even under currently practised technology. Use of adequate capital in conjunction with improved technology showed even higher potential for increasing the income. There was 25.70 per cent increase in net returns by the optimum allocation of the resources and releasing the capital constraint and 30.86 per cent increase when improved technology also was adopted.

Sadasivan and Rai (1967) prepared a plan for allocation of cultivable land among the different economic crops of Kerala State, subject to a set of four conditions. The results indicated that, overall, by reallocation as recommended, net income would increase by more than 19 per cent. In the optimal programme, the area under paddy, coconut, pepper, cardamom and coffee declined, whereas area under arecanut, tapioca and tea showed significant increase.

Economic optima in resource allocation for the cultivators of Kanjhawala Block was worked out by Sirohi and Gangwar (1968) and they found in their optimal plans that about 52 per cent increase in returns was possible by the removal of the capital restriction.

Singh et al. (1972) developed optimum cropping patterns, considering restrictions of land, human labour, bullock labour and cash, in three regions of U.P. Optimal plans were formulated with limited and unlimited cash and it was compared with the existing cropping patterns. The results clearly demonstrated that under the existing cropping patterns, farm resources were not utilized optimally on the small farms of all the three regions and a change in the cropping pattern would positively enhance the existing farm incomes.

Balasubramanian (1975) developed optimum plans in the garden land farms in Dindigul division of Madurai District, Tamil Nadu, for three farming situations in the area. The optimal plans indicated significant increase in net incomes. The labour utilization also found to increase by the adoption of the optimal plans.

Dhawan and Kahlon (1974) developed optimum plans for small, medium and large holdings, in the central plains of Punjab, indicated marked shift in the production patterns, when compared with the existing ones. Maize-Potato-Wheat-Green gram came out to be the most paying rotation in both the regions of the central plains of the state.

The optimum plans developed by Gangwar and Gakhar (1976) in the Gurgaon district of Haryana, indicated that the resource - capital - was acting as the major limiting factor, for the full utilization of all other resources. They had revealed that the farmers own working capital was inadequate even for the optimum farm plans with the existing level of technology.

Impact of optimum allocation of production credit in different farm size groups of Western U.P. were studied by Arora and Prasad (1978). They concluded that for getting best results from the adoptions of modern technology judicious and efficient use of credit is essential.

In developing optimum plans at existing resource levels for maximizing income and employment in farms in the Annur Block of Coimbatore district, Shanmugam (1979) found that the net returns, with the optimum plans could be increased by 38 per cent on small farms and 21.64 per cent on marginal farms, even by re-organizing the existing resources.

Muthusamy (1982) studied optimization of resource use in garden land farms in Namakkal Block in Salem district of Tamil Nadu. The results of his study showed that the optimum crop plan included only less water consuming crops such as cotton, groundnut and cholam. Tapioca even though an annual crop found a place in the optimum plan since it required less water.

Nagaraja (1982) assessed the impact of credit resource re-allocation and indicated that, farmers could increase net farm returns with re-allocation of existing resources to the extent of Rs. 5,485.92 for small and Rs. 26,594.00 for large farmers over the prevailing income.

The optimum crop plans developed by Jayachandran (1985), with the re-allocation of the existing resources in the Ollukkara development block in Trichur district, Kerala had shown that by re-allocation 52 per cent, 10 per cent, 10 per cent and 9 per cent increase was possible in the four size groups (smallest to the largest, respectively) in the net farm income over the existing income.

2.4 Studies on production function analysis

Usha Rani (1971) tried an exponential function of the following form $Y = A X^b$ where Y (yield per acre) and X (farm size) were dependent and independent variables, respectively. The regression coefficients of the size of farms in 14 out of the 15 cases were negative. When the 't' test was applied to test the significance of the regression coefficient, at 10 per cent level of significance the formulation of the inverse relationship between the yield per acre and the size of farm was found valid.

Bhattacharya and Saini (1972) had tried linear and log linear regressions for 20 villages by taking holding size as independent and value of output per acre of holding size as dependent variables. The results showed the value of the slope coefficient to be negative for most of the villages.

Verma and Pareek (1975) in an attempt to test the difference in resource use efficiency between small and large farmers in the Jaipur district of Rajasthan obtained higher marginal value productivity of land on small farmers as compared to large farmers.

Patel and Patel (1976) tried Cobb-Douglas production function for dry and irrigated wheat in Dholka Taluk (dry region) and Anand Taluk (irrigated region) of Gujarat. The functions explained 71 per cent and 86 per cent of the the variations, respectively. In the dry region fertilizer was found to be the most significant variable followed by seed. In the irrigated region the most significant variable was irrigation and it was followed by fertilizer. The analysis showed decreasing returns to scale in the dry region and increasing returns to scale in the irrigated regions.

Sharma (1977) had tried Cobb-Douglas production function, to understand the role and efficacy of fertilizer input in the pre and post green revolution periods in the selected district of Rajasthan and found high correlation between value productivity and the expenditure on fertilizer and manure. He concluded that even a slight increase in investment in fertilizers and manures would sizeably affect the value productivity.

Saini (1979) had tried Cobb-Douglas production functions on dis-aggregated farm management data from U.P. and Punjab. He concluded the inverse relationship between farm size and productivity as a confirmed phenomenon. He also found that the seene of Indian agriculture is ruled in general by constant returns to scale.

Patel (1982) estimated production functions for the farms in Baroda district of Gujarat. The production functions on per farmer basis for all crops together for irrigated farms for each size group and the aggregate level had indicated the existance of inverse relationship between farm size and gross value of output. For paddy the variable NPK was found to be significant for the irrigated farms in the large size group and at the aggregate level, and irrigated and dry farmers combined in the large size group. When functions were tried for all the crops together NPK was found to be significant in irrigated and dry farms. The variable irrigation was also found to be significant.

Azad <u>et al</u>. (1986) in an attempt to study the maximizations of farm production and income by the optimum use of fertilizers in Achhalda block of Etawah district in U.P. and found that by shifting the funds used for human labour, bullock labour and seed, in levels, the yields can be increased from 16.43, 36.31, 30.05 and 11.85 to 24.55, 47.48, 40.47 and 21.53 quintals per hectare for maize, paddy, wheat and mustard, respectively.

Description of the study area

DESCRIPTION OF THE STUDY AREA

This chapter deals with a brief description of Trivandrum Rural Block which was purposely selected for the study. Trivandrum Rural Block (Vattiyoor Kavu Block) which is located in Trivandrum Taluk of Trivandrum district was selected as the study area.

The block is semi-urban and occupies a geographical area of 4312 hectares The block consists of four panchayats and six revenue villages.

The four panchayats are Chettivilakam, Kadakampally, Ulloor and Vattiyoorkavu and the six villages are Randamada, Anchamada, Kadakampally, Chettivilakam, Ulloor and Cheruvakkal.

3.1 Population

The total population in the block area according to the 1981 census was 1,10,238 of which 55,267 were males and 54,971 females. The density of population was 2,564 persons per square kilometre. There were 20,766 families.

3.2 Occupational distribution of the population

Of the total population of 1,10,238, 22 per cent were workers. The highest percentage of workers came under the other services category i.e. 34.76 per cent.

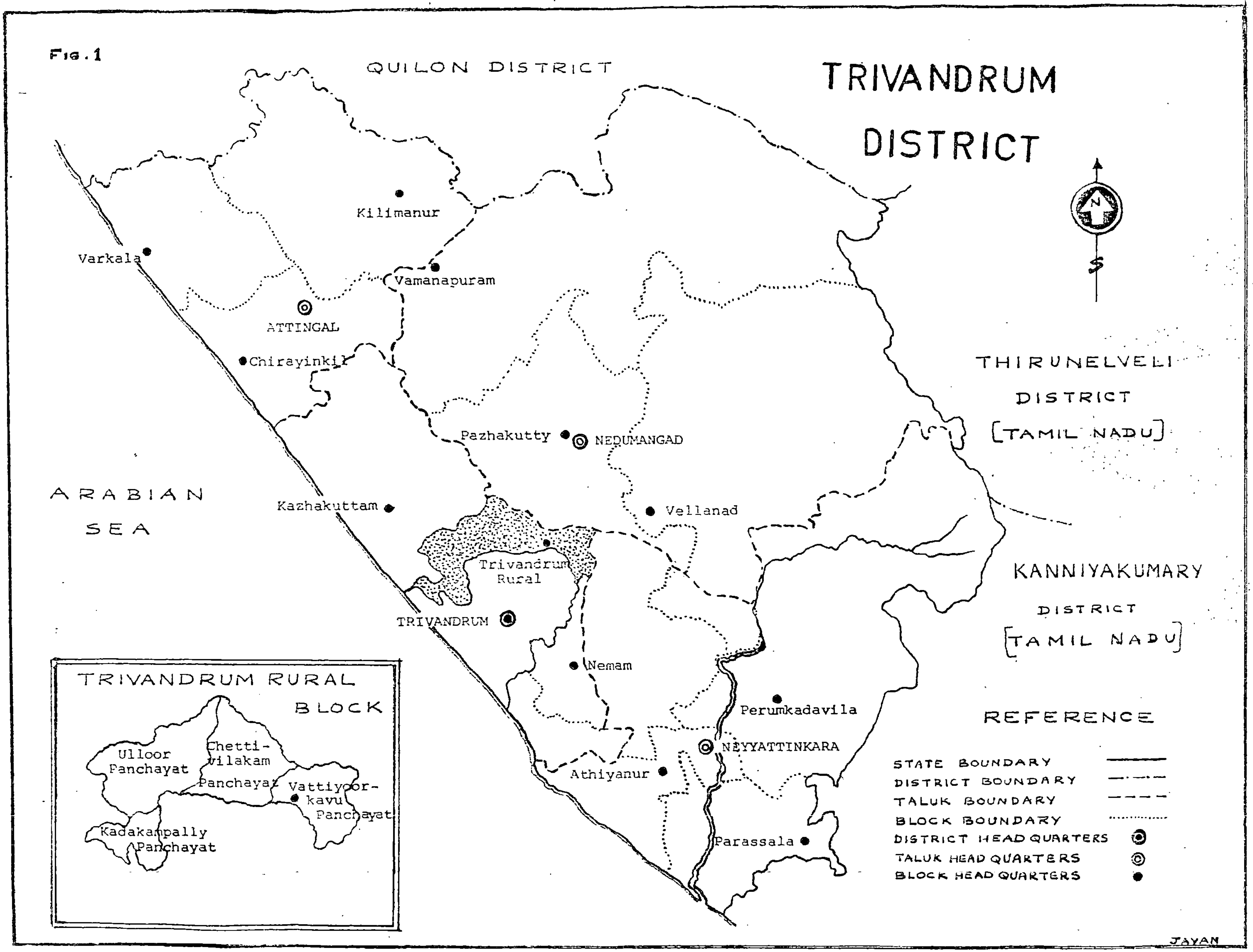
26.24 per cent of workers were employed in the agricultural sector as agricultural labourers. Industries other than household industries accommodated 10.66 per cent of the workers. The details of the occupational distribution of the population in the block are given in the Table 3.1.

Table 3.1 Occupational distribution of the workers in Trivandrum Rural Block (as per the 1981 census)

Category	No. of persons	Percentage to total
Cultivators	1,389	5.69
Agricultural labourers	6,399	26.24
Activities allied to agriculture	404	1.67
Mining and quarrying	280	1.15
House hold industries	516	2.12
Industries other than house hold industries	2,599	10.66
Construction workers	993	4.07
Trade and commerce	1,996	8.19
Transport, storage and communication	1,330	5.46
Other services	8,476	34.75
Total	24,382	100.00

Source: Block Development Office, Trivandrum Rural Block.

Fig. 1



TRIVANDRUM DISTRICT
QUILON DISTRICT
THIRUNELVELI DISTRICT [TAMIL NADU]
KANNIYAKUMARY DISTRICT [TAMIL NADU]
ARABIAN SEA
N
S
Kilimanur
Varkala
Vamanapuram
ATTINGAL
Chirayinkil
Pazhakutty
NEDUMANGAD
Kazhakuttam
Vellanad
Trivandrum Rural
TRIVANDRUM
Nemam
Perumkadavila
NEYYATTINKARA
Athiyanur
Parassala
TRIVANDRUM RURAL BLOCK
Ulloor Panchayat
Chetti-vilakam Panchayat
Vattiyoor-kavu Panchayat
Kadakampally Panchayat
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
TALUK BOUNDARY
BLOCK BOUNDARY
DISTRICT HEAD QUARTERS
TALUK HEAD QUARTERS
BLOCK HEAD QUARTERS
JAYAN

3.3 Land holding pattern

In the block area there were 6,875 holdings and of that about 88 per cent had less than one hectare area. Ten per cent of the holdings were having size between one hectare and 2.5 hectares. Only 1.6 per cent of the total holdings had an area above 2.5 hectares. Details of the land holding pattern of the block area are given in the Table 3.2.

Table 3.2 Land holding pattern of Trivandrum Rural Block (1984-'85)

Size of holding	Number	Percentage to total
Less than 1 hectare	6,020	87.7
1 to 2.5 hectares	710	10.2
2.5 to 5 hectares	110	1.6
5 to 10 hectares	30	0.4
Above 10 hectares	5	0.1
Total	6,875	100.0

Source: Block Development Office, Trivandrum Rural Block

3.4 Cropping pattern

Major crops grown in the block area were coconut, rice, tapioca and banana. Other than these some area was put under vegetables, pulses and miscellaneous tree crops. More than 38 per cent of the gross cropped area was under paddy. Coconut occupied more than 28 per cent, 18 per cent was occupied by tapioca and seven per cent by banana. Other crops occupied only six per cent of the gross cropped area. Cropping pattern of the area is given in the Table 3.3 below:

Table 3.3 Cropping pattern in Trivandrum Rural Block (1984-'85)

Crop	Gross area (hectares)	Percentage to total
Paddy	1,832	38.3
Coconut	1,360	28.4
Tapioca	860	18.0
Banana	340	7.1
Pulses	182	3.8
Vegetables	123	2.6
Other crops	85	1.8
Total	4,782	100.0

Source: Compiled from the Agricultural Development Offices in Mannanthala and Oruvathilkotta

Net area under irrigation was 1,900 hectares and the modes of irrigation were ponds, tanks and springs. There were no canals or tube wells.

Two Agricultural Development/Extension Offices were operating in the block area, one at Mannanthala and the other at Oruvathilkotta. The Central Tuber Crops Research Institute (CTCRI) also is located in this block area.

There are nine commercial bank branches and 13 organized Primary Agricultural Credit Socities in the Block area. Twelve fertilizer selling outlets are functioning in the block area and of which four are in the co-operative sector and eight owned by individuals. No regulated markets are functioning in the block area but there are eight unregulated markets. There are 31 schools in the block area.

Materials and Methods

MATERIALS AND METHODS

This chapter consists of five sections. Section one contains the general procedure adopted for the study. Sections two and three contain the sampling procedure and the methods followed for the collection of data. Section four deals with a brief description of the selected sample and section five describes the procedure of analysis of the data.

4.1 General procedure of the study

The study was conducted in two parts. The first part consisted of a macro level study by which the details regarding the institutional credit arrangements in the selected block area were reviewed. The agencies involved, the norms and conditions by which the credit was extended, the criteria followed, the magnitude of credit extended and the problems associated with it from the creditors and debtors point of view were assessed. This was achieved by visiting all the institutional credit agencies operating in the selected block area and collecting the necessary information by personal interview method.

The district level details were collected from the lead bank of the district, that is, Indian Overseas Bank.

The second part of the study consisted of two random samples of equal size, the first sample being that of farmers who are the beneficiaries of the institutional credit facilities and the second sample being that on Non-Beneficiaries.

4.2 Sampling procedure

Multistage random sampling technique was used for the selection of samples. Trivandrum Rural Block was purposely selected for the study. The block area consisted of four panchayats from which two panchayats were selected at random. The selected panchayats were Chettivilakom and Ulloor. From each selected panchayat two wards were selected at random. The selected wards were Chettivilakom two and five and Ulloor one and four.

The reference period for the study was the agricultural year 1985-'86.

4.2.1 Selection of the sample of beneficiaries

A sampling frame was prepared by listing out all the beneficiaries who have availed agricultural loans from any of the institutional lending agencies operating in the selected area, during five years prior to the reference period. From the four wards selected at random nine samples each were selected at random to form 36 number of farmers in the Beneficiary category.

4.2.2 Selection of the sample of Non-Beneficiaries

From the panchayat and village records, ward wise list of cultivators in the selected areas having holding size of 50 cents (0.20 hectare) and above was prepared. From each of the selected wards, nine farms were selected at random to form a sample of 36 in the Non-Beneficiary category. Proper substitutions were made for farmers who were found (during the survey) to have availed credit facility for agricultural purposes from any of the institutional agencies.

4.3 Collection of data

Collection of data was done by personal interview method, using a well structured interview schedule. Main items of observation were, the use of inputs and the generation of output, farm and non farm incomes, kind and quantum of capital assistance received if any, problems faced by the farmers in general and in particular in getting assistance from the institutional financing agencies. The schedule used for collecting data is given in Appendix-I.

4.4 Description of the selected sample

From the 36 farms in the beneficiary category one farm was rejected because, the farmer was found to have diverted the whole amount for his personal purpose. In the non-beneficiary category also one farm was rejected because of sub-division of the holding and change in the operationalship. Since equal numbers of samples were obtained in the two categories, even after rejection, no attempt was made for substitution. The remaining seventy farms (35 each in the two categories) formed the ultimate sample.

4.4.1 Land holding pattern

According to the size of holding the holdings selected were grouped into three categories viz. 0.5 to 1.25 acres, 1.25 to 2.5 acres and above 2.5 acres.

Of the 35 farms in the beneficiary category 15 farms were in the first size group, 10 farms were in the second size group and the remaining 10 were in the third size group. In the non-beneficiary category the distribution of the sample holdings were 17, 10 and 8 in the first, second and third size groups, respectively. In the aggregate the beneficiaries held 68.60 acres of area compared to 60.61 acres in the non-beneficiary category. In the beneficiary category 15.80 acres (23.03 per cent) was under the first size group 19.70 acres (28.72 per cent) was under the second size group and 33.10 acres (48.25 per cent) was under the third size group. The corresponding size groups in the

Table 4.1 Distribution of holding size among the different size groups of sample farmers in the beneficiary and non-beneficiary category

Size group	Number of farmers under each size group		Total area sampled (acres)		Average size of holding (acres)	
	Beneficiary category	Non-beneficiary category	Beneficiary category	Non-beneficiary category	Beneficiary category	Non-beneficiary category
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0.5 to 1.25 acres	15	17	15.80 (23.03)	14.08 (23.23)	1.05	0.83
1.25 to 2.5 acres	10	10	19.70 (28.72)	18.33 (30.24)	1.97	1.83
Above 2.5	10	8	33.10 (48.25)	28.20 (46.53)	3.31	4.14
Total	35	35	68.60 (100)	60.61 (100)	1.96	1.73

1 acre = 0.4 hectares

Figures in parentheses indicate percentage to total non-beneficiary category held 14.08 acres (23.23 per cent), 18.33 acres (30.24 per cent) and 28.20 acres (46.53 per cent), respectively. The average holding sizes were 1.96 acres and 1.73 acres in the beneficiary and non-beneficiary categories, respectively. Size group wise the average holding sizes were 1.05 acres, 1.97 acres and 3.31 acres in the beneficiary category and 0.83 acres, 1.83 acres and 4.14 acres in the non-beneficiary category, respectively, for the first, second and third size groups. The details of the distribution of holding size among the different size groups of sample farms are given in Table 4.1.

4.4.2 Cropping pattern

Paddy, coconut, tapioca and banana were the major crops grown in the sample holdings. Of these coconut was the most important crop in the sampled area occupying the highest percentage of the gross cropped area and it was followed by paddy.

Of the gross cropped area of 79.69 acres in the beneficiary category 34.08 acres (42.77 per cent) was under coconut, 31.58 acres (39.63 per cent) was under paddy, 6.53 acres (8.19 per cent) was under tapioca, 6.04 acres (7.58 per cent) was under banana and 1.46 acres (1.83 per cent) was under other crops such as vegetables, pulses, other tuber crops and miscellaneous tree crops. The details of the cropping pattern are given in Table 4.2.

In the non-beneficiary category the gross cropped area was 64.80 acres. Coconut occupied the maximum percentage of area. Area under coconut was 34.12 acres (52.65 per cent), that under paddy was 22.39 acres (34.55 per cent). Tapioca occupied 3.57 acres (5.51 per cent) and banana occupied 3.55 acres (5.48 per cent). Other crops occupied an area of 1.17 acres sharing 1.81 per cent of the gross corpped area.

In the beneficiary category, of the total area of 31.58 acres of paddy 23.38 acres (74 per cent) were cultivated with high yielding varieties, while in the non-beneficiary category only 8.96 acres (40 per cent) out of 22.39 acres were put under high yielding varieties.

Among the four principal crops, banana is a high income crop which require heavy investment of capital. The percentage of the area under banana to the net cultivated area was 9.34 per cent in the beneficiary category and 6.09 per cent in the non-beneficiary category.

Table 4.2 Cropping pattern in the sample farms

Crops	Area under each crop in acres	
	Beneficiary category	Non-Beneficiary category
(1)	(2)	(3)
Paddy		
1. Virippu	16.56 (20.78)	12.30 (18.98)
2. Mundakan	15.02 (18.85)	10.09 (15.33)
Total	31.58 (39.63)	22.39 (34.55)
Coconut	34.08 (42.77)	34.12 (52.65)
Tapioca	6.53 (8.19)	3.57 (5.51)
Banana	6.04 (7.58)	3.55 (5.48)
Other crops	1.46 (1.83)	1.17 (1.81)
Total (Gross cultivated area)	79.69 (100.00)	64.80 (100.00)
Total area	68.60	60.61
Area put under non agricultural purposes	3.93	5.90
Net area	64.67	54.71
Cropping intensity (%)	123.23	118.44

Figures in parentheses indicate percentage to total

4.4.3 Details of capital assistance received by the beneficiary farmers

The loans received by the beneficiary farmers were categorised into three groups viz. (1) crop loans (2) irrigation loans (medium term loans) and (3) loans for land development (long term loans). The details are given in Table 4.3 below.

Table 4.3 Type and quantum of capital assistance received by the beneficiary farmers

Sl. No.	Purpose	Number of accounts	Amount (Rs.)
1.	Crop loans (including loans for whole farm development)	13 (32.50)	35,500 (14.64)
2.	Irrigation loans (medium term loans)	17 (42.50)	1,21,000 (49.90)
3.	Loans for land development (long term loans)	10 (25.00)	86,000 (35.46)
	Total	40 (100.00)	2,42,500 (100.00)

Figures in parentheses indicate percentage to total

The 35 beneficiaries sampled had availed loans from different institutional agencies in 40 accounts. That is, a few of the beneficiaries have taken loans for more than one purpose, in the five year period.

Of the 40 loan accounts 17 (42.5 per cent) were extended for irrigation purpose, 13 (32.5 per cent) were extended as crop loans and 10 (25 per cent) were extended as land development loans including loans for soil conservation.

Of the total amount availed by the beneficiaries (Rs. 2,42,500), 49.9 per cent (Rs. 1,21,000) were for irrigation, 35.46 per cent (Rs. 86,000) were for land development and 14.64 per cent (Rs. 35,500) were crop loans. With regard to the number as well as quantum of assistance received by the beneficiaries, the highest percentage was the loans for irrigation purposes. With respect to the number of accounts the second position goes to crop loans and with respect to the amount of loans the second position goes to the loans for land development.

Of the 13 accounts of crop loans one each were for tapioca and banana. Four accounts were for coconut and seven accounts were for loans for whole farm development.

The non-beneficiary farmers have mentioned different reasons for not availing any loans from the institutional agencies. One of them was ignorent about the credit facilities available to them. Six of them told that they do not need any credit. Twenty one of the farmers have mentioned the lengthy procedures involved, as the reason. Seven of the farmers have told that they do not want to get indebted because of the fear. of the legal procedures.

4.5 Methods of analysis

Multiple regression analysis (production function analysis) and linear programming were the general analytical tools used for the analysis of data for this study besides tabulated ratios, percentages and the students 't' test for comparing the means.

4.5.1 Multiple regression analysis (production function analysis)

To find out the productivity of inputs and to determine the most productive form of capital which is used up in the production process in various forms, multiple regression analysis has been used.

Linear and Cobb-Douglas forms of production functions were tried for the purpose.

The model

Linear production function

$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5$$

Cobb-Douglas (long linear) production function

$$\text{Log } Y = \log b_0 + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5$$

The following were the variables used in the multiple regression analysis:

A. Independent variables

1. Farm size (x_1) : Holding size expressed in acres

2. Human labour (x_2) : Human labour used per acre for the crop expressed in mandays

(During the survey it was found that in the sample farms, human labour was mainly consisted of hired labour. Family labour was present only in the smaller farms and there also only the adult members of the family contributed for the family labour. Since the quantity of family labour employed was very much limited no attempt was made to separate family and hired labour. Whereever family labour was present, it was accounted giving value equal to that of hired labour.

Standardisation of female and male labour was done by converting the femalelabour into male labour in proportion to the ratio between their wage rates)

3. Fertilizer (x_3) : Quantity of fertilizer used per acre for the crop expressed in kilograms of NPK nutrients

(Since the types of fertilizers used by the farmers were highly different - they were found using straight, complex and mixed fertilizers - the marginal cost (MC) of fertilizer was worked out for each crop separately, as the cost of straight fertilizers required to supply one kilogram of N + P + K nutrients. The proportion of the NPK nutrients used for this were 2 : 1 : 1 for paddy, 2 : 1 : 4 for coconut, 1 : 1 : 1 for tapioca and 1.65 : 1 : 2.61 for banana as per the package of practice recommendations for fertilizers for the above crops by Kerala Agricultural University)

4. Cost of irrigation (x_4) : Cost of irrigation for the crop expressed in rupees per acre

5. Other capital (x_5) : Includes the cost of organic manures and cost of plant protection (expressed in rupees per acre).

B. Dependent variable

Value of output (Y) : Value of output for each crop expressed in rupees per acre

b_0, b_1, b_2, b_3, b_4 and b_5 were constants

4.5.2 Linear programming analysis

One of the specific objectives of the study was to find out the credit gap for the adoption of improved technology in the farms under study. The aim was to develop optimum farm plans under the existing and improved technological conditions and to work out the capital requirement under the two situations.

Linear programming of the following form was used as a tool to develop the optimum plans in the farms under study.

Maximize

$$Z_0 = \sum_{i=i}^{n} Ci\, Xi$$

Subject to

$$\sum_{i=i}^{n} Aij\, Xi \qquad Bj$$

$$Xi \qquad 0$$

Where

Z_0 = Net farm income (returns to fixed farm resources) to be maximized

Ci = Net returns from the ith activity

Xi = The level of the ith activity

Bj = Availability of the jth resource

Aij = Quantity of the Bj input required per unit of activity (input coefficient)

Optimum plans were developed under different size groups and technological conditions for both beneficiary and non-beneficiary categories. The capital requirement for optimum plans under existing and improved levels of technology were worked out for both the groups under different size categories. The additional dose of capital required for the adoption of the improved agricultural technology was also worked out by L.P. technique.

Representative farms were identified, one each from the three size groups and the combined set in the beneficiary and non-beneficiary categories. For the selection of the representative farms, the garden land and wet land area of each farm in each size group were listed and from that list, modal sized farms were selected. From the modal sized farms selected, representative farms were identified after examining the resource position in each of the modal sizes farms so that the representative farms identified, truly represents the farms in that size group. The optimum crop plans were developed for the representative farms refered hereafter as model farms.

Resource restriction levels were fixed based on the resource availability in each of these model farms. Net margins for all the crops except coconut were worked out as average net income per acre. For coconut which is a perennial crop, average annual net present worth was worked out for each size category and this was taken as the net margin for coconut. The economic life period of coconut, for finding out the net present worth was taken as 40 years.

The input coefficients for each activity were worked out as the average level of input use per acre for each crop activity in each size category.

4.5.2.1 Selections of activities and constraints

Four crops which almost completely dominated the cropping pattern of the area, were selected as the activities whose levels were to be optimized. These crops were rice, coconut, tapioca and banana. In the study area summer crop of rice was very rare and so two cropping seasons only were taken into consideration for rice crop.

The programming was done for a period of one year. Rice being a seasonal crop, the two main crop seasons viz. first crop season i.e. the south-west monsoon season starting from May-June to September-October, and the second crop season i.e. the north-east monsoon season starting from October-November to December-January, were taken into account for the programming. Tapioca and banana being annual crops, no further adjustments were necessary. For coconut, which is a perennial crop there was some problem. In programming all the activities included, should contribute to the income and so only the yielding palms could be taken into account. For the calculation of input coefficients, the cost of maintenance for the yielding palms alone was considered. As stated earlier, average annual net present worth was worked out and this was used as net margins for coconut.

The following constraints were identified as limiting factors for the optimization:

1) Land: Two types of land were identified in the study area. The first was wet land suitable for rice, banana and tapioca and the second was garden land suitable for coconut, banana and tapioca. So the constraint was divided into three:

a) Wet land

b) Garden land

c) Total land

Area under each crop was accounted for pure crops such as rice, banana and tapioca. Coconut could be specified only by number and not by area and so the number of yielding trees was taken and then it was converted into area as per the broad guide lines recommended for the spacing of coconut by the Kerala Agricultural University.

2) Human labour: Labour use and availability were different in the two agricultural seasons and so the constraint was split up into two.

a) Human labour - in the first crop season

b) Human labour - in the second crop season

Family labour was accounted giving value equal to that of hired labour. Labour utilization in the model farms were taken as the restriction levels. Standardization of female labour was done by converting it to male labour in proportion to the ratio between the wage rates.

3) Bullock labour: This constraint was used only for paddy crop because for the cultivation of other crops, bullock labour was not used. The utilization of bullock labour in the model farms were taken as the restriction levels.

Like human labour this constraint was also split up into two:

a) Bullock labour - in the first crop season

b) Bullock lebour - in the second crop season

4) Irrigation: This constraint comes only for coconut and banana, since paddy and tapioca were taken purely as rainfed crops. The input coefficients of irrigation were worked out as the mean number of hours of irrigation used per acre in each size group. The number of hours of irrigation used per acre multiplied by the number of acres of land that can be irrigated by the existing irrigation sources in the model farms were taken as the restriction levels.

5) Working capital: This was the most important of all the constraints. Levels of use of all other inputs are determined by the availability of the working capital input. The amount of working capital used in the model farms for the four crop activities during the reference period was taken as the restriction level.

Definition of terms

1) Beneficiary farmers: Farmers those who have availed agricultural loans (short, medium or long term loans) from any of the institutional lending agencies during five years prior to the reference period.

2) Non-beneficiary farmers: Farmers who have not availed any credit facility related to agriculture from any of the institutional financing agencies.

3) Input coefficients: Indicate the quantum of each variable input used up in the production process of a unit of each crop activity. This was worked out as the average use of the variable input per unit area of the crop activity.

4) Net margins: Indicate the net returns obtained for each crop activity over the variable costs. This was worked out as average net return per unit area over the variable costs for each crop activity.

5) Average annual net present worth: Average annual net present worth was calculated using the following formula:

$$\text{A.A.N.P.W.} = \frac{\text{N.P.W.}}{\text{Annuity factor for the discount factor } r \text{ for } n \text{ years}}$$

$$\text{N.P.W.} = \sum_{i=1}^{n} \frac{R_i - C_i}{(1 + r)^i}$$

Where n = Economic life period

C_i = Gross cost for the i^{th} year

R_i = Gross return for the i^{th} year

r = Discount rate

The economic life period for coconut was taken as 40 years (Jayachandran, 1985) and the discount rate used was 12.5 per cent which is the interest rate at which credit is available as long term loans.

Results and Discussion

RESULTS AND DISCUSSION

This chapter consists of five sections. Section one deals with a brief analysis of the present system of financing agriculture in the study area. Section two discribes the input use and the generation of output in the selected holdings. Section three consists of the results and discussions of production function analysis. Section four comprises of the results and discussions of the linear programming analysis and sections five consolidates the problems faced by the debtors and the lending institutions with respect to the institutional financing programme in agriculture, in the study area. The suggestions and recommendation are also included in this section.

5.1 Present system of institutional finance for agriculture in Trivandrum district

The institutional net work for financing agriculture in Trivandrum district comprises of 275 branches of commercial banks, 34 branches of co-operative banks, 102 co-operative societies and the offices of the State Department of Agriculture. During the year 1985 the commercial and the co-operative banks together had disbursed an amount of Rs. 3,830.77* lakhs for agriculture and allied activities in Trivandrum district.

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* Source: Trivandrum district Annual Action Plan (A.A.P.) 1987, Published by the Indian Overseas Bank

Depending on the duration of the loan, the loans for agricultural purposes are grouped into three, viz. short term loans, medium term loans and long term loans.

a) Short term loans (crop loans)

Extended generally for a maximum period of 18 months, to meet the cultivation expenses like purchase of quality seeds, fertilizers and pesticides, for the cultivation of paddy, banana, tapioca, coconut (maintenance expenditure) oil seeds, vegetables and pulses.

b) Medium term loans

Extended for a period of three to seven years. This includes loans for minor irrigation, loans for the purchase of farm implements, equipments and plough animals. In addition medium term loans are also advanced to activities allied to agriculture such as dairy, poultry, fishery, goat rearing, piggery, beekeeping and loans for bio-gas development programme.

c) Long term loans

Extended for a period of seven to 14 years, for the purposeslike land development and land reclamation, land levelling and soil conservation and loans for new plantations. Purpose wise the loans extended for agriculture and allied activities can be grouped into ten categories.

(1) Crop loans: These are short term loans extended to meet the cultivation expenses

(2) Irrigation loans: Loans extended for digging of wells and valkulams (special type of tanks used for irrigating betal vine), rennovation or repair of wells and valkulams, installation of pumpsets and construction of pump houses etc. have been included under irrigation loans

(3) Loans for farm equipments: Loans extended for the purchase of plough animals, tractors, bullock-carts and other agricultural implements have been grouped under this category

(4) Loans for land development: Loans extended for land levelling, bunding, soil conservation and land reclamation have been included under this group.

(5) Plantation loans: Loans extended for starting new plantations. In Trivandrum district plantation loans are extended for rubber, coconut and betal vine. Loans for rubber development schemes of the Rubber Board and Coconut rehabilitation schemes of

the Special Agricultural Development Unit (SADU) implemented in the district also come under this group

(6) Loans for other investments on farms: Includes loans for, construction of farm house, godowns and loan for storage bins and nurseries

(7) Loans for dairying: Loans for milch animals, calf rearing, goat rearing, construction of cattle shed etc.

(8) Loans for fisheries: Loans for the purchase of fishing equipments

(9) Loans for bio-gas programme: The finance provided for the constructions of bio-gas plants

(10) Loans for other allied activities: This includes the loans extended for rabbit rearing, poultry, bee-keeping, duckery etc. The activity wise disbursement of loans for agriculture and allied activities in Trivandrum district is given in Appendix II.

5.1.1 Eligibility criteria and security norms

Loan schemes are available in all the commercial banks for financing activities in agriculture and allied sectors. Up to Rs. 5,000/- agricultural loans will be extended on personal guarantee and crop hypothecation. Up to Rs. 10,000/- (and above Rs. 5,000/-) loans will be extended on personal guarantee, crop hypothecation and with one or two guarantors. Above Rs. 10,000/- loans will be extended on personal guarantee and equitable mortgage on landed property.

5.1.2 Repayment schedule

Agricultural short term loans should be repayed as a single instalment within the expiry of the loan period. Medium term loans can be repayed within seven years of loan sanction and the instalments can be fixed as monthly, bimonthly, quarterly, half yearly or yearly. For agricultural long-term loans, depending on the gestation period of the investment, repayment holidays will be given. After the repayment holiday the loans should be repayed in instalments. Usually equal instalments will be fixed for medium and long-term loans.

Since the introduction of the lead bank scheme(1969), which envisaged the improvement of economic conditions by adopting 'area approach' to development, through extension of timely and sufficient credit, infrastructure and extension facilities jointly by financing institutions, district administration and service organizations; it was an integral part of the scheme to formulate district credit plan, jointly by financing institutions and district adminstration.

5.1.3 District credit plan and annual action plan

District credit plan includes those programmes or schemes taken up by banks on their own; without governmental assistance, by way of subsidies, as well as those for providing institutional credit support for programmes eligible for government subsidies under the 20 point economic programme, Integrated Rural Development Programme, Self Employment Programme of the state government, margin money scheme of the Kerala State Development Corporation for scheduled castes and scheduled tribes etc. It will contain all the bankable ongoing and new programmes.

The district credit plan is prepared for a period of two or three years and for each year a separate Annual Action Plan (A.A.P.), also is prepared. The responsibility of preparing the district credit plan and annual action plan is left with the lead bank of the district.

5.1.4 Preparation of the District Credit Plan

Credit outlays for various schemes are worked out on the basis of the credit needs assessed for each community development block. The plan outlay will be worked out by aggregating the credit outlays of all the development blocks. The Annual Action Plan for 1986 assessed the total credit need for agriculture in Trivandrum district as Rs. 3,742.20 lakhs*. This is the aggregated figure of the credit needs for the twelve development blocks in the district.

The credit needs for all the programmes are estimated by taking into account the existing and anticipated improvements in the capacity of the financing institutions to undertake the tasks as well as the adequacy or otherwise of the supporting arrangements for the implementation of the programme.

Assessment of credit demand will be made by detailed discussions with the block development officers of each block, financial institutions, Government departments and other agencies. Credit outlays will be worked out on the basis of number of units of each programme for each block with the respective scale of finance.

5.1.5 Scale of finance

Scale of finance for each crop or activity for each district will be prepared by the District Co-operative banks. This will be approved by the

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* Source: Trivandrum district A.A.P. for 1986

district credit council with modifications if any. Each year the scale of finance will be revised. The scale of finance adopted for different financing activities in agriculture and allied sectors for Trivandrum district for the year 1986 are given in Appendix III.

5.2 Analysis of input use and generation of output in the sample holdings

The average levels of input used and output generated were analysed crop wise and category wise in the sample farms. The major inputs taken for this analysis were (i) human labour expressed in mandays, (ii) fertilizer expressed in kilograms of N.P.K. nutrients (iii) cost of irrigation and (iv) other capital expressed in rupees. The average quantities of inputs used per acre and the average values of output generated per acre were used for comparison between the two categories of farms. The student's 't' test was conducted to test the difference between the means of the beneficiary and non-beneficiary categories. The results are discussed crop wise

5.2.1 Paddy

5.2.1.1 Human labour

The average levels of 'Labour' input used per acre for paddy are given in Tables 5.1, 5.6 and 5.7. In the

In the beneficiary category the average use of 'Fertilizer' was 50.44 kg per acre of N.P.K. nutrients and that in the non-beneficiary category was only 37.10 kg per acre. The quantity used in the beneficiary category was significantly higher than that in the non-beneficiary category; the 't' value was significant at one per cent level. The average use of 'Fertilizer' was 43.87 kg per acre for the whole sample.

Size group wise in the beneficiary category the quantities of N.P.K. nutrients used for paddy were 58.63, 44.44 and 47.53 kilograms for the first, second and third size groups, respectively. The corresponding figures for the non-beneficiary category were 40.47, 36.47 and 31.98, respectively.

Just as in the case of human labour the quantity of 'Fertilizer' was also found to be significantly higher in the case of beneficiary farmers. Size group wise also, the farms in the beneficiary category were found to use more quantity of fertilizer than those in the non-beneficiary category.

5.2.1.3 Other capital

The use of other capital in the selected farms are given in Tables 5.4, 5.11 and 5.12. In the beneficiary category the average use of 'Other capital' per acre was Rs. 1,234.86 and that in the non-beneficiary category was Rs. 1,216.56. There is no significant difference between the utilization of 'Other capital' in the beneficiary and non-beneficiary categories. For the entire sample the mean use of 'Other capital' was Rs. 1,225.85 per acre

Size group wise the average use of 'Other capital' per acre for paddy for the beneficiary category were Rs. 1,300.23, Rs. 1,239.32 and Rs. 1,141.78 in the first, second and third size groups, respectively and in the non-beneficiary category the corresponding figures were Rs. 1,180.29, Rs. 1,223.06 and Rs. 1,271.90, respectively.

There was no significant difference between the amounts of 'Other capital' used in the categories.

The farms in the beneficiary category were found to utilize significantly higher quantities of all the inputs considered except 'Other capital' compared with the farms in the non-beneficiary category. The use of 'Other capital' for paddy which comprised of the expenditures on organic manures and plant protection; was not significantly different between the two categories.

5.2.1.4 Values of output

Tables 5.5, 5.13 and 5.14 gives the means of the value of output for paddy crop. The average value of output in the beneficiary category (Rs. 3,473.12) was found to be significantly higher than that in the non-beneficiary category (Rs. 2,803.38). The 't' value was significant at one per cent level. The mean value of output was Rs. 3,143.40 per acre in the whole sample.

The means of the value of output for paddy were Rs.3,938.58, Rs. 3,242.58 and Rs. 3,159.89 in the first, second and third size groups in the beneficiary category and Rs. 2,902.64, Rs. 2,653.50 and Rs. 2,817.00 for the first, second and third size groups in the non-beneficiary category, respectively.

The values of output for paddy were significantly higher in the beneficiary category.

5.2.2 Coconut

5.2.2.1 Human labour

The average quantities of 'Human labour' used for coconut in the selected farms are given in Tables 5.1, 5.6 and 5.7. The average use per acre of 'Labour' was 43.39 mandays in the beneficiary and 40.76 mandays in the non-beneficiary categories. The average labour use in the beneficiary category was significantly higher and the 't' value was significant at 10 per cent level. For the whole sample the average use of labour for coconut was 42.07 mandays.

In the beneficiary category the average labour use were 42.16, 44.75 and 43.61 mandays in the first, second and third size groups, respectively and the corresponding figures in the non-beneficiary category were 39.56, 41.04 and 42.95, respectively.

Average labour use for coconut was found to be significantly higher in the beneficiary category. All the three size groups of the beneficiary category also showed higher average labour use than those in the non-beneficiary category.

5.2.2.2 Fertilizer

The Tables 5.2, 5.8 and 5.9 gives the average of the quantity of fertilizer used in the selected farms.

The quantity of fertilizers used in the beneficiary category (90.07 kg per acre) was significantly higher than that used in the non-beneficiary category (47.93 kg per acre) and the 't' value was significant at one per cent level. On an average 68.83 kg per acre of N.P.K. nutrients were used in the sample farms as a whole for coconut. The mean nutrient use were 87.07, 89.35 and 95.07 kg per acre in the first, second and third size groups; respectively in the beneficiary category. The non-beneficiary category farms used 54.41, 40.90 and 41.41 kg nutrients per acre in the first, second and third size groups, respectively.

The farms in the beneficiary category used significantly higher quantities of 'Fertilizer' for coconut than those in the non-beneficiary category. All the three size groups also showed higher fertilizer use in the beneficiary category.

5.2.2.3 Cost of irrigation

This input comes only in the beneficiary category of farms and on an average the farms spent Rs. 124.66 for irrigation. Size group wise the average amount spent for irrigation were Rs. 108.48, Rs. 158.81 and Rs. 109.73 respectively in the first, second and third size groups (Table 5.10).

5.2.2.4 Other capital

Tables 5.4, 5.11 and 5.12 gives the mean value of the amounts spent as 'Other capital' for coconut in the sample farms. In the beneficiary category the mean amount spent as 'Other capital' was Rs. 813.67 and that in the non-beneficiary category was Rs. 457.64. The amount spent as 'Other capital' in the beneficiary category (Rs. 813.67) was significantly higher than that in the non-beneficiary category (Rs. 457.64) and the 't' value was significant at one per cent level. The average amount spent as 'Other capital' for the sample as a whole was Rs. 635.65.

Rupees 847.39, Rs. 844.31 and Rs. 732.77 were spent as 'Other capital' in the first, second and third size groups respectively in the beneficiary category and the corresponding figures in the non-beneficiary category were 435.17, 418.30 and 554.55, respectively.

The levels of all the inputs considered for coconut were found to be significantly higher in the beneficiary category than in the non-beneficiary category.

5.2.2.5 Value of output

The Tables 5.5, 5.13 and 5.14 give the values of output for coconut in the sample farms.

In the beneficiary category the mean value of the output was Rs. 4,857.49 and in the non-beneficiary category it was Rs. 2,874.47. The value of output for coconut was significantly higher in the beneficiary category and the 't' value was significant at one per cent level.

The mean values of output per acre for coconut for the beneficiary category were Rs. 5,249.93, Rs. 4,774.03 and Rs. 4,399.89 for the first, second and third size groups, respectively. The corresponding figures in the non-beneficiary category were Rs.2,854.21, Rs. 2,731.96 and Rs. 3,095.67, respectively.

The value of output for coconut was found to be significantly higher in the beneficiary category.

5.2.3 Tapioca

5.2.3.1 Human labour

The mean quantity of 'Human labour' used per acre for tapioca were 36.30 mandays 38.44 mandays and 34.00 mandays, respectively in the sample as a whole and in the beneficiary and non-beneficiary categories(Table 5.1). The labour use per acre in the beneficiary category was found to be significantly higher than that in the non-beneficiary category. The 't' value was significant at one per cent level.

The mean values of labour used per acre in the beneficiary category were 36.31, 38.68 and 41.40 mandays in the first, second and third size groups, respectively. In the non-beneficiary category the corresponding figures were 32.04, 35.38 and 35.21 mandays, respectively (Tables 5.6 and 5.7).

Category wise and size group wise the use of 'Human labour' for tapioca was found to be higher in the beneficiary category than those in the non-beneficiary category.

5.2.3.2 Fertilizer

Average quantity of 'Fertilizer' used per acre for tapioca were 64.06 kg, 75.08 kg and 52.02 kg, respectively for the whole sample and in the beneficiary and non-beneficiary categories (Table 5.2). The use of fertilizer in the beneficiary category was found to be significantly higher than that in the non-beneficiary category and the 't' value was significant at five per cent level.

On an average the different size groups of farms used 82.06 kg, 83.14 kg and 56.53 kg of fertilizer in the first, second and third size groups respectively in the beneficiary category and the corresponding figures in the non-beneficiary category were 68.64 kg, 26.25 kg and 56.01 kg, respectively (Tables 5.8 and 5.9).

Farms in the beneficiary category were found to use significantly higher quantities of fertilizer than the farms in the non-beneficiary category. Size group wise also there were higher levels of use of fertilizer in the beneficiary category.

5.2.3.3 Other capital

Use of capital in the forms of 'Other capital' came to Rs. 957.94 per acre, Rs. 1,226.94 per acre and Rs. 668.26 per acre in the whole sample and in the beneficiary and non-beneficiary categories, respectively (Table 5.4). The use was significantly higher in the beneficiary category and the 't' value was significant at one per cent level.

The average use per acre of 'Other capital' were Rs. 1,445.38, Rs. 1,122.58 and Rs. 988.63 respectively in the first, second and third size groups, respectively in the beneficiary category. The corresponding figures in the non-beneficiary category were Rs. 746.89, Rs. 627.75 and Rs. 591.00, respectively (Tables 5.11 and 5.12).

The use of 'Other capital' was found to be significantly higher in the beneficiary category. In all the size groups of the beneficiary category also this was found to be higher. For tapioca the farmers in the beneficiary category were found to use significantly higher quantities of all the inputs.

5.2.3.4 Value of output

The beneficiary farms were found to have higher 'Value of output' than the non-beneficiary farms for tapioca. The average values of output per acre were found to be Rs. 3,352.20, Rs. 3,683.24 and Rs. 2,995.69 for the whole sample and for the beneficiary and non-beneficiary categories respectively (Table 5.5).

The 't' value; significant at one per cent level indicated, the value of output in the beneficiary category to be significantly higher then that in the non-beneficiary category.

The means of the values of output in the first, second and third size groups were Rs. 3,916.56, Rs.3,623.63 and Rs. 3,392.88, respectively in the beneficiary category and Rs. 2,973.27, Rs. 2,888.75 and Rs. 3,153.14 respectively in the non-beneficiary category (Tables 5.13 and 5.14).

5.2.4 Banana

5.2.4.1 Human labour

The averages of the quantity of 'Human labour' used for banana are 80.15, 79.54 and 80.86 mandays in the sample as a whole and in the beneficiary and non-beneficiary categories, respectively (Table 5.1). There was no significant difference between the use of labour in the beneficiary and non-beneficiary categories.

Size group wise the first, second and third size groups used 72.10, 81.65 and 89.53 mandays of labour, respectively in the beneficiary category and 81.82, 77.71 and 83.08 mandays of labour, respectively in the non-beneficiary category (Tables 5.6 and 5.7).

Even though the quantity of human labour used per acre for banana was lower in the beneficiary category than the non-beneficiary category, the difference was not statistically significant.

5.2.4.2 Fertilizer

The mean levels of use of N.P.K. nutrients for banana are given in Table 5.2.

On an average 546.96 kg per acre, 616.50 kg per acre and 466.26 kg per acre were the average us of 'Fertilizer' for banana, for the sample as a whole and in the beneficiary and non-beneficiary categories, respectively. The average use of fertilizer was found to be significantly higher in the beneficiary category and the 't' value was significant at five per cent level.

Size group wise the average use per acre of N.P.K. nutrients were found to be 728.21 kg, 580.56 kg and 470.90 kg in the beneficiary category and 462.81 kg, 411.38 kg and 533.90 kg in the non-beneficiary category for the first, second and third size groups, respectively.

The averege use of fertilizer for banana was found to be significantly higher in the beneficiary category.

5.2.4.3 Cost of irrigation

Table 5.3 shows the average amount spent for irrigation for banana. On an average Rs. 726.94 per acre, Rs. 922.96 per acre and Rs. 499.56 per acre were spent on irrigation in the sample as a whole and in the beneficiary and non-beneficiary categories. The beneficiary category was found to spent significantly higher amounts for irrigation and the 't' value was found significant at one per cent level.

The farms in the first, second and third size groups spent on an average Rs. 1,009.37 per acre, Rs. 988.25 per acre and Rs. 717.25 per acre, respectively in the beneficiary category and Rs. 662.90 per acre, Rs. 379.00 per acre and Rs. 404.00 per acre respectively in the non-beneficiary category, for irrigating the banana crop (Table 5.10).

Significantly higher amounts were spent by the beneficiary farmers for irrigation than the non-beneficiary farmers.

5.2.4.4 Other capital

On an average the use per acre of 'other capital' were Rs. 4,686.83, Rs. 5,390.21 and Rs. 3,870.92, respectively in the sample as a whole and in the beneficiary and non-beneficiary categories. The use of

'Other capital' was found to be significantly higher in the beneficiary category than that in the non-beneficiary category and the 't' value was highly significant (Table 5.4).

The first, second and third size groups use on an average Rs. 5,141.69 per acre, Rs. 5,706.87 per acre and Rs. 5,477.37 per acre, respectively in the beneficiary category and Rs. 4,593.40 per acre, Rs. 2,830.38 per acre and Rs. 4,028.00 per acre, respectively in the non-beneficiary category; as 'Other capital' (Tables 5.11 and 5.12).

The use of 'Other capital' was found to be significantly higher in the beneficiary category than than in the non-beneficiary category.

For banana the average use of all the inputs except human labour were found to be higher in the beneficiary category than that in the non-beneficiary category.

5.2.4.5 Value of output

Table 5.5 shows the average of the values of output obtained per acre for banana, the average values per acre were Rs. 21,256.28, Rs. 23,630.62 and Rs. 18,502.04, respectively for the sample as a whole and for the beneficiary and non-beneficiary categories, respectively. The output obtained for banana in the beneficiary category was found to be significantly higher than that in the non-beneficiary category and the 't' value was highly significant.

The value of output obtained for the first, second and third size groups were Rs. 24,584.61 per acre, Rs. 22,941.75 per acre and Rs. 22,769.25 per acre, respectively in the beneficiary category and Rs.18,228.90 per acre, Rs. 18,429.50 per acre and Rs. 18,975.14 per acre, respectively in the non-beneficiary category (Tables 5.13 and 5.14).

Just like in the case of input use the values of output obtained for banana was found to be significantly higher in the beneficiary category than that in the non-beneficiary category.

The analysis of input use and the generation of output in the sample farms can be summarised as follows.

The farms in the beneficiary category were found to use higher rates of all the inputs (except 'Human labour' in paddy) than the farms in the non-beneficiary category.

The averages of the value of output per acre were also found to be higher in the beneficiary category.

Table 5.1 Mean values of the quantity of Human Labour used per acre in the selected sample

Crops	Per acre use of labour for each crop expressed in mandays			't' value
	Beneficiary category	Non-beneficiary category	Combined	
(1)	(2)	(3)	(4)	(5)
Paddy	51.39	42.98	47.25	4.42***
	(1.34)	(1.30)	(1.07)	
Coconut	43.39	40.76	42.07	1.68*
	(1.24)	(0.92)	(0.79)	
Tapioca	38.44	34.00	36.30	3.65***
	(0.78)	(0.90)	(0.67)	
Banana	79.54	80.86	80.15	0.36
	(2.12)	(2.91)	(1.76)	

Figures in parentheses indicate standard errors

* Significant at 10% level

*** Significant at 1% level

Table 5.2 Mean values of the quantity of fertilizer used per acre in the selected sample

Crops	Per acre use of fertilizer for each crop expressed in kilograms of NPK nutrients			't' value
	Beneficiary category	Non-beneficiary category	Combined	
(1)	(2)	(3)	(4)	(5)
Paddy	50.44	37.10	43.87	4.46***
	(2.24)	(1.90)	(1.67)	
Coconut	90.07	47.93	68.83	7.13***
	(3.98)	(4.26)	(4.09)	
Tapioca	75.08	52.20	64.06	2.07**
	(4.26)	(10.27)	(5.64)	
Banana	616.50	466.26	546.94	2.44**
	(44.04)	(40.24)	(31.78)	

Figures in parentheses indicate standard errors

** Significant at 5% level

*** Significant at 1% level

Table 5.3 Mean values of cost of irrigation per acre in the selected sample

Crop	Cost of irrigation per acre expressed in rupees			't' value
	Beneficiary category	Non-bene-ficiary category	Combined	
(1)	(2)	(3)	(4)	(5)
Banana	922.96	499.56	726.94	3.18***
	(78.49)	(107.46)	(71.25)	

Figures in parentheses indicate standard errors

*** Significant at 1% level

Table 5.4 Mean values of 'Other capital' per acre in the sample farms

Crops	Per acre use of 'Other capital' for each crop expressed in Rupees			't' value
	Beneficiary category	Non-beneficiary category	Combined	
(1)	(2)	(3)	(4)	(5)
Paddy	1234.86	1216.56	1225.85	0.47
	(33.21)	(19.05)	(19.32)	
Coconut	813.67	457.64	635.65	10.58***
	(25.97)	(20.62)	(26.97)	
Tapioca	1226.94	668.26	957.94	4.66***
	(54.46)	(60.64)	(55.61)	
Banana	5390.21	3870.92	4686.83	5.29***
	(154.85)	(244.38)	(174.19)	

Figures in parenetheses indicate standard errors

*** Significant at 1% level

Table 5.5 Means of the values of output per acre of major crops in the selected sample expressed in rupees

Crops	Average values of products per acre expressed in Rupees: Beneficiary category	Non-beneficiary category	Combined	't' value
(1)	(2)	(3)	(4)	(5)
Paddy	3473.12	2803.38	3143.40	5.74***
	(93.61)	(65.48)	(70.87)	
Coconut	4857.49	2874.47	3865.98	10.13***
	(144.37)	(128.07)	(152.82)	
Tapioca	3683.24	2995.69	3352.20	4.07***
	(125.25)	(107.16)	(95.21)	
Banana	23630.62	18502.04	21256.28	4.12***
	(758.69)	(980.06)	(702.13)	

Figures in parentheses indicate standard errors

*** Significant at 1% level

Table 5.6 Mean values of the quantity of Human Labour used per acre in different size groups of farms in the beneficiary category

Crops	Labour use per acre expressed in Mandays			
	Size groups			
	0.5 to 1.25	1.25 to 2.5	above 2.5	Combined
(1)	(2)	(3)	(4)	(5)
Paddy	53.32 (2.35)	49.22 (2.11)	51.69 (2.29)	51.39 (1.34)
Coconut	42.16 (1.00)	44.75 (2.31)	43.61 (3.18)	43.39 (1.24)
Tapioca	36.31 (1.21)	38.68 (0.64)	41.40 (1.36)	38.44 (0.78)
Banana	72.10 (2.42)	81.65 (3.55)	89.53 (2.63)	79.54 (2.12)

Figures in parentheses indicate standard errors.

Table 5.7 Mean values of the quantity of Human Labour used per acre in different size groups of farms in the non-beneficiary category

Crops	Labour use per acre expressed in Mandays			
	Size groups			
	0.5 to 1.25 Acres	1.25 to 2.5 Acres	Above 2.5 Acres	Combined
(1)	(2)	(3)	(4)	(5)
Paddy	37.70 (1.75)	43.93 (0.69)	51.02 (1.69)	42.98 (1.30)
Coconut	39.56 (1.54)	41.04 (1.15)	42.95 (1.65)	40.76 (0.92)
Tapioca	32.04 (1.26)	35.38 (1.55)	35.51 (1.68)	34.00 (0.90)
Banana	81.82 (6.75)	77.71 (1.64)	83.08 (2.93)	80.86 (2.91)

Figures in parentheses indicate standard errors

Table 5.8 Mean values of the quantity of fertilizer used per acre in different size groups of farms in the beneficiary category

Crops	Fertilizer use per acre expressed in kgms of N.P.K nutrients			
	Size groups			
	0.5 to 1.25 Acres	1.25 to 2.5 Acres	Above 2.5 Acres	Combined
(1)	(2)	(3)	(4)	(5)
Paddy	58.63 (4.48)	44.44 (2.10)	47.53 (2.73)	50.44 (2.24)
Coconut	87.07 (4.78)	89.35 (8.11)	95.07 (8.10)	90.07 (3.98)
Tapioca	82.06 (7.58)	83.14 (4.97)	56.53 (2.95)	75.08 (4.26)
Banana	728.21 (63.72)	580.56 (122.86)	470.90 (167.29)	616.50 (78.49)

Figures in parentheses indicate standard errors

Table 5.9 Mean values of the quantity of fertilizer used per acre in different size groups of farms in the non-beneficiary category.

Crops	Fertilizer use per acre expressed in kgms of N.P.K nutrients			
	Size groups			
	0.5 to 1.25 Acres	1.25 to 2.5 Acres	Above 2.5 Acres	Combined
(1)	(2)	(3)	(4)	(5)
Paddy	40.47 (2.30)	36.47 (3.38)	31.98 (4.22)	37.10 (1.90)
Coconut	54.41 (6.49)	40.90 (9.20)	41.41 (11.70)	47.93 (4.26)
Tapioca	68.64 (17.22)	26.25 (10.17)	56.01 (20.30)	52.20 (10.27)
Banana	462.81 (71.60)	411.38 (70.22)	533.90 (51.06)	466.26 (40.24)

Figures in parentheses indicate standard errors

Table 5.10 Mean values of Cost of Irrigation per acre in different size groups of farms in the beneficiary and non-beneficiary categories

Category	Crops	Cost of irrigation per acre in Rupees			
		Size groups			
		0.5 to 1.25 Acres	1.25 to 2.5 Acres	Above 2.5 Acres	Combined
Beneficiary category	Coconut	108.48 (27.09)	158.81 (28.93)	109.73 (38.05)	124.66 (18.27)
	Banana	1009.37 (107.53)	988.25 (122.86)	717.25 (167.29)	922.96 (78.49)
Non-beneficiary category	Banana	662.90 (218.58)	379.00 (130.15)	404.00 (136.16)	499.56 (107.46)

Figures in parentheses indicate standard errors

Table 5.11 Mean values of 'Other capital' used in different size groups of farms in the beneficiary category

Crops	Use of 'Other capital' per acre expressed in rupees			
	Size groups			
	0.5 to 1.25 Acres	1.25 to 2.5 Acres	Above 2.5 Acres	Combined
(1)	(2)	(3)	(4)	(5)
Paddy	1300.23	1239.32	1141.78	1234.86
	(52.04)	(53.76)	(57.23)	(33.21)
Coconut	847.39	844.31	732.77	813.67
	(39.38)	(38.69)	(49.91)	(25.97)
Tapioca	1455.38	1122.58	988.63	1226.94
	(62.31)	(80.20)	(53.99)	(54.46)
Banana	5141.69	5706.87	5477.37	5390.21
	(243.43)	(205.95)	(300.28)	(154.85)

Figures in parentheses indicate standard errors

Table 5.12 Mean values of 'Other capital' used in different size groups of farms in the non-beneficiary category

Crops	Use of 'Other capital' per acre expressed in rupees			
	Size groups			
	0.5 to 1.25 Acres	1.25 to 2.5 Acres	Above 2.5 Acres	Combined
(1)	(2)	(3)	(4)	(5)
Paddy	1180.29 (32.00)	1223.06 (22.62)	1271.90 (34.51)	1216.56 (19.05)
Coconut	435.17 (19.12)	418.30 (22.66)	554.55 (64.28)	457.64 (20.62)
Tapioca	746.89 (109.06)	627.75 (93.11)	591.00 (86.78)	668.26 (60.64)
Banana	4593.40 (202.93)	2830.38 (422.93)	4028.00 (396.55)	3870.92 (244.38)

Figures in parentheses indicated standard errors

Table 5.13 Mean of the values of output per acre in different size groups of farms in the beneficiary category

Crops	Means of the values of output per acre expressed in rupees			
	Size groups			
	0.5 to 1.25 Acres	1.25 to 2.5 Acres	Above 2.5 Acres	Combined
(1)	(2)	(3)	(4)	(5)
Paddy	3938.58 (133.22)	3242.58 (114.74)	3159.89 (109.48)	3473.12 (93.61)
Coconut	5249.93 (241.38)	4774.03 (196.94)	4399.89 (225.66)	4857.49 (144.37)
Tapioca	3916.56 (179.56)	3623.63 (215.65)	3392.88 (227.87)	3683.24 (125.25)
Banana	24584.61 (1128.58)	22941.75 (1631.55)	22769.25 (1096.16)	23630.62 (758.69)

Figures in parentheses indicate standard errors

Table 5.14 Means of the values of output per acre in different size groups of farms in the non-beneficiary category

Crops	Means of the values of output per acre expressed in rupees			
	Size groups			
	0.5 to 1.25 Acres	1.25 to 2.5 Acres	Above 2.5 Acres	Combined
(1)	(2)	(3)	(4)	(5)
Paddy	2902.64 (94.30)	2653.50 (139.71)	2817.00 (71.98)	2803.38 (65.48)
Coconut	2854.21 (167.74)	2731.96 (166.96)	3095.67 (365.98)	2874.47 (128.07)
Tapioca	2973.27 (173.31)	2888.75 (180.46)	3153.14 (190.23)	2995.69 (107.16)
Banana	18228.90 (1665.18)	18429.50 (1767.02)	18975.14 (1570.51)	18502.04 (980.06)

Figures in parentheses indicate standard errors

for all the crops; compared to the non-beneficiary category.

From the analysis, it can be assumed that, external financial assistance have helped the farms in the beneficiary category, to use higher levels of all the major inputs and to reap higher levels of output then the farms in the non-beneficiary category.

5.3 Empirical findings of production function analysis

Linear and Cobb-Douglas forms of production functions were tried for the analysis. When the functions were fitted, linear functions showed better fit than the Cobb-Douglas functions for all the crops, indicated by the higher and significant R square values of the former. The results of the linear production function analysis and the discussions there on follow.

5.3.1 Paddy

For the estimation of production functions for paddy, the independent variable "irrigation charges (X_4)" has been omitted because paddy was cultivated as a rainfed crop in the study area. The variable 'Other capital' for paddy crop included the expenditure on organic manures and plant protection.

The results of production function analysis for paddy for the Beneficiary and Non-Beneficiary categories for different size groups are given in the Tables 5.15 to 5.18.

In the Beneficiary category the regression fitted could explain 77 per cent of the variation in the per acre value of output; while in the Non-Beneficiary category the regression estimated could explain only 31 per cent of the variation. The R square values were significant at one per cent and five per cent levels respectively. Size group wise the R square value was significant only in two cases i.e. in the first size group (0.5 to 1.25 acres) of the Beneficiary category where the R^2 value was 0.84 and significant at one per cent level and also in the first size group of the Non-Beneficiary category where the R square value was 0.58 and significant at ten per cent level. The variability explained by the regression was more in the Beneficiary category than in the Non-Beneficiary category indicating that the influence of the variables analysed on total value of production was more among the Beneficiary farmers.

5.3.1.1 Farm size

Among the variables, the regression coefficient of the variable 'Farm size' was found to be highly

Table 5.15 Regression coefficients of parameters (Beneficiary and Non-Beneficiary categories combined)

Crops	Y intercept	Regression coefficients: Farm size (Acres)	Human labour (Mandays)	Fertilizer N.P.K. (Kg)	Cost of irrigation (Rs.)	Other capital (Rs.)	R^2 value	F value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Paddy	1088.54	-250.04 (-2.174)**	21.70 (3.299)***	23.47 (5.821)***		0.156 (0.475)	0.6770	31.447***
Coconut	1629.88	-199.86 (-1.272)	-20.42 (-1.455)	15.09 (4.870)***	1.09 (1.048)	3.36 (7.404)***	0.8335	64.098***
Tapioca	1623.03	87.15 (0.527)	15.64 (0.981)	7.02 (3.484)***	[illegible]	0.673 (3.075)***	0.5766	16.682***
Banana	5701.63	694.16 (0.735)	56.65 (1.570)	9.06 (3.717)***	3.97 (3.398)***	0.56 (1.371)	0.7037	22.803***

Figures in parentheses indicate 't' values

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

Table 5.16 Correlation coefficients of the independent variables with the dependent variable

Independent variables	Correlation coefficients							
	Paddy		Coconut		Tapioca		Banana	
	Beneficiary category	Non-Beneficiary category	Beneficiary category	Non-Beneficiary category	Beneficiary category	Non-Beneficiary category	Beneficiary category	Non-Beneficiary category
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Farm size (acres)	-0.576 (-3.92)***	-0.098 (-0.539)	-0.367 (-2.27)**	0.082 (0.47)	-0.258 (-1.36)	0.048 (0.23)	-0.197 (-0.95	0.005 (0.02)
Human Labour (mandays)	0.546 (3.66) ***	0.093 (0.511)	0.446 (2.86)***	0.626 (4.61)***	0.034 (0.17)	0.300 (1.54)	-0.146 (-0.78)	0.560 (3.24)***
Fertilizer (NPK, kg)	0.794 (7.27)***	0.515 (3.29)***	0.444 (2.84)***	0.599 (4.30)***	0.531 (3.20)***	0.825 (7.15)***	0.647 (4.41)***	0.722 (5.00)***
Cost irrigation (Rs.)	-	-	0.599 (4.30)***	-	-	-	0.666 (4.64)***	0.713 (4.88)***
Other capital (Rs.)	0.651 (4.78)***	0.327 (1.90)*	0.651 (4.93)***	0.637 (4.75)***	0.456 (2.61)**	0.636 (4.04)***	0.366 (2.04)*	0.506 (2.81)**

Figures in parentheses indicate 't' values

* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

Table 5.17 Regression coefficients of parameters for paddy crop in the Beneficiary category

Size groups	Y intercept	Regression Coefficients				R^2 value	F value
		Farm size (Acres)	Human labour (Mandays)	Fertilizer (Kg)	Other capital (Rs)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0.5 to 1.25 (acres)	1781.24	-1342.64 (-0.976)	-17.72 (-0.904)	8.89 (0.971)	2.423 (1.928)*	0.8401	9.191***
1.25 to 2.5 (acres)	1567.94	-501.99 (-0.550)	13.65 (0.894)	23.19 (1.154)	0.294 (0.335)	0.4875	1.665
Above 2.5 (acres)	749.56	186.85 (0.376)	39.57 (1.491)	24.23 (1.686)	-0.903 (-0.838)	0.6757	2.083
Combined	1902.36	-491.19 (-3.543)***	11.34 (1.429)	22.96 (4.187)***	0.179 (0.477)	0.7676	23.121***

Figures in parentheses indicate the 't' values

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

Table 5.18 Regression coefficients of parameters for paddy crop in this Non-Beneficiary category

Size groups (acres)	Y intercept	Regression Coefficients: Farm size (acres)	Human labour (Mandays)	Fertilizer (Kg)	Other capital (Rs.)	R^2 value	F value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0.5 to 1.25 (acres)	2043.92	-1823.26 (-1.409)	1.51 (0.121)	18.66 (1.917)*	0.578 (0.827)	0.5764	3.062*
1.25 to 2.5 (acres)	-2891.42	1079.84 (1.133)	158.10 (1.605)	9.31 (0.519)	-2.070 (-0.595)	0.5731	1.678
Above 2.5 (acres)	1676.46	184.80 (0.745)	-47.16 (-1.195)	4.59 (0.546)	2.468 (1.274)	0.6760	1.565
Combined	1279.47	-20.25 (-0.105)	1.99 (0.161)	15.83 (2.462)**	0.712 (1.076)	0.3102	3.036**

Figures in parentheses indicate the 't' values

* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

significant in the Beneficiary category but non-significant in the Non-Beneficiary category. In both the cases the coefficients were negative (-491.19 and -20.25 respectively). The regression coefficient of 'Farm size' for the combined analysis of Beneficiary and Non-Beneficiary categories together (Table 5.15) was also found to be negative (-250.04 significant at five per cent level).

The correlation coefficient between 'Farm size' and the value of output was also found to be negative in both the categories and was highly significant in the Beneficiary category as given in the Table 5.16 (-0.576 significant at one per cent level). This would perhaps be an indication of the inverse relationship between 'Farm size' and productivity as observed in many farm management studies. This inverse relationship was more pronounced and significant in the Beneficiary category and less pronounced and non-significant in the Non-Beneficiary category.

5.3.1.2 Human labour

The variable 'Labour' did not show any significant influence on per acre value of output in both Beneficiary and Non-Beneficiary categories. But for the combined set of observations of both the categories together the regression coefficient was highly significant (at one per cent level) with a value of 21.70 as shown in

Table 5.15. In the three size groups as well as in the combined set of both Beneficiary and Non-Beneficiary categories the regression coefficients of 'Labour' were positive. The correlation coefficients (Table 5.16) of 'Labour' with the value of output were also positive in both the categories and was significant in the Beneficiary category (correlation coefficient 0.546 significant at one per cent level).

Size group wise the regression coefficients of the variable 'Labour' were found to be non-significant in all the size groups in the Beneficiary and Non-Beneficiary categories. The results of the regression analysis for the variable 'Labour' indicated that there is a pronounced and significant positive correlation between the quantity of labour used and the value of output in the beneficiary category. In the non-beneficiary category, the relationship was not statistically significant.

The Marginal Revenue of labour (MR) for paddy indicated by the regression analysis was Rs. 21.70 (shown in Table 5.15) and was less than the wage rate which is the Marginal Cost of labour (MC). In the study area the wage rate per man day of labour was Rs. 30, i.e. investment of one rupee on 'Labour' produces on output worth Rs. 0.72 only. So even though the regression indicated the potential for increasing the paddy yield by increasing the labour, the MC of labour makes it uneconomic to invest more labour.

5.3.1.3 Fertilizer

The regression coefficient of the variable 'Fertilizer' for the combined set of both the Beneficiary and Non-Beneficiary categories together was highly significant (shown in Table 5.15). The regression coefficient was 23.47, significant at one per cent level. For the Beneficiary category the regression coefficient was 22.96 and was significant at one per cent level. In the Non-Beneficiary category the coefficient was 15.83 significant at five per cent level. Size group wise the variable fertilizer has shown significance only in the first size group of the Non-Beneficiary category with the value of the regression coefficient as 18.66 significant at ten per cent level. In all the cases the values of the regression coefficients of the variable 'Fertilizer' were positive. The correlation coefficient of the variable 'Fertilizer' with the dependent variable (Value of output) were 0.794 and 0.515 respectively for the Beneficiary and Non-Beneficiary categories and the coefficients were significant at one per cent level.

The results of the regression analysis for paddy indicated a strong direct relationship between the quantity of fertilizer used and the value of output. The Marginal Revenues (MR) indicated by the regression analysis for the variable 'Fertilizer' were Rs. 22.96 per kg of N.P.K. nutrients in the Beneficiary category and Rs. 15.83 per kg of N.P.K. nutrients in the Non-Beneficiary category. The marginal cost of 'Fertilizer' was worked out as Rs. 4.04 per kg. So by an investment of one rupee worth of fertilizer to paddy crop; Rs. 5.68 worth of output was generated in the Beneficiary category. In the Non-Beneficiary category equivalent output was worth Rs. 3.92 only.

When we look into the average quantity of fertilizer used per acre in both these categories it was 50.44 kgs for the Beneficiary category and 37.10 kgs for the Non-Beneficiary category. When the high yielding variety (HYV) coverage for paddy in both these categories were considered there is significantly higher coverage of HYV in the Beneficiary category when compared with the Non-Beneficiary category. In the Beneficiary category 74 per cent of the area under paddy was under HYV, while in the Non-Beneficiary category only 40 per cent of the paddy area was under the HYV. The improved varieties of paddy require higher doses of fertilizers and will show a higher response to the added doses of fertilizer than the local varieties. The package of practice recommendations of fertilizers are higher for the HYV than the local varieties. This clearly explains the higher significance and higher marginal productivity of the variable 'Fertilizer' in the Beneficiary category than in the Non-Beneficiary category even though the average quantity of fertilizer used was higher in the case of Beneficiaries.

5.3.1.4 Other capital

The regression coefficient of the variable 'Other capital' was found to be non-significant in both the Beneficiary and Non-Beneficiary categories and in the combined set (Tables 5.15, 5.17 and 5.18). But the correlation coefficient indicated a significant positive correlation between the variable 'Other capital' and the value of the output. In the Beneficiary category the correlation coefficient was 0.651 significant at one per cent level and in the Non-Beneficiary category the correlation coefficient was 0.327 significant at 10 per cent level (Table 5.16).

Size group wise the regression coefficient of the variables 'Other capital' was significant only in one case, i.e., in the first size group of the Beneficiary category where the regression coefficient was 2.423 significant at 10 per cent level.

The results of regression analysis for the variable 'Other capital' indicate that even though there exists a significant and direct relationship between the amount of capital used as 'Other capital' and the value of output per acre; the contribution of this variable to the value of output was not statistically significant.

For paddy crop the major components of 'Other capital' were the expenditures on organic manures and plant protection activities. There was some variation in the expenditures on manures from farm to farm. But the major variation in other capital from farm to farm can be attributed to the difference in expenditure on plant protection. Role of plant protection operation is not to enhance the yield but to prevent the probable reduction in yield due to the attack of pest and diseases. The yield of a paddy crop without any attack of pest or disease will be as good as the yield of another crop of paddy with pest problem timely controlled using plant protection measures. This peculiarity explains the non-significance of the variable 'Other capital' for paddy crop.

The results of the multiple regression analysis for paddy crop can be summarized as follows:

The linear regression fitted for paddy crop for the Beneficiary and Non-Beneficiary categories and for the sample as a whole were significant. The study indicated the presence of an inverse relationship between the variable 'Farm size' and the value of output per acre. This inverse relationship was more pronounced and statistically significant in the Beneficiary category of farms and less pronounced and non-significant in the Non-Beneficiary category of holdings. The variable 'Labour' found to influence the value of output positively and significantly in the Beneficiary category. But the positive relationship between the quantity of labour used and the value of output was not statistically significant in the Non-Beneficiary category. In both the cases the Marginal Revenue of 'Labour' was less than the Marginal Cost of labour. The function fitted being linear no optimum use of 'Labour' can be recommended. But this may probably be an indication of low productivity of 'Labour' in the sample farms due, perhaps to exess use.

The regression analysis showed that the variable 'Fertilizer' significantly influence the value of output in both the categories. The marginal analysis indicated high marginal productivity of fertilizer in both the categories. The Marginal Revenue of

'Fertilizer' for the Beneficiary category was much higher than that in the Non-Beneficiary category. This may probably be due to the higher coverage of high yielding varieties in the Beneficiary category farms. In the aggregate for the whole sample an investment of one rupee worth of fertilizer was able to produce an output worth Rs. 5.81.

The regression analysis failed to indicate any significant influence of the variable 'Other capital' on the value of output.

5.3.2 Coconut:

In the estimation of production functions for coconut the independent variable 'Cost of irrigation' has been omitted in the Non-Beneficiary category because none of the 35 farmers in the Non-Beneficiary category were using irrigation for their coconut palms. The major components of the variable 'Other capital' for coconut were the expenses on organic manure and the expenses on plant protection operation.

The results of the production function analysis for coconut for the Beneficiary and Non-Beneficiary categories for different size groups are given in the Tables 5.19 and 5.20. The results of regression analysis for both the categories together are given in Table 5.15.

Table 5.19 Regression coefficients of parameters for coconut in the Beneficiary category

Size group	Y inter-cept	Regression coefficients					R^2 value	F value	$\bar{R}^2$
		Farm size (acres)	Human labour (mandays)	Ferti-lizer (kg)	Cost of irriga-tion (Rs.)	Other capital (Rs.)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
0.5 to 1.25 (acres)	-3172.55	601.32 (0.195)	71.95 (0.968)	16.14 (1.235)	-2.24 (-0.599)	4.69 (2.334)**	0.7205	4.124**	0.55
1.25 to 2.5 (acres)	6677.12	-4030.68 (-3.075)**	44.49 (0.749)	-6.76 (-0.769)	5.70 (2.533)*	-1.12 (-0.669)	0.8239	4.678*	0.65
Above 2.5 (acres)	3923.71	-1059.12 (-3.328)**	54.39 (3.305)**	-21.15 (-2.251)*	6.22 (4.598)**	1.08 (1.811)	0.9728	28.646***	0.94
Combined	3376.71	-898.31 (-3.293)***	-5.92 (-0.230)	8.04 (1.060)	2.84 (2.022)*	1.66 (1.893)*	0.6348	10.084***	0.58

Figures in parentheses indicate 't' values

* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

Table 5.20 Regression coefficients of parameters for coconut in the Non-Beneficiary category

Size groups	Y intercept	Regression coefficient					R^2 value	F value	$\bar{R}^2$
		Farm size (acres)	Human labour (mandays)	Fertilizer (kg)	Cost of irrigation (Rs.)	Other capital (Rs.)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
0.5 to 1.25 (acres)	455.49	1293.59 (0.865)	68.75 (2.123)*	13.05 (2.302)**	-	-3.350 (-1.678)	0.7525	9.122***	0.67
1.25 to 2.5 (acres)	4461.64	-932.88 (-1.360)	-80.36 (-2.128)*	21.14 (5.415)***	-	3.320 (2.382)*	0.8832	9.450**	0.79
Above 2.5 (acres)	2663.48	656.17 (4.843)**	-89.06 (-2.965)*	25.43 (5.829)**	-	4.109 (13.036)***	0.9936	116.713***	0.99
Combined	154.14	2.643 (0.014)	15.41 (0.713)	13.69 (3.307)***	-	3.135 (3.973)***	0.6632	14.767***	0.60

Figures in parentheses indicate 't' values

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

The regressions fitted were highly significant in the case of both Beneficiaries and Non-Beneficiaries as well as in the combined set of both the categories. The function fitted could explain 63 per cent of the variation in the value of output in the Beneficiary category and 66 per cent of the variation in the Non-Beneficiary category. In the sample as a whole the regression fitted was able to explain 83 per cent of variation in the value of output. In all the three cases the R square values were significant at one per cent level. For comparing the R square values in the two categories where the number of variables were different, adjusted R square values were calculated ($\bar{R}^2$). The adjusted R square value for the Beneficiary category was 0.58 and for the Non-Beneficiary category it was 0.60. Adjusted R square values were calculated for the different size groups also.

Size group wise the regression fitted was significant in all the three size groups in both the categories. In the Beneficiary category the R square values were 0.72 ($\bar{R}^2 = 0.55$) for the first size group (0.5 to 1.25 acres) significant at five per cent level, 0.82 ($\bar{R}^2 = 0.65$) for the second size group (1.25 to 2.5 acres) significant at 10 per cent level and 0.97 ($\bar{R}^2 = 0.94$) for the third size group (above 2.5 acres) significant at one per cent level. In the

Non-Beneficiary category, the R square values were 0.75 ($\bar{R}^2$ = 0.67) for the first size group significant at one per cent level, 0.88 ($\bar{R}^2$ = 0.79) for the second size group significant at five per cent level and 0.99 ($\bar{R}^2$ = 0.99) for the third size group significant at one per cent level.

5.3.2.1 Farm size

Among the variables, the regression coefficient of the variable 'Farm size' was found to be highly significant in the Beneficiary category. The regression coefficient was -898.31 significant at one per cent level. The negative value of the regression coefficient indicates an inverse relationship between the size of holding and the 'Value of output'. Size group wise, for the Beneficiary category the regression coefficients of the variable 'Farm size' were found to be significant in the second and third size groups. The values were -4030.68 for the second size group and -1059.12 for the third size group, both significant at five per cent level. The correlation coefficient for the variable 'Farm size' with the 'Value of output' for the Beneficiary category was -0.367 significant at five per cent level (shown in Table 5.16). Thus the analysis indicated a significant inverse in relationship between 'Farm size' and the 'Value of output' in the Beneficiary category.

In the Non-Beneficiary category the regression analysis did not show any significant relationship between the variable 'Farm size' and the 'Value of output'. The correlation coefficient between 'Farm size' and the value of output was also not significant. Size group wise the regression coefficient of the variable 'Farm size' was significant in the third size group (656.17) at five per cent level.

The regression coefficient of the variable 'Farm size' in the combined set of both the categories together was -199.86, but the value was not significant.

To summerise, multiple regression analysis for coconut indicated a significnat inverse relationship between 'Farm size' and value of output in the Beneficiary category of farms. But in the Non-Beneficiary category as well as in the combined set of both the categories, the regression fitted have failed to establish any significant relationship between 'Farm size' and the 'Value of output'.

The inverse relationship found between 'Farm size' and the 'Value of output' in the Beneficiary category for the crop coconut is in consensus with the findings in the case of paddy crop where there was a pronounced and significant inverse relationship between 'Farm size' and the 'Value of output' in the Beneficiary category.

5.3.2.2 Human Labour

The regression coefficient of the variable 'Human 'Labour' was found to be Non-significant in the Beneficiary category. The correlation coefficient of the variable 'Labour' with the 'Value of output' was 0.446 significant at one per cent level. Size group wise the regression coefficient of 'Labour' was significant in the third size group and the value was 54.39 significant at five per cent level. In the Beneficiary category, though the correlation coefficient indicated that the value of output varies directly and significantly with the quantity of labour, the regression analysis did not indicate any significant contribution of labour to the 'Value of output' except in a single size group.

In the Non-Beneficiary category also the regression analysis did not indicate any significant influence of 'Labour' on the 'Value of output'. The correlation coefficient between the quantity of labour and the 'Value of output' was positive and highly significant with a value of 0.626 significant at one per cent level. Size group wise the regression coefficients of 'Labour' were significant in all the three size groups. In the first size group the coefficient was positive (68.75 significant at 10 per cent level) but in the second and third size groups the regression coefficients were negative (-80.36 and -89.06 respectively both significant at 10 per cent level).

In the combined analysis of both the categories together also the regression coefficient of the variable 'Labour' was found to be non-significant. So eventhough there exists a direct linear relationship between the quantity of labour and the 'Value of output', as indicated by the correlation coefficients the regression analysis failed to establish any significant relationship between the two.

5.3.2.3 Fertilizer

The regression coefficient of the variable 'Fertilizer' was found to be non-significant in the Beneficiary category. The correlation coefficient of 'Fertilizer' with the 'Value of output' was found to be positive and highly significant with a value of 0.444 significant at one per cent level. Size group wise in the Beneficiary category the regression coefficient of the variable 'Fertilizer' was significant in one case i.e. in the third size group, where the value of the coefficient was -21.15 significant at 10 per cent level.

In the Non-Beneficiary category the regression coefficient of 'Fertilizer' was highly significant with a value of 13.69 significant at one per cent level. The value of the correlation coefficient between the quantity of 'Fertilizer' and the value of output in the Non-Beneficiary category was 0.599 significant at one per cent level. In all the three size groups the coefficients of 'Fertilizer' were significant and the values were 13.05 in the first size group significant at five per cent level, 21.14 in the second size group significant at one per cent level and 25.43 in the third size group significant at five per cent level.

In the combined analysis of both the categories also, the regression coefficient of the variable 'Fertilizer' was found to be highly significant with a value of 15.09 significant at one per cent level.

The Marginal Revenue of the variable 'Fertilizer' was Rs. 13.69 in the Non-Beneficiary category and Rs. 15.09 for the combined analysis (for the Beneficiary category MR of 'Fertilizer' was non-significant). The Marginal Cost of 'Fertilizer' was worked out to be Rs. 3.26 per kg. In the Non-Beneficiary category an investment of Re. 1/- as fertilizer could produce on output worth Rs. 4.20 and in the combined set of both the categories, a similar investment was able to generate Rs. 4.62 worth of output. The regression analysis for both the categories together indicated, that quantity of fertilizer positively and significantly, influenced the value of output. But category wise, the responses of the value of output to the added doses of fertilizer was different. In the Beneficiary category the regression coefficients were non-significant except in one case i.e. in the third size group were the regression coefficient was negative. But in the Non-Beneficiary category the regression coefficients were positive and significant in all the three size groups as well as in the combined set.

The difference in response in the two categories; in the value of output to the added doses of fertilizer, may be due to the difference in the quantity of fertilizer used in the two categories. The average quantity of 'Fertilizer' used per acre in the Beneficiary category for coconut was 90.07 kilograms of N P K while the average use in the Non-Beneficiary category was only 47.93 kilograms of N P K per acre. The average values of output generated in these two categories for coconut were Rs. 4,875.49 per acre in the Beneficiary category and Rs. 2,874.47 per acre in the Non-Beneficiary category. So on the basis of the value of output; for producting an output worth Rs. 100 for coconut, the farmers in the Beneficiary category use 1.85 kilograms of

N P K nutrients while in the Non-Beneficiary category they use only 1.67 kilograms on N P K nutrients. That is, for the same quantity of output farmers in the Beneficiary category use more quantity of fertilizer than the farmers in the Non-Beneficiary category. When we consider the average cost of fertilizer for coconut, it works out to Rs. 3.26 per kilogram of N P K nutrients. On the average, farms in the Beneficiary category spend Rs. 6.04 in fertilizer for getting an output worth Rs. 100/- while the farms in the Non-Beneficiary category spend only Rs. 5.44 for getting the same output. So the non-significant regression coefficients for the variable 'Fertilizer' in the Beneficiary category, may be due to the higher levels of application of fertilizers in that category.

The external financial assistance received by the Beneficiary farmers might have helped them to invest more capital as fertilizer than the Non-Beneficiary farmers.

5.3.2.4 Cost of irrigation

The variable irrigation comes only in the Beneficiary category where the regression coefficient was significant. The value of the regression coefficient was 2.84 significant at five per cent level. Size group wise the coefficient was significant in two cases i.e.

in the second and third size groups; the values of the regression coefficients were 5.70, in the second size groups significant at 10 per cent level: 6.22 in the third size group significant at five per cent level. The correlation coefficient of the variable 'Cost of irrigation' to the value of output in the Beneficiary category was 0.599, significant at one per cent level (Table 5.16). The regression analysis indicated that 'Cost of irrigation' as a variable has a significant positive influence on the value of output in coconut.

5.3.2.5 Other capital

The regression coefficient of the variable 'Other capital' was found to be significant in the Beneficiary category. The value of the regression coefficient was 1.66 significant at 10 per cent level. Size group wise the regression coefficient was significant only in the first size groups where the coefficient was 4.69 significant at five per cent level. The correlation coefficient of 'Other capital' with the value of output was 0.651 significant at one per cent level in the Beneficiary category (Table 5.16).

In the Non-Beneficiary category the coefficient of the variable 'Other capital' was found to be highly significant. The value of the regression coefficient was 3.135 significant at one per cent level. The correlation coefficient of the variable 'Other capital' with the value of output was 0.637 significant at one per cent level. Size group wise the regression coefficients weré significant in two size groups i.e. in the second group where the coefficient was 3.320 significant at 10 per cent level and in the third size group where the coefficient was 4.109 significant at one per cent level.

In the combined analysis of both the categories together also the regression coefficient of 'Other capital' was highly significant. The value of the regression coefficient was 3.36 significant at one per cent level.

The regression analysis thus indicated that the variable 'Other capital' had a significant positive contribution to the value of output, for coconut crop in both the Beneficiary and Non-Beneficiary categories.

As mentioned earlier, the major components of the variable 'Other capital' for coconut were the expenditures on organic manures and plant protection measures. In the study area plant protection operation for coconut was rarely done and so the variations in 'Other capital' from farm to farm for the crop coconut was mainly altributed to the variations in the expenditures on organic manures. The high significance of 'Other capital' on the value of output seen in the regression results of both the categories may be due to the influence of organic manures on coconut yields.

The results of the multiple regression analysis for coconut can be summerized as follows.

The regression fitted to the data was highly significant in the sample as a whole and it could explain 83 per cent of the variation in the 'Value of output'.

As seen in the case of paddy here also the variable 'Farm size' has shown an inverse relationship with the 'Value of output' in the Beneficiary category of farms. The regression analysis for the Non-Beneficiary category as well as for the sample as a whole failed to establish any significant relationship between these two.

In the case of 'Labour' the correlation coefficient indicated a significant direct relationship between the quantity of labour used and the value of output, but the regression analysis did not establish any significant statistical relationship between these two.

In the case of 'Fertilizer' the analysis has established with statistical validity that the quantity of fertilizer applied, influences positively and significantly the value of output in coconut, in the Non-Beneficiary category as well as in the sample as a whole. In the case of the Beneficiary category farms, the regression analysis failed to indicate any statistically significant relationship between the two.

The role of irrigation in enhancing the yield was established by the results of the regression analysis. In the Beneficiary category where the palms were irrigated the variable 'Cost of irrigation' was found influencing positively and significantly the 'Value of output'.

The regression analysis has shown that the variable 'Other capital' influence the 'Value of output' positively and significantly in both the categories and the sample as a whole.

5.3.3 Tapioca

For the estimation of production function for tapioca the variable 'Cost of irrigation' has been excluded because tapioca was cultivated as a rainfed crop in the study area. The results of production function analysis for tapioca are given in Tables 5.15, 5.16, 5.21 and 5.22. In the case of tapioca the variable 'Other capital' included the costs of organic manures and the costs for plant protection operation.

In the Beneficiary category the multiple regression estimated could explain only 33 per cent of the variation (shown in Table 5.21). The R square value was significant at five per cent level. Size group wise the R square value was significant only in the first size group (0.5 - 1.25 acres) and there the value was 0.824 significant at one per cent level.

Table 5.21 Regression coefficients of parameters for tapioca in the Beneficiary category

Size groups	Y intercept	Regression coefficients				R^2 value	F value
		Farm size (acres)	Human labour (mandays)	Fertilizer (kg)	Other capital (Rs.)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0.5 to 1.25 (acres)	3818.87	-4646.19 (-2.624)**	-8.07 (-0.240)	11.15 (1.897)*	0.957 (1.365)	0.8238	8.180***
1.25 to 2.5 (acres)	12004.03	-759.62 (0.156)	-266.50 (0.547)	42.25 (0.906)	-0.939 (-0.558)	0.3649	0.431
Above 2.5 (acres)	-3079.35	1001.35 (1.082)	75.05 (1.242)	5.35 (0.212)	1.594 (1.336)	0.7794	2.650
Combined	1554.08	11.71 (0.032)	14.12 (0.419)	12.07 (1.964)*	0.547 (0.997)	0.3275	2.801**

Figures in parentheses indicate the 't' values

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

Table 5.22 Regression coefficients of parameters for tapioca in the Non-Beneficiary category

Size groups	Y inter-cept	Regression coefficients				$\bar{R}^2$ value	F value
		Farm size (acres)	Human labour (mandays)	Fertilizer (kg)	Other capital (Rs.)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0.5 to 1.25 (acres)	1278.78	1324.64 (1.368)	14.09 (0.748)	6.58 (3.754)***	0.437 (1.545)	0.9112	15.399***
1.25 to 2.5 (acres)	2964.16	516.29 (0.658)	-19.80 (-0.860)	16.87 (2.921)*	-0.324 (-0.615)	0.9123	7.801*
Above 2.5 (acres)	4451.13	-529.73 (-1.297)	-13.99 (-0.288)	10.33 (1.538)	-1.146 (-0.861)	0.8941	4.220
Combined	1809.31	210.84 (1.468)	13.75 (0.992)	7.71 (4.679)***	0.242 (0.875)	0.7400	14.941***

Figures in parentheses indicate 't' values

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

In the Non-Beneficiary category the regression fitted was able to explain 74 per cent of the variability in the value of output (shown in Table 5.22) and the R square value was significant at one per cent level. Size group wise in the Non-Beneficiary category the regression was significant in two cases i.e. in the first and second size groups with R square values 0.911 significant at one per cent level and 0.912 significant at 10 per cent level respectively.

The combined regression analysis of both the categories together was able to explain 58 per cent of the variability in the value of output and the R square value was significant at one per cent level.

Between the two categories, the variables selected were able to explain the variation in the value of output more significantly in the Non-Beneficiary category than in the Beneficiary category.

5.3.3.1 Farm size

Among the variables the regression coefficient of the variable 'Farm size' was found to be non-significant in the case of Beneficiary category. Size group wise it was found significant in the first size group. The value of the regression coefficient was -4646.19 significant at five per cent level. The correlation coefficient between 'Farm size' and the value productivity in the Beneficiary category was non-significant.

In the Non-Beneficiary category also the regression coefficient of the variable 'Farm size' was non-significant. The correlation coefficient of 'Farm size' with the value of output was 0.048 but it was also non-significant. Size group wise analysis also failed to give any significant relationship between these two.

The combined analysis of both the categories together, also failed to establish any significant relationship between these two.

So unlike in the case of coconut and paddy, in the case of tapioca the regression analysis did not indicate any significant relationship between 'Farm size' and the value productivity in either of the categories.

5.3.3.2 Human labour

The regression coefficients of 'Labour' was found to be non-significant in the Beneficiary and Non-Beneficiary categories. Size group wise also the regression did not indicate any significant influence of 'Labour' on the value of output in either of the categories. The combined analysis of both the categories also failed to establish any significant relationship between 'Labour' and the value of output. The correlation coefficients of 'Labour' with the value productivity were 0.034 and 0.300 for the Beneficiary and Non-Beneficiary categories respectively; both were non-significant statistically . Thus the regression analysis for tapioca failed to indicate any significant relationship between the quantity of labour used and the value of output.

5.3.3.3 Fertilizer

The regression coefficient of the variable 'Fertilizer' was found to be significant in the Beneficiary category. The regression coefficient was 12.07 significant at 10 per cent level. Size group wise the coefficient was significant in the first size group where it was 11.15 significant at 10 per cent level. The correlation coefficient of the variable 'Fertilizer' with the value of output was 0.531 in the Beneficiary category significant at one per cent level.

In the Non-Beneficiary category the regression coefficient of the variable 'Fertilizer' was highly significant with a value of 7.71 significant at one per cent level. Size group wise the coefficient was significant in two cases is is in the first and second size groups. The regression coefficients were 6.58 in the first size group significant at one per cent level and 16.87 in the second size group significant at 10 per cent level. The correlation coefficient of 'Fertilizer' with the value of output was 0.825 in the Non-Beneficiary category, significant at one per cent level.

The combined analysis of both the categories together also indicated a significant contribution of 'Fertilizer' to the value of output. The regression coefficient was 7.02 significant at one per cent level.

The Marginal Revenue of 'Fertilizer' in the Beneficiary category was Rs. 12.07 per acre per kilograme of N.P.K. nutrients while that in the Non-Beneficiary category was only Rs. 7.71. The cost of N.P.K. nutrients were worked out to Rs. 3.64 per kilograme of N.P.K. nutrients.

Marginally an investment of Re 1/- as 'Fertilizer' generated an output worth Rs. 3.32 in the Beneficiary category while in the Non-Beneficiary category the output generated was worth only Rs. 2.12. So the productivity of fertilizer was more in the Beneficiary category. For the sample as a whole the Marginal Revenue of 'Fertilizer' was 7.02 and the output generated by the investment of Re 1/- as fertilizer was worth Rs. 1.93.

The regression analysis for tapioca indicated that the variable 'Fertilizer' significantly and positively influence the value of output in both the Beneficiary and Non-Beneficiary categories. The Marginal productivity of the variable 'Fertilizer' was found to be more in the Beneficiary category.

5.3.3.4 Other capital

The regression coefficients of the variable 'Other capital' was non-significant in both Beneficiary and Non-Beneficiary categories. But the correlation coefficients between 'Other capital' and the value of output was highly significant in both the categories. The correlation coefficients were 0.456 in the beneficiary category and 0.636 in the Non-Beneficiary category both significant at one per cent level. In the combined analysis of both the categories together the regression coefficient was highly significant with a value of 0.673 significant at one per cent level. So in the case of tapioca the separate analysis for the two categories did not show any significant contributions of 'Other capital' to the value of output. But the combined analysis of both the categories together indicated highly significant and positive contribution of 'Other capital' to the value of output.

The regression estimated for the crop tapioca was significant in the sample as a whole as well as in the two categories of farms separately.

The regression analysis did not indicate any significant relationship between the variables 'Farm size' and the 'Value of output'. The contribution of the variable 'Labour' to the 'Value of output' was also found to be non-significant. The variable 'Fertilizer' was found to influence the 'Value of output' positively and significantly in both Beneficiary and Non-Beneficiary categories. The Marginal productivity of 'Fertilizer' was more in the Beneficiary category. In the sample as a whole an investment of Rs 1 as fertilizer was able to generate an output worth Rs 1.92. The variable 'Other capital' was found to influence the 'Value of output' significantly in the sample as a whole but for the two categories seperately the contribution of the variable to the 'Value of output' was found to be non-significant.

5.3.4 Banana

The results of the multiple regression analysis for banana are given is tables 5.15, 5.16, 5.23 and 5.24.

For the sample as a whole the regression estimated was able to explain 70 per cent of the variation in the 'Value of output'. In the Beneficiary and Non-Beneficiary categories the regression fitted were able to explain 61 per cent and 76 per cent of the variation in the 'Value of output' respectively. In all the three cases the R square values were significant at one per cent level. The variables selected were found to explain the variation in the 'Value of output' more in the case of the Non-Beneficiary category than in the case of the Beneficiary category.

Table 5.23 Regression coefficients of parameters for banana in the Beneficiary category

Size groups	Y inter-cept	Regression coefficients					$\bar{R}^2$ value	F value
		Farm size (acres)	Human labour (mandays)	Ferti-lizer (kg)	Cost of irrigi-ation (Rs.)	Other capital (Rs.)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0.5 to 1.25 (acres)	3588.01	5696.80 (0.545)	110.26 (1.013)	10.46 (2.885)**	3.228 (1.133)	-0.041 (-0.031)	0.8272	6.703**
1.25 to 2.5 (acres)	40092.74	-1819.82 (-0.060)	-163.06 (-0.283)	6.08 (0.201)	3.751 (0.177)	-1.690 (-0.308)	0.4977	0.396
Above 2.5 (acres)	9672.06	2439.39 (1.199)	-2.51 (-0.020)	14.16 (2.227)	4.107 (2.671)	0.008 (0.009)	0.9378	6.035
Combined	16337.62	2056.92 (1.282)	-59.91 (-0.894)	6.96 (2.241)**	5.105 (3.126)***	0.253 (0.321)	0.6089	7.162***

Figures in parentheses indicate the 't' values

** Significant at 5% level
*** Significant at 1% level

Table 5.24 Regression coefficients of parameters for banana in the Non-Beneficiary category

Size groups	Y inter-cept	Regression coefficients					R^2 value	F value
		Farm size (acres)	Human labour (mandays)	Ferti-lizer (kg)	Cost of irrigi-ation (Rs.)	Other capital (Rs.)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0.5 to 1.25 (acres)	5520.82	19464.52 (0.482)	150.74 (1.575)	15.92 (1.078)	-0.33 (-0.073)	-2.75 (-0.957)	0.8644	5.099
1.25 to 2.5 (acres)	1233.20	-23660.64 (-1.454)	411.52 (0.847)	18.43 (2.257)	9.29 (1.164)	-2.63 (-0.829)	0.9195	4.567
Above 2.5 (acres)	5181.59	-514.37 (-0.483)	4.60 (0.64)	15.87 (5.970)	4.01 (3.485)	0.99 (1.731)	0.9976	83.412
Combined	687.65	-623.31 (-0.397)	144.42 (3.411)**	12.72 (2.618)	1.99 (1.124)	-0.08 (-0.136)	0.7615	12.134**

Figures in parentheses indicate 't' values

** Significant at 5% level

In the beneficiary category; size group wise, R square value was significant only in one size group i.e., in the first size group where the R square value (0.83) was significant at five per cent level. In the Non-Beneficiary category the R square value was found to be non-significant in all the three size groups.

5.3.4.1 Farm size

The regression coefficient of the variable 'Farm size' was found to be non-significant in the two categories as well as in the sample as a whole. In the three size groups of both the categories also it was found to be non-significant.

The correlation coefficient between 'Farm size' and the 'Value of output' (given in Table 5.16) was also found to be non-significant. The probable inference that can be drawn from this is that in the study area the productivity of banana was size neutral.

5.3.4.2 Human labour

The regression coefficient of the variable 'Human labour' was found to be non-significant in the sample as a whole as well as in the Beneficiary category. In the non-Beneficiary category it was found to be significant at five per cent level with a value of 144.42. Size group wise the coefficients were non-significant in all the size groups of the two categories. The correlation between the quantity of 'Human labour' and the 'Value of output' was found to be, non-significant in the Beneficiary category and highly significant in the Non-Beneficiary category (r = 0.56).

5.3.4.3 Fertilizer

The regression coefficient of the variable 'Fertilizer' was found to be significant in the sample as a whole and in the Beneficiary category. The coefficients were 9.04 significant at one per cent level and 6.96 significant at five per cent level, respectively.

In the size groups the regression coefficient of the variable 'Fertilizer' was found significant in the first size group of the Beneficiary category (10.46, significant at five per cent level). In the Non-Beneficiary category the coefficient was found to be significant in none of the cases.

The correlation coefficients between the quantity of 'Fertilizer' and the value of output were found to be 0.647 and 0.722 in the Beneficiary and Non-Beneficiary categories, respectively, both significant at one per cent level.

The correlation coefficients indicated a direct positive relationship between the quantity of 'Fertilizer' and the 'Value of output' in both the categories. But the regression analysis indicated that individual contribution of the variable 'Fertilizer' to the 'Value of output' was significant only in the Beneficiary category.

The marginal cost of 'Fertilizer' was found out and it was Rs. 3.38 per kilograms of N.P.K. nutrients. The marginal revenues found significant were Rs. 9.04 and Rs. 6.96 in the sample as a whole and in the Beneficiary category. The marginal revenue of fertilizer was found to be much higher then the marginal cost.

5.3.4.4 Cost of irrigation

The variable 'Cost of irrigation' found to influence the 'Value of output' in the sample as a whole (the regression coefficient was 3.97 significant at one per cent level) and in the Beneficiary category (the regression coefficient was 5.105 significant at one per cent level). In the Non-Beneficiary category the regression analysis has failed to establish any significant relationship between the two. The regression coefficients were not found to be significant in any of the size groups in the either of the categories.

The correlation coefficients between 'Cost of irrigation' and the 'Value of output' were found to indicate a strong positive linear relationship between these two. The correlation coefficients were 0.666 and 0.713, respectively in the Beneficiary and Non-Beneficiary categories, both significant at one per cent level.

Eventhough the correlation coefficients indicated a significant and direct linear relationship between 'Cost of irrigation' and the 'Value of output' in both the categories, the individual contribution of 'Cost of irrigation' to the 'Value of output' was found to be significant only in the beneficiary category.

5.3.4.5 Other capital

The regression coefficient of 'Other capital' was found to be non-significant in the sample as a whole and in the two categories. Size group wise also it was found to be non-significant. But the correlation coefficients indicated a significant direct linear relationship between 'Other capital' and the 'Value of output'. The correlation coefficients were 0.366 significant at 10 per cent level and 0.506 significant at five per cent level, respectively in the beneficiary and non-beneficiary categories.

The results of the regression analysis for banana can be summarised as follows. The regression estimated was able to explain 70, 61 and 76 per cent variation in the 'Value of output' in the sample as a whole and in the beneficiary and non-beneficiary categories, respectively. Among the independent variables 'Farm size' did not show any significant influence on the 'Value of output'. The variable 'Human labour' was found to contribute to the 'Value of output' significantly in the non-beneficiary category where the MR of 'Human labour' was Rs. 144.42. The variable 'Fertilizer' was found contributing significantly to the 'Value of output' in the sample as a whole and in the beneficiary category. The MR of 'Fertilizer' was found to be Rs. 9.06 per kg of fertilizer in the sample as a whole (MC = Rs. 3.38). The variable 'Cost of irrigation' was found to influence the 'Value of output' in the sample as a whole and in the beneficiary category and marginal revenues were found to be Rs. 3.97 and Rs. 5.11 in the two cases, respectively. The variable 'Other capital' did not show any significant influence on the 'Value of output'.

The discussions on production function analysis can be summarised as follows:

Linear production functions were fitted for the major crops in the study area viz. paddy, coconut, tapioca and banana. In the case of all the four crops the regression estimated was significant.

The variable 'Farm size' was found to have an inverse relationship with the value of output in the case of paddy and coconut in the beneficiary category. Many previous studies had indicated the presence of such inverse relationship. The findings of

Usha Rani (1971), Bhattacharya and Saini (1972), Verma and Pareek (1975), Saini (1979) and Patel (1982) indicated the presence of this inverse relationship. However, in this study the farms are very small - even the largest size group - and also the inverse relationship was found only in the beneficiary category. So the probable conclusion is that the external financial assistance received by the smaller farms are better utilized than the larger farms and so the productivity was found to be higher in the smaller farms, in the beneficiary category. In the non-beneficiary category the regression did not indicate, any significant relationship between 'Farm size' and the value productivity. However, this study cannot clearly explain the reason for the non-occurance of this inverse relationship in the case of tapioca and banana in the beneficiary category. Further studies in this line are suggested to have a better understanding of this problem.

In the analysis the productivity of the variable 'Human labour' was found to be less significant. The marginal revenue (MR) of human labour was found to be significant only in two cases, (seting apart the results of the size group wise analysis) i.e. in the case of paddy (the two categories combined) and in the case of banana (non-beneficiary category). In the case of paddy, eventhough the MR of 'Human labour' was significant; it was less than the marginal cost of labour. So altogether it can be concluded that human labour was less productive in the study area.

Fertilizer was the only variable which showed a consistent positive contribution to the output (except in two cases i.e., in the beneficiary category of coconut and in the non-beneficiary category of banana; where the marginal revenues were found to be non-significant). In all the cases where the MR of fertilizer was found to be significant, the MR was significantly higher than the marginal cost of fertilizer.

The marginal revenue of the variable 'Cost of irrigation' was found to be significant except in the case of banana in the non-beneficiary category.

The variable 'Other capital' was found to contribute to the value of output significantly in five cases (seting apart the results of the size group wise analysis) i.e. in the case of coconut (beneficiary category, non-beneficiary category and combined) and tapioca (beneficiary and non-beneficiary categories combined). But in the case of tapioca the MR of 'Other capital' was less than one rupee, indicating the low productivity of 'Other capital' in the case of tapioca.

The final conclusions that can be drawn from the production function analysis are

1) Fertilizer followed by irrigation are the most productive forms of capital, with consistent positive contribution to the output

2) External financial assistance might have helped the small farmers in the beneficiary category (particularly in the case of paddy and coconut) to operate more efficiently than the larger farmers

3) The input 'Human labour' was found to be less productive in all the cases and so diversion of funds, used for this input in favour of fertilizers and irrigation, to a certain extent, may be helpful for increasing the net farm income

5.4 Results and discussions on linear programming analysis

Linear programming analysis was done to generate optimum crop plans for the representative farms in the beneficiary and non-beneficiary categories. The results of the analysis and the discussions thereon follows:

The programming was done under three situations

(A) Optimum crop plans under the existing technology with the existing levels of availability of resources (B) Optimum crop plans under the existing technology with capital borrowing activity to the extent of 50 per cent of the available capital (C) Optimum crop plans under improved technology along with relaxation of the capital constraint.

Since the adoption of improved technology necessitates the availability of irrigation facilities additional capacity to the existing irrigation systems were also assumed to generate the optimum plans in the third situation.

The net farm incomes under the three situations were worked out for the two categories.

The requirement of working capital for the optimum plans were also worked out. The amount of working capital used in the existing crop plan was taken as the available capital and the additional dose of capital required for the optimum crop plan under the improved technology was assumed as the credit gap for the adoption of the improved technology.

5.4.1 Input coefficients, resources constraints and net margins

The input coefficients, levels of resource restriction and net margins for the crop activities in the two categories are given size group wise in the Tables 5.25 to 5.32.

The input bullock labour was used only for paddy crop in both the categories. The input irrigation was used for coconut and banana crop activities in the beneficiary category and coconut crop activity in the non-beneficiary category.

5.4.1.1 Beneficiary category

Input coefficients, resource restriction levels and net margins of crop activities for the beneficiary category are given size group wise in the Tables 5.25 to 5.28.

In the first size group (0.5 to 1.25 acres) among the different crop activities banana had the highest requirement of irrigation and working capital (175 hours and Rs. 11,011.13 per acre, respectively). In the case of the first and second season human labour, paddy was the activity with the highest requirement (53.32 mandays and 58.43 mandays per acre, respectively. Among the four crops, banana had the highest net margin (Rs. 13,573.47 per acre) followed by coconut (Rs. 4,125.60 per acre).

In the second size group (1.25 to 2.5 acres) banana showed the highest per acre requirement of all the inputs except the first season human labour (53.70

Table 5.25 Input coefficients, resource availability and net margins of crop activities size group I (0.5 to 1.25 acres) of the beneficiary category

Inputs		Input coefficients/acre				Resource availability
		Paddy	Coconut	Tapioca	Banana	
(1)		(2)	(3)	(4)	(5)	(6)
Land (acres)	Wet land	1.00	0.00	0.00	0.00	0.50
	Garden land	0.00	1.00	0.00	0.00	0.61
	Total land	0.00	0.00	1.00	1.00	1.11
Bullock labour (days)	First season	5.16	0.00	0.00	0.00	1.70
	Second season	5.26	0.00	0.00	0.00	1.73
Human labour (mandays)	First season	53.32	26.56	21.42	27.67	36.00
	Second season	58.43	15.59	14.89	44.42	38.00
Irrigation (hours)		0.00	32.21	0.00	175.60	80.00
Working capital (rupees)		5833.96	2543.15	2848.30	11011.13	4550.00
Net margins/acre (rupees)		1643.20	4125.60	1068.30	13573.47	

Table 5.26 Input coefficients, resource availability and net margins of crop activities size group II (1.25 to 2.5 acres) of the beneficiary category

Inputs		Input coefficients/acre				Resource availability
		Paddy	Coconut	Tapioca	Banana	
(1)		(2)	(3)	(4)	(5)	(6)
Land (acres)	Wet land	1.00	0.00	0.00	0.00	0.81
	Garden land	0.00	1.00	0.00	0.00	1.41
	Total land	0.00	0.00	1.00	1.00	2.22
Bullock labour (days)	First season	5.21	0.00	0.00	0.00	4.20
	Second season	5.28	0.00	0.00	0.00	4.25
Human labour (mandays)	First season	49.22	27.29	25.92	31.21	73.00
	Second season	53.45	17.45	12.76	53.70	80.00
Irrigation (hours)		0.00	35.05	0.00	180.68	243.00
Working capital (rupees)		5761.02	2676.55	2590.90	11294.85	10485.00
Net margins/acre (rupees)		924.14	4019.16	1032.70	11646.90	

Table 5.27 Input coefficients, resource availability and net margins of crop activities size group III (above 2.5 acres) of the beneficiary category

Inputs		Input coefficients/acre				Resource availability
		Paddy	Coconut	Tapioca	Banana	
(1)		(2)	(3)	(4)	(5)	(6)
Land (acres)	Wet land	1.00	0.00	0.00	0.00	1.82
	Garden land	0.00	1.00	0.00	0.00	2.23
	Total land	0.00	0.00	1.00	1.00	4.05
Bullock labour (days)	First season	5.31	0.00	0.00	0.00	5.80
	Second season	5.41	0.00	0.00	0.00	5.90
Human labour (mandays)	First season	51.69	29.65	24.43	34.02	133.00
	Second season	50.89	13.95	16.67	55.50	139.00
Irrigation (hours)		0.00	38.50	0.00	185.80	440.00
Working capital (rupees)		5737.04	2502.90	2439.98	10624.55	17300.00
Net margins/acre (rupees)		882.74	3518.83	952.90	12144.70	

Table 5.28 Input coefficients, resource availability and net margins of crop activities all size groups combined - beneficiary category

Inputs		Input coefficients/acre				Resource availability
		Paddy	Coconut	Tapioca	Banana	
(1)		(2)	(3)	(4)	(5)	(6)
Land (acres)	Wet land	1.00	0.00	0.00	0.00	1.12
	Garden land	0.00	1.00	0.00	0.00	1.98
	Total land	0.00	0.00	1.00	1.00	3.10
Bullock labour (days)	First season	5.23	0.00	0.00	0.00	4.10
	Second season	5.32	0.00	0.00	0.00	4.21
Human labour (mandays)	First season	51.39	27.34	23.06	30.84	102.00
	Second season	54.12	16.05	15.38	50.70	100.00
Irrigation (hours)		0.00	34.60	0.00	178.70	275.00
Working capital (rupees)		5826.74	2573.62	2658.24	10982.70	14900.00
Net margins/acre (rupees)		1019.50	3891.12	1025.00	12647.90	

mandays of second season human labour, 180.63 hours of irrigation and Rs. 11,294.85 as working capital). Paddy showed the highest requirement of the first season human labour (49.22 mandays per acre). Net margin of banana was the highest (Rs. 11,646.90 per acre) followed by coconut (Rs. 4,019.16 per cent).

In the third size group (above 2.5 acres) the highest requirement of second season human labour, irrigation and working capital was for banana (55.50 mandays, 185.80 hours of Rs. 10,624.55, respectively per acre). Paddy showed the highest per acre requirement of first season human labour (51.69 mandays). The highest net margin was for banana (Rs. 12,144.70 per acre) followed by the coconut (Rs. 3,518.83 per acre).

In the combined set of all the size groups, in the case of inputs viz. second season human labour, irrigation and other capital, banana showed the highest requirement (50.70 mandays, 178.70 hours and Rs.10,982.70, respectively per acre). For first season human labour, paddy showed the highest per acre requirement (51.39 mandays). The net margin was the highest for banana (Rs. 12,647.90 per cent) followed by coconut (Rs.3,891.12 per acre).

5.4.1.2 Non-beneficiary category

The input coefficients, resource restriction levels and the net margins of the crop activities for the non-beneficiary category are given size group wise in the Tables 5.29 to 5.32.

In the case of the first size group the requirement per acre of second season human labour, irrigation and working capital were the highest for banana (45.91 mandays, 155.08 hours and Rs. 6,593.40, respectively). Paddy showed the highest per acre requirement of first season human labour (37.70 mandays).

The highest net margin was for banana (Rs.8,803.90 per acre) followed by coconut (Rs. 3,258.71 per acre).

The situation was similar in the second size group also. Among the crop activities, banana came first with the highest per acre requirement of second season human labour, irrigation and working capital (50.31 mandays, 158.56 hours and Rs. 7,064.30, respectively). Paddy showed the highest per acre requirement of first season human labour (43.93 mandays). The net margin was the highest for banana (Rs. 11,365.20 per acre) followed by coconut (Rs. 3,018.36 per acre).

In the third size group also the highest per acre requirement of second season human labour, irrigation and working capital was for banana (54.07 mandays, 167.96 hours and Rs. 8,901.84). Paddy showed the highest

Table 5.29 Input coefficients, resource availability and net margins of crop activities size group I (0.5 to 1.25 acres) of the non-beneficiary category

Inputs		Input coefficients/acre				Resource availability
		Paddy	Coconut	Tapioca	Banana	
(1)		(2)	(3)	(4)	(5)	(6)
Land (acres)	Wet land	1.00	0.00	0.00	0.00	0.38
	Garden land	0.00	1.00	0.00	0.00	0.64
	Total land	0.00	0.00	1.00	1.00	1.02
Bullock labour (days)	First season	4.16	0.00	0.00	0.00	1.15
	Second season	4.21	0.00	0.00	0.00	1.15
Human labour (mandays)	First season	37.70	25.09	20.61	31.91	34.00
	Second season	40.17	14.47	11.43	45.91	33.00
Irrigation (hours)		0.00	0.00	0.00	155.08	53.00
Working capital (rupees)		4322.00	1823.00	1962.31	6593.40	2670.00
Net margins/acre (rupees)		882.94	3258.71	1010.96	8803.90	

Table 5.30 Input coefficients, resource availability and net margins of crop activities size group II (1.25 to 2.50 acres) of the non-beneficiary category

Inputs		Input coefficients/acre				Resource availability
		Paddy	Coconut	Tapioca	Banana	
(1)		(2)	(3)	(4)	(5)	(6)
Land (acres)	Wet land	1.00	0.00	0.00	0.00	0.95
	Garden land	0.00	1.00	0.00	0.00	1.07
	Total land	0.00	0.00	1.00	1.00	2.02
Bullock labour (days)	First season	4.69	0.00	0.00	0.00	5.00
	Second season	5.12	0.00	0.00	0.00	5.02
Human labour (mandays)	First season	43.93	25.81	20.70	27.40	67.00
	Second season	45.21	15.23	14.67	50.31	73.00
Irrigation (hours)		0.00	0.00	0.00	158.56	90.00
Working capital (rupees)		5052.00	1800.98	1786.35	7064.30	5310.00
Net margins/acre (rupees)		245.06	3018.36	1102.40	11365.20	

Table 5.31 Input coefficients, resource availability and net margins of crop activities size group III (above 2.5 acres) of the non-beneficiary category

Inputs		Input coefficients/acre				Resource availability
		Paddy	Coconut	Tapioca	Banana	
(1)		(2)	(3)	(4)	(5)	(6)
Land (acres)	Wet land	1.00	0.00	0.00	0.00	1.58
	Garden land	0.00	1.00	0.00	0.00	2.07
	Total land	0.00	0.00	1.00	1.00	3.65
Bullock labour (days)	First season	5.15	0.00	0.00	0.00	6.00
	Second season	5.31	0.00	0.00	0.00	6.00
Human labour (mandays)	First season	51.02	27.69	21.31	29.00	120.00
	Second season	48.64	15.26	14.20	54.07	128.00
Irrigation (hours)		0.00	0.00	0.00	167.96	160.00
Working capital (rupees)		5843.88	1996.42	1863.74	8901.84	10880.00
Net margins/acre (rupees)		258.12	2985.13	1289.40	10073.30	

Table 5.32 Input coefficients, resource availability and net margins of crop activities for all the size groups combined for the non-beneficiary category

Inputs		Input coefficients/acre				Resource availability
		Paddy	Coconut	Tapioca	Banana	
(1)		(2)	(3)	(4)	(5)	(6)
Land (acres)	Wet land	1.00	0.00	0.00	0.00	0.98
	Garden land	0.00	1.00	0.00	0.00	1.45
	Total land	0.00	0.00	1.00	1.00	2.43
Bullock labour (days)	First season	4.89	0.00	0.00	0.00	4.60
	Second season	5.20	0.00	0.00	0.00	4.80
Human labour (mandays)	First season	42.98	25.86	20.40	28.50	80.00
	Second season	45.43	14.57	13.60	51.36	84.00
Irrigation (hours)		0.00	0.00	0.00	160.50	157.00
Working capital (rupees)		5086.74	1863.96	1881.59	8523.14	9530.00
Net margins/acre (rupees)		520.02	2985.82	1114.10	9978.90	

requirement of first season human labour (51.02 mandays per acre). The highest net margin was for banana (Rs. 10,073.30 per acre) followed by coconut (Rs.2,985.13 per acre).

In the combined set of all the size groups banana showed the highest per acre requirement of second season human labour, irrigation and working capital (51.36 mandays, 160.50 hours and Rs. 8,523.14). The requirement per acre of first season human labour was the highest for paddy (42.98 mandays). The highest net margin was for banana (Rs. 9,978.90 per acre) followed by coconut (Rs. 2,985.82 per acre).

5.4.2 Study of the optimal crop plans

The optimal crop plans developed under the three situations viz. A, B and C are discussed below:

5.4.2.1 Optimum crop plans under the existing technology with the existing levels of resources (situation A)

The existing crop plans and the optimum crop plans generated are given in Table 5.33 and 5.34.

5.4.2.1.1 Beneficiary category

For all the size groups and the combined set, the optimum plans completely excluded paddy crop.

Table 5.33 Existing and optimum crop plans under existing technology - beneficiary category

Crops	Size group I (0.5 to 1.25 acres)			Size group II (1.25 to 2.50 acres)			Size group III (above 2.50 acres)			Combined		
	Area in acres		% age change of the second over the first	Area in acres		% age change of the second over the first	Area in acres		% age change of the second over the first	Area in acres		% age change of the second over the first
	Under existing plan	Under optimum plan		Under existing plan	Under optimum plan		Under existing plan	Under optimum plan		Under existing plan	Under optimum plan	
Paddy	0.32	0.00	-100.00	0.81	0.00	-100.00	1.10	0.00	-100.00	0.70	0.00	-100.00
Coconut	0.28	0.52	85.71	0.88	1.41	60.23	1.55	2.23	43.87	1.20	1.92	60.00
Tapioca	0.37	0.40	8.11	0.30	0.28	-6.67	1.05	0.93	-11.43	0.82	0.36	-56.08
Banana	0.14	0.19	35.71	0.23	0.53	130.43	0.35	0.89	154.29	0.38	0.82	115.79
Net farm income (Rs)	3950.00	5151.59	30.42	7838.00	12098.37	54.35	12120.00	19578.88	61.54	12080.00	18211.23	50.75

The reason was that among the four crops, paddy was the least remunerative activity.

In the first size group the size of the model farm was 1.11 acres and the optimum plan showed an increase of 85.71 per cent, 35.71 per cent and 8.11 per cent in the area under coconut, banana and tapioca. The optimum plan showed the potential for increasing the net income to the extent of 30.42 per cent over the existing income.

In the second size group (size of the model farm = 2.22 acres) there was 60.23 per cent increase in the area under coconut and 130.43 per cent increase in the area under banana. Area under tapioca decreased by 6.67 per cent. The optimum plan showed the possibility of producing 54.35 per cent increase in net farm income.

In the third size group (size of model farm = 4.05 acres) there was 43.87 per cent and 154.29 per cent increase in the area under coconut and banana, respectively. Area under tapioca decreased by 11.43 per cent. The increase in income anticipated by the optimum plan was 61.54 per cent.

In the combined set of all the size groups in the beneficiary category the size of the model farm was

3.1 acres and just as in the case of the different size groups, paddy was completely eliminated in the optimum plan. Area under coconut and banana increased by 60 and 115.79 per cent, respectively. Area under tapioca decreased by 56.08 per cent. The optimum plan showed the possibility of increasing the net income to the extent of 50.75 per cent.

In absolute terms, the optimum crop plans synthesized in the beneficiary category, showed the potential for increasing the net farm income to the extent of Rs. 1,201.59 (Rs. 1,082.51 per acre) Rs. 4,260.37 (Rs. 1,919.09 per acre), Rs. 7,458.88 (Rs. 1,841.70 per acre) and Rs. 6,131.23 (Rs. 1,977.82 per acre) in the first, second and third size groups and in the combined set, respectively.

All the four optimum crop plans generated in the beneficiary category showed the potential for increasing the net income by the re-organization of the resources. The highest increase over the existing income was noticed in the third size group (61.54 per cent) followed by the second size group (54.35 per cent).

All the optimum plans, showed the general trend of increasing the area under coconut and banana. Area under tapioca, decreased in the optimum plans, except in the first size group.

5.4.2.1.2 Resource utilization by the optimal plans under situation A in the beneficiary category

Among the different inputs, land and working capital were completely utilized in the optimal plans. Since paddy crop was absent in the optimum plans, the resource bullock labour was left fully unutilized. The utilization of the other resources viz. first season human labour, second season human labour and irrigation were, respectively 27.64 mandays (76.77 per cent), 22.50 mandays (59.22 per cent) and 50.11 hours (62.64 per cent) in the first size group, 62.28 mandays (85.31 per cent), 56.64 mandays (73.56 per cent) and 145.18 hours (59.75 per cent) in the second size group, 119.12 mandays (89.56 per cent), 96.01 mandays (69.07 per cent) and 251.22 hours (57.09 per cent) in the third size group and 86.08 mandays (84.40 per cent) 77.93 mandays (97.41 per cent) and 212.97 hours (85.19 per cent) in the combined set.

5.4.2.1.3 Non-beneficiary category

Table 5.34 gives the existing and optimum crop plans in the non-beneficiary category

Just like in the case of the beneficiary category here also paddy has been excluded completely in all the optimum plans.

Table 5.34 Existing and optimum crop plans under existing technology - non-beneficiary category

Crops	Size group I (0.5 to 1.25 acres)			Size group II (1.25 to 2.50 acres)			Size group III (above 2.50 acres)			Combined		
	Area in acres		% age change of the second over the first	Area in acres		% age change of the second over the first	Area in acres		% age change of the second over the first	Area in acres		% age change of the second over the first
	Under existing plan	Under optimum plan		Under existing plan	Under optimum plan		Under existing plan	Under optimum plan		Under existing plan	Under optimum plan	
Paddy	0.25	0.00	-100.00	0.95	0.00	-100.00	1.20	0.00	-100.00	0.83	0.00	-100.00
Coconut	0.35	0.52	48.57	0.85	1.07	25.88	1.14	2.07	81.58	0.85	1.35	58.82
Tapioca	0.34	0.34	0.00	0.08	0.63	687.50	1.00	1.04	0.04	0.40	0.33	-17.50
Banana	0.08	0.16	100.00	0.14	0.32	128.57	0.31	0.54	74.19	0.35	0.75	200.00
Net farm income (Rs)	2300.00	3446.88	49.86	4120.00	7524.65	82.64	7900.00	12950.31	63.93	6900.00	11880.87	72.18

In the first size group there was 48.57 per cent and 100 per cent increase in the area under coconut and banana, respectively. Area under tapioca did not show any change. The net farm income increased by 49.86 per cent.

The optimum crop plan in the second size group showed increase in the area under all crops except paddy. There was an increase of 25.88 per cent 687.50 per cent and 128.57 per cent in the area under coconut, tapioca and banana, respectively. The net farm income increased by 82.64 per cent by the adoption of the optimum plan.

In the third size group also the optimum plan showed increase in the area under all the crops except paddy. The area under coconut, tapioca and banana increased by 81.58 per cent, 0.04 per cent and 74.19 per cent, respectively. The optimum plan has shown the possibility of increasing the net farm income by 63.93 per cent.

In the combined set of all the size groups the optimum plan showed an increase of 58.82 per cent and 200 per cent in the area under coconut and banana, respectively. The area under tapioca decreased by 17.50 per cent. The net income was found to increase by 72.18 per cent.

The optimal crop plans developed for the non-beneficiary category were found to increase the net farm income by Rs. 1,146.88 (Rs. 1,224.39 per acre), Rs.3,404.65 (Rs. 1,685.47 per acre) Rs. 5,050.31 (Rs. 1,383.65 per acre) and Rs. 4,980.87 (Rs. 2,049.74 per acre) in the first, second and third size groups and in the combined set, respectively.

All the optimum crop plans generated for the non-beneficiary category showed the possibility of increasing the net farm income. Among the size groups the highest increase in income over the existing level was noticed in the case of the second size group (82.64 per cent) followed by the third size group (63.93 per cent).

The area under coconut and banana were found to increase by the adoption of the optimum plan. Area under tapioca was found, to remain the same in the first size group, increase in the second and third size groups and decrease in the combined set.

5.4.2.1.4 Resource utilization by the optimal plans under situation A, in the non-beneficiary category

The optimal plan completely utilized the land and capital resources in all the four cases. Since paddy crop was completely excluded in the optimum plans, the resource bullock labour was left fully unutilized. The utilization of the first and second season labour and irrigation were 25.16 mandays (74 per cent) 18.77 mandays (56.87 per cent) and 24.81 hours (46.82 per cent) in the first size group, 49.43 mandays (73.77 per cent), 41.64 mandays (57.04 per cent) and 50.74 hours (56.38 per cent) in the second sige group, 95.14 mandays (79.28 per cent) 75.55 mandays (59.03 per cent) and 90.70 hours (56.69 per cent) in the third size group and 63.02 mandays (78.77 per cent), 62.68 mandays (74.62 per cent) and 120.38 hours (76.67 per cent) in the combined set.

To conclude the discussions on the optimal crop plans under situation A; the optimal plans for all the size groups in the two categories were found to exclude paddy crop, the reason being that, paddy was highly input intensive but the least remunerative of all the crops. (Except in the first size group of the beneficiary category where tapioca was found to be the least remunerative activity. But there also paddy was absent in the optimal plan because, tapioca utilizes lower levels of inputs, compared to paddy. Incput use per rupees of net margin was found to be the highest for paddy in all the size groups of both the categories).

The area under coconut and banana were found to increase in all the size groups of both the categories. The optimum crop plans have shown the potential for increasing the farm income by the optimum use of the existing resources to the extent of 50.75 per cent in the beneficiary category and 72.18 per cent in the non-beneficiary category. For all the size groups the increase in net farm income by the optimum crop plans were higher in the non-beneficiary category farms then in the beneficiary category farms. This indicates that the existing pattern of input use was more towards optimum in the beneficiary category than in the non-beneficiary category.

The highest increase in the net farm income by optimization was noticed in the case of the third size group in the beneficiary category and second size group in the non-beneficiary category.

The optimal plans under situation A has completely utilized the land and the capital resources in both the categories. There was displacement of human labour to the extent of 15.60 per cent in the first season and 2.59 per cent in the second season and the unused irrigation potential was 14.81 per cent, in the beneficiary category. In the non-beneficiary category the human labour displacement by the optimal plan under situation A were 21.23 per cent and 25.38 per cent in the first and second season and the unutilized irrigation potential was 23.33 per cent.

Many studies done previously had indicated the potential for increasing the farm income even under the existing technology, just by the re-organization of the existing resources. Ramanna (1966), Singh et al. (1972), Shanmugam (1979), Nagaraja (1982) and Jayachandran (1985), had shown that, even under the currently practised technologies, net farm income could be increased substantially, just by the re-allocation and judicious use of the existing resources.

5.4.2.2 Optimum crop plans under the existing technology with capital borrowing activity to the extent of 50 per cent of the available capital.(situation B).

Optimum crop plans were developed by increasing the capital availability by 50 per cent over the existing level. Table 5.35 and 5.36 gives the optimum crop plans with the available capital and with 50 per cent increase in capital in the two categories.

5.4.2.2.1 Beneficiary category

Optimum crop plans with the relaxation of the capital constraint, for the beneficiary category are given in table 5.35 . In the optimum plans a general shift from the less remunerative crops - tapioca and coconut - to the more remunerative crop - banana - was evident.

Banana was the most remunerative of all the crops and the area under banana was restricted mainly by the capital

Table 5.35 Optimum plans under existing technology with capital restriction and capital relaxation - beneficiary category

Crops	Size group I (0.5 to 1.25 acres)			Size group II (1.25 to 2.50 acres)			Size group III (above 2.50 acres)			Combined		
	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first
	With existing capital	With 50% increase in capital		With existing capital	With 50% increase in capital		With existing capital	With 50% increase in capital		With existing capital	With 50% increase in capital	
Paddy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coconut	0.52	0.59	13.46	1.41	1.08	-23.40	2.23	2.10	-5.83	1.92	1.92	0.00
Tapioca	0.40	0.17	-57.50	0.28	0.00	-100.00	0.93	0.00	-100.00	0.36	0.00	-100.00
Banana	0.19	0.35	84.21	0.53	1.14	115.09	0.89	1.95	119.10	0.82	1.18	43.90
Net farm income (Rs)	5151.59	7366.43	42.99	12098.37	17584.19	45.34	19578.88	31039.44	58.54	18211.23	22395.47	22.98

constraint (The requirement of working capital was also the highest for banana). So when the capital constraint was relaxed there was a general shift in the area under other crops towards banana.

In the first size group the area under coconut and banana increased by 13.46 per cent and 84.21 per cent. Area under tapioca decreased by 57.50 per cent. The net farm income was 42.99 per cent higher than that under situation A and 86.49 per cent higher than the existing plan.

In the second size group the new plan showed a decrease in the area under coconut and tapioca. (23.40 per cent and 100 per cent respectively). The area under banana increased by 115.09 per cent. The net farm income showed an increase of 45.34 per cent, over that under situation A and 124.35 per cent over the existing plan.

The new optimal plan in the third size group also, showed a reduction in the area under coconut and tapioca (5.38 per cent and 100 per cent respectively). The area under banana increased by 119.10 per cent. There was an increase of 58.54 per cent in net farm income over that of situation A and 156.10 per cent over that of the existing plan.

In the combined set of all the size groups the area under banana was found to increase by 43.90 per cent. The area under tapioca was found to decrease by 100 per cent. The area under coconut was unaffected. Net farm income was 22.98 per cent higher in the new optimum plan over that of situation A and 85.39 per cent over that of the existing plan.

Among the three size groups the highest increase in the net farm income by the new optimal plan under situation B was noticed in the case of the third size group (58.54 per cent) followed by the second size group (45.34 per cent).

The new optimum plans showed the potential for increasing the net farm incomes to the extent of Rs.2,214.84 (Rs.1,995.35 per acre), Rs.5,485.82 (Rs.2,471.09 per acre), Rs.11,460.56 (Rs. 2,828.77 per acre) and Rs. 4,184.24 (Rs. 1,349.75 per acre) in the first, second and third size groups and in the combined set, respectively, by the increased availability of capital to the extent of 50 per cent of the existing capital in the beneficiary category.

5.4.2.2.2 Resource utilization by the optimal plans under situation - B in the beneficiary category

All the four optimal plans generated have fully utilized the land and the irrigation resources. The other resources that were utilized fully are second season human labour and working capital in the second size group and working capital in the third size group. Bullock labour was left unutilized. The actual and percentage utilization of other partially utilized resources are as follows:- First season human labour (29.00 mandays and 80.54 per cent), second season human labour (27.28 mandays and 71.78 per cent) and working capital (Rs. 5838.57 and 85.55 per cent of the total capital after relaxation) in the first size group and first season human labour (65.05 mandays and 89.11 per cent) in the second size group, first season human labour (128.60 mandays and 96.69 per cent) and second season human labour (137.52 mandays and 96.63 per cent) in the third size groups and first season human labour (88.88 mandays and 87.14 per cent), second season human labour (90.64 mandays and 90.64 per cent) and working capital (Rs. 17900.94 and 80.09 per cent of the total capital after relaxation) in the combined set.

The resource utilization was found to be higher in all the optimal plans under situation B compared to the optimal plans under situation A. The increased use of the resources viz. first season human labour, second season human labour, irrigation and working capital, in situation B over that of situation A were 1.36 mandays (4.92 per cent), 4.78 mandays (21.24 percent), 29.89 hours (59.65 per cent) and Rs. 1288.57 (28.32 per cent), respectively in the first size group, 2.77 mandays (4.45 per cent), 23.42 mandays (41.35 per cent), 97.82 hours (67.38 per cent) and Rs. 5281.80 (50.37 per cent), respectively in the second size group, 9.48 mandays (7.96 per cent) 41.51 mandays (43.24 per cent), 188.78 hours (75.15 per cent) and Rs. 8673.96 (50.14 per cent), respectively in the third size group and 2.8 mandays (3.25 per cent) 12.71 mandays (16.31 per cent), 62.03 hours (29.13 per cent) and Rs. 3000.94 (20.14 per cent), respectively in the combined set.

Percentage increase in input utilization after the relaxation of the capital restriction was found to be more for irrigation and it was followed by working capital, second season human labour and first season human labour.

5.4.2.2.3 Non-beneficiary category

Similar to the case of the beneficiary category, here also the area under banana was found to increase by the relaxation of the capital restriction (Table 5.36). The area under tapioca was found to decrease in the new plan. The area under coconut was found to increase in some cases and found to remain the same in some other cases.

The new optimal plan in the first size group showed 15.38 per cent and 112.50 per cent increase in the area under coconut and banana, respectively. The area under tapioca was found to decrease by 76.47 per cent. There was an increase of 45.91 per cent in the net farm income over that under situation A and 118.67 per cent over that of the existing plan.

Table 5.36 Optimum plans under existing technology with capital restriction and capital relaxation - non-beneficiary category

Crops	Size group I (0.5 to 1.25 acres)			Size group II (1.25 to 2.50 acres)			Size group III (above 2.50 acres)			Combined		
	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first
	With existing capital	With 50% increase in capital		With existing capital	With 50% increase in capital		With existing capital	With 50% increase in capital		With existing capital	With 50% increase in capital	
Paddy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coconut	0.52	0.60	15.38	1.07	1.07	0.00	2.07	2.07	0.00	1.35	1.45	7.40
Tapioca	0.34	0.08	-76.47	0.63	0.38	-39.68	1.04	0.62	-40.38	0.33	0.00	-100.00
Banana	0.16	0.34	112.50	0.32	0.57	78.13	0.54	0.96	77.78	0.75	0.98	30.67
Net farm income (Rs)	3446.88	5029.43	45.91	7524.65	10122.82	34.53	12950.31	16632.18	28.43	11880.87	14108.76	18.75

In the second size group the new plan showed a decrease of 39.68 per cent in the area under tapioca and an increase of 78.13 per cent in the area under banana. The area under coconut remained without change. The net farm income was found to increase by 34.53 per cent over that of situation A and 145.70 per cent over that of the existing plan.

In the third size group the area under tapioca was reduced by 40.38 per cent, the area under banana increased by 77.88 per cent and the net income increased by 28.43 per cent, over that of situation A and 110.53 per cent over that of the existing plan. The area under coconut remained without change.

In the combined set the area under coconut and banana were found to increase by 7.40 per cent and 130.67 per cent, respectively. There was 100 per cent reduction in the area under tapioca. The net income was found to increase by 18.75 per cent over that of situation A and 104.47 per cent over that of the existing plan.

The highest increase in the net farm income was noticed in the first size group followed by the second size group.

The optimum plan under situation B in the non-beneficiary category has shown the potential for increasing the net farm income by the relaxation of the capital constraint in all the size groups. The absolute increase in net income contemplated by the new optimal plans were Rs. 1,582.55 (Rs. 1,551.52 per acre), Rs. 2,598.17 (Rs. 1,286.22 per acre), Rs. 3,681.87 (Rs. 1,008.73 per acre) and Rs. 2,227.89 (Rs. 916.83 per acre) in the first, second and third size groups and in the combined set.

5.4.2.2.4 Resource utilization by the optimal plans under situation B in the non-beneficiary category

With the relaxation of the capital constraint the input utilization has changed over that of situation A. The land and the irrigations resources were fully utilized. Since paddy was not present in the optimal plans, the resource bullock labour was left unutilized. The actual and percentage utilization of the other resources were as follows. The utilization of first season human labour, second season human labour and working capital were 27.55 mandays (81.04 per cent) 25.21 mandays (76.38 per cent) and Rs. 3,492.52 (87.20 per cent); respectively in the first size group, 51.10 mandays (76.27 per cent), 50.55 mandays (69.24 per cent) and Rs. 6,632.49 (83.27 per cent), respectively in the second size group, 98.37 mandays (81.98 per cent), 92.30 mandays (72.11 per cent) and Rs. 13,833.88

(84.77 per cent) in the third size groups and 65.43 mandays (81.78 per cent), 71.46 mandays (85.07 per cent) and Rs. 11,055.42 (77.34 per cent) in the combined set.

There was appreciable increase in the utilization of inputs by the relaxation of the capital constraint. The increase in input utilization in the optimal plans under situation B over that of situation A are as follows. The absolute and relative increase in the utilization of inputs viz. first season human labour, second season human labour, irrigation and working capital were 2.39 mandays (9.50 per cent), 6.44 mandays (34.31 per cent), 28.19 hours (113.62 per cent) and Rs. 822.54 (30.81 per cent), respectively in the first size group, 1.67 mandays (3.38 per cent), 8.91 mandays (21.40 per cent), 39.26 hours (77.37 per cent) and Rs. 1,322.49 (24.91 per cent), respectively inthe second size group, 3.23 mandays (3.39 per cent), 16.75 mandays (22.17 per cent), 69.30 hours (76.41 per cent) and Rs. 2,953.88 (27.15 per cent), respectively in the third size group and 2.41 mandays (3.82 per cent), 8.78 mandays (14.01 per cent), 36.62 hours (30.42 per cent) and Rs. 1,525.42 (16.01 per cent), respectively in the combined set. In all the size groups and in the combined set the highest percentage increase in resource utilization was noticed in the case of irrigation.

The discussions on the optimal crop plans under situation B can be summarised as follows. Capital constraint relaxation in all the situations produced an increase in the net farm income. This increase was found to be higher in the beneficiary category than that in the non-beneficiary category (except in the first size group). That is, the anticipated increase in income by the relaxation of the capital constraint was found to be higher in the beneficiary category. This may seem to be contradictory because the capital input is expected to be more crucial for the non-beneficiary farmers. But in this programming the availability of capital alone was increased, the levels of all other inputs (constraints) were kept fixed at the existing level. In the beneficiary category where the farmers were found using higher levels of all the inputs (as evident in section 5.1), the re-allocation was more flexible. But in the non-beneficiary category where the existing levels of input use were significantly lower than the beneficiary category, the re-allocation after the relaxation of the capital constraint was more restricted. So the relative increase in net income after the relaxation of the capital constraint was found to be more in the beneficiary category, than that in the non-beneficiary category.

The optimal plans under situation B has shown increased potential for the utilization of all the resources over that of situation A. In the beneficiary category the employment potential of human labour has increased by 3.25 per cent and 16.31 per cent in the first and the second season by the increased provision of capital. The utilization of irrigation has increased by 29.13 per cent and that of capital by 20.14 per cent. In the non-beneficiary category the consumption of human labour has increased by 3.82 per cent and 14.01 per cent in the first and the second season and irrigation by 30.42 per cent and capital by 16.01 per cent.

Many previous studies had indicated the possibility of increasing the farm income even under the existing technology, by the relaxation of the capital constraint. Sirohi and Gangwar (1968) noticed 52 per cent increase in net returns by the removal of the capital restriction. Dahia (1975) indicated an increase of 30 per cent in net returns just by the removal of the capital restriction.

Misra (1975), Gangwar and Gakhar (1976) also got similar results. The optimum crop plans developed by Arora and Prasad (1978) had shown that by additional borrowing 10 to 20 per cent increase in farm income was possible.

5.3.2.3 Optimum crop plans under the improved technology with the relaxation of the capital constraint and assuming additional capacity to the existing irrigation systems

The optimum crop plans under the existing technology and that under the improved technology are presented in the Tables 5.38 and 5.39.

The inputs coefficients of crop activities and the net margins used, for generating optimum crop plans under the improved technology are given in Table 5.37.

5.3.2.3.1 Beneficiary category

In general there was an increase in the area under banana and reduction in the area under tapioca by the adoption of optimum crop plans under situation C.

In the first size group there was 17.31 per cent and 163.16 per cent increase in the area under coconut and banana, respectively. Tapioca was absent in the new plan. The optimal plan showed an increase of 120.75 per cent in net farm income by the adoption of the improved technology.

The optimum plan under the improved technology, in the second size group has shown 31.91 per cent

Table 5.37 Input coefficients and net margins of crop activities under improved technology, for all size groups and for the two categories

Inputs		Input coefficients/acre			
		Paddy	Coconut	Tapioca	Banana
(1)		(2)	(3)	(4)	(5)
Land (acre)		1	1	1	1
Bullock labour (days)	First season	6.00	0.00	0.00	0.00
	Second season	6.00	0.00	0.00	0.00
Human labour (mandays)	First season	54.00	34.00	28.00	32.00
	Second season	58.00	15.00	19.00	50.00
Irrigation (hours)		0.00	45.00	0.00	190.00
Working capital (rupees)		5950.00	2950.00	3560.00	12010.00
Net margins/acre (rupees)		2990.00	6512.00	3240.00	14800.00

Table 5.38 Optimum plans under existing and improved technologies - beneficiary category

Crops	Size group I (0.5 to 1.25 acres)			Size group II (1.25 to 2.50 acres)			Size group III (above 2.50 acres)			Combined		
	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first
	With existing techno-logy	With improved techno-logy		With existing techno-logy	With improved techno-logy		With existing techno-logy	With improved techno-logy		With existing techno-logy	With improved techno-logy	
Paddy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coconut	0.52	0.61	17.31	1.41	0.96	-31.91	2.23	2.23	0.00	1.92	1.58	-17.71
Tapioca	0.40	0.00	-100.00	0.28	0.00	-100.00	0.93	0.12	-87.10	0.36	0.00	-100.00
Banana	0.19	0.50	163.16	0.53	1.26	137.74	0.89	1.70	91.01	0.82	1.52	85.37
Net farm income (Rs)	5151.59	11372.32	120.75	12098.37	24876.66	105.62	19578.88	40068.35	104.65	18211.23	32784.96	80.02

reduction in the area under tapioca. The banana area has increased by 137.74 per cent. The net income has shown an increase of 105.62 per cent.

In the third size group the area under coconut remained without change. The area under tapioca decreased by 87.10 per cent and the area under banana increased by 91.01 per cent. There was an increase of 104.65 per cent in net income.

The optimal plan under situation C in the combined set has shown a reduction of 100 per cent in the area under tapioca and 17.71 per cent in the area under coconut. The area under banana and the net income were found to increase by 85.37 per cent and 80.02 per cent, respectively.

In all the four cases the optimum plans under situation C has shown an increase in net farm income. Highest increase in net farm income was noticed in the first size group followed by the second.

The optimal plans under situation C were found to increase the net farm income over the optimal plans under situation A to the extend of Rs. 6,220.73 (Rs. 5,604.26 per acre), Rs. 12,778.29 (Rs.5,755.99 per acre), Rs. 20,489.47 (Rs. 5,059.13 per acre) and

Rs. 14,573.73 (Rs. 4,701.20 per acre) in the first, second and third size groups and in the combined set of the beneficiary category.

5.4.2.3.2 Resource utilization in the optimal plans under situation C in the beneficiary category

With the introduction of the improved technology the utilization of all the input were increased over that of situation A. Under situation C, since the capital and irrigation constraints were relaxed, their utilization has exceeded the available limits. Land and first season human labour were fully utilized in all the optimal plans. The absolute and relative utilization of other resources viz. second season human labour, irrigation and working capital were 34.00 mandays (89.87 per cent), 122.45 hours (153.06 per cent) and Rs. 7,804.50 (171.53 per cent), respectively in the first size group, 77.40 mandays (96.75 per cent), 282.60 hours (116.30 per cent) and Rs. 17,964.60 (171.34 per cent), respectively in the second size group, 120.73 mandays (86.86 per cent), 423.35 hours (96.22 per cent) and Rs. 27,422.70 (158.51 per cent), respectively in the third size group and 99.70 mandays (100 per cent), 359.90 hours (130.87 per cent) and Rs.22,916.20 (153.80 per cent) respectively in the combined set. With the introduction of the new technology, the only resource that was left under utilized is the second season human labour.

The absolute and relative increase in the utilization of resources by the optimal plans under situation C over that of situation A are as follows. The increased consumption of the inputs viz. first season human labour, second season human labour, irrigation and working capital were, 8.36 mandays (30.25 per cent), 11.50 mandays (51.11 per cent), 72.34 hours (144.36 per cent) and Rs. 3,254.50 (71.52 per cent), respectively in the first size group, 1068 mandays (17.15 per cent), 20.76 mandays (36.65 per cent), 137.42 hours (94.65 per cent) and Rs. 7,479.60 (71.34 per cent), respectively in the second size group, 14.46 mandays (12.14 per cent), 24.72 mandays (25.75 per cent), 172.13 hours (168.52 per cent) and Rs. 10,122.70 (58.51 per cent), respectively in the third size group and 16.28 mandays (18.91 per cent), 21.77 mandays (27.94 per cent), 146.93 hours (68.99 per cent) and Rs. 8,016.20 (53.80 per cent), respectively in the combined set. The highest increase in utilization by the introduction of the new technology was noticed in the case of irrigation and it was followed by working capital.

5.4.2.3.3 Non-beneficiary category

As in the case of the beneficiary category, here also the area under banana was found to increase in all the optimum plans and the area under tapioca was found to decrease (Table 5.39).

In the first size group the area under coconut and banana were found to increase by 13.46 per cent and 200 per cent. The area under tapioca was decreased by 100 per cent. The net farm income has shown an increase of 208.11 per cent.

The optimal plans in the second size group showed a reduction in the area under tapioca (95.24 per cent) and an increase in the area under banana (187.50 per cent). The area under coconut remained without change. The net income increased by 174.49 per cent.

In the third size group with the adoption of the optimum plan under situation C, the area under coconut remained the same, the area under tapioca decreased by 72.12 per cent and the area under banana increased by 138.89 per cent. The net income increased by 158.54 per cent.

The optimal plan under situation C, in the combined set in the non-beneficiary category has shown a reduction of 100 per cent in the area under tapioca and 21.48 per cent

Table 5.39 Optimum plans under existing and improved technologies - non-beneficiary category

Crops	Size group I (0.5 to 1.25 acres)			Size group II (1.25 to 2.50 acres)			Size group III (above 2.50 acres)			Combined		
	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first	Optimum plans (acres)		% age change of the second over the first
	With existing techno-logy	With improved techno-logy		With existing techno-logy	With improved techno-logy		With existing techno-logy	With improved techno-logy		With existing techno-logy	With improved techno-logy	
Paddy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coconut	0.52	0.54	13.46	1.07	1.07	0.00	2.07	2.07	0.00	1.35	1.06	-21.48
Tapioca	0.34	0.00	-100.00	0.63	0.03	-95.24	1.04	0.29	-72.12	0.33	0.00	-100.00
Banana	0.16	0.48	200.00	0.32	0.92	187.50	0.54	1.29	138.89	0.75	1.37	82.67
Net farm income (Rs)	3446.88	10620.48	208.11	7524.65	20654.70	174.49	12950.31	33481.68	158.54	11880.87	27178.72	128.76

in the area under coconut. Banana area was increased by 82.67 per cent and net income by 128.76 per cent.

The highest increase in net income by the adoption of the optimal plan under situation C was noticed in the first size group followed by the second.

The increase in net farm income in absolute terms were Rs. 7,173.60 (Rs. 7,032.94 per acre), Rs.13,130.05 (Rs. 6,500.02 per acre), Rs. 20,531.37 (Rs. 5,625.03 per acre) and Rs. 15,297.85 (Rs. 6,295.41 per acre) in the first, second and third size groups and in the combined set, respectively in the non-beneficiary category.

5.4.2.3.4 Resource utilization in the optimal plans under situation C in the non-beneficiary category

As in the case of the beneficiary category, land and first season human labour were fully utilized in the optimal plans under situation C in the non-beneficiary category. Here also the utilization of the relaxed constraints have exceeded their existing levels of availability (irrigation and working capital). The absolute and relative utilization of second season human labour, irrigation and working capital were 32.10 mandays (97.27 per cent), 115.50 hours (217.92 per cent) and Rs. 7,357.80 (275.57 per cent), respectively in the first size group, 62.62 mandays (85.78 per cent), 222.95 hours (247.92 per cent) and Rs. 14,312.50 (269.54 per cent), respectively in the second size group, 101.06 mandays (78.95 per cent), 338.25 hours (211.41 per cent) and Rs. 22,631.80 (208.01 per cent), respectively in the third size group and 84.4 mandays (100 per cent), 308 hours (196.18 per cent) and Rs. 19,580.70 (205.46 per cent), respectively in the combined set. Second season human labour was the only input that was left under utilized in the optimal plans under situation C.

The absolute and relative increase in the utilization of the resources after the introduction of the new technology (i.e. increased utilization under C over that of A) were as follows. The increased utilization of first season human labour, second season human labour, irrigation and working capital were 8.56 mandays (34.02 per cent), 13.33 mandays (71.02 per cent), 90.69 hours (365.54 per cent) and Rs. 4,687.80 (175.57 per cent), respectively in the first size group, 17.23 mandays (34.86 per cent), 20.98 mandays (50.38 per cent), 172.21 hours (339.40 per cent) and Rs.9,002.50 (169.54 per cent), respectively in the second size group, 24.64 mandays (25.90 per cent), 25.51 mandays (33.77 per cent), 247.55 hours (272.93

per cent) and Rs. 11,751.80 (108.01 per cent), respectively in the third size group and 16.86 mandays (26.75 per cent), 21.72 mandays (34.65 per cent), 187.62 hours (155.86 per cent) and Rs. 10,050.70 (105.46 per cent), respectively in the combined set. Among the resources, the maximum increase in the utilization was noticed in the case of irrigation and it was followed by working capital.

In all the size groups of both the categories the adoption of improved technology coupled with additional borrowing showed appreciable increase in net farm income. In the beneficiary category the net farm income increased by 80.02 per cent (Rs. 4,701.21 per acre) and in the non-beneficiary category the net farm income increased by 128.76 per cent (Rs. 6,295.41 per acre). In absolute as well as relative terms the increase in net income by the adoption of the improved technology was more in the case of the non-beneficiary category, indicating that the highest technological gap is existing in the case of the non-beneficiary category.

By the introduction of the credit-technology package, the utilization of all the inputs has increased substantially. In the beneficiary category the use of human labour has increased by 18.91 per cent and 27.94 per cent in the first and the second season, irrigation by 68.99 per cent and working capital by 53.80 per cent. In the non-beneficiary category there was 26.75 per cent and 34.65 per cent increase in the first and second season human labour, 155.86 per cent increase in irrifation and 105.46 per cent increase in working capital.

Mann et al. (1968) showed that the adoption of the H.Y.V. technology coupled with additional borrowing could increase the farm income by 314 per cent. Similar results, from the adoption of credit technology package, were obtained for Pandey (1972), Dahia (1975) and Vijayakumar (1976).

5.4.3 Capital requirements and credit gap for the adoption of the improved technology

Earlier discussions on the optimal crop plans has shown the inadequacy of capital even under the existing level of technology. The most important constraint that prevents the optimum use of all the other available resources was capital. To find out the role of capital in the adoption of the new farm technology, the requirement of capital for the optimum plans under the improved technology was worked out. The amount of capital currently used for the existing cropping plan was taken as the available capital. The additional amount of capital required for the optimum plans under the improved technology was worked out as the credit gap for the adoption of the improved technology.

The capital requirements and the credit gap calculated are presented in the Table 5.40.

5.4.3.1. Beneficiary category

In the first size group of the beneficiary category the amount of capital required for the adoption of the improved farm technology was Rs. 7,804.50 and the capital availability was only Rs. 4,550. The credit gap experienced for the adoption of the improved technology was Rs. 3,254.50 and it works out to 71.52 per cent of the currently available capital. The credit gap per acre was Rs. 2,931.98.

In the second size group the credit gap was worked out to Rs. 7,479.60 per farm (Rs. 3,223.97 per acre) and it was 71.34 per cent of the available capital.

In the third size group the credit gap for the adoption of the improved technology was Rs. 10,122.70 per farm (Rs. 2,499.43 per acre) and it was 58.51 per cent of the available capital.

In the combined set the credit gap was found to be Rs. 8,016.20 per farm (Rs. 2,585.87 per acre) and it was 53.80 per cent of the available capital.

Table 5.40 Capital requirements and credit gap for the adoption of improved technology beneficiary and non-beneficiary categories

Use and requirement of capital	Size group I (0.5 to 1.25 acres)		Size group II (1.25 to 2.5 acres)		Size group III (above 2.5 acres)		Combined	
	Beneficiary category	Non-beneficiary category	Beneficiary category	Non-beneficiary category	Beneficiary category	Non-beneficiary category	Beneficiary category	Non-beneficiary category
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Capital use under existing technology (rupees)	4550.00	2670.00	10485.00	5310.00	17300.00	10880.00	14900.00	9530.00
Capital requirement for the optimum plan under improved technology (rupees)	7804.50	7357.80	17964.60	14312.50	27422.70	22631.80	22916.20	19580.70
Credit gap (rupees)	3254.50	4687.80	7479.60	9002.50	10122.70	11751.80	8016.20	10050.70
Credit gap as percentage over the existing level of capital	71.52	175.57	71.34	169.54	58.51	108.01	53.80	105.46
Credit gap per acre (rupees)	2931.98	4595.88	3223.97	4055.18	2499.43	3219.87	2585.87	4136.09

Among the size groups the largest credit gap was found in the first size group (71.52 per cent) followed by the second size group (71.34 per cent). In absolute terms the highest requirement of capital for the adoption of the improved technology was noticed in the second size group (Rs. 3,223.97 per acre).

5.4.3.2 Non-beneficiary category

The credit gap for the adoption of the improved technology was worked out to Rs. 4,687.80 per farm (175.57 per cent and Rs. 4,595.88 per acre) Rs.9,002.50 per farm (169.54 per cent and Rs. 4,055.18 per acre) Rs. 11,751.80 per farm (108.01 per cent and Rs.3,219.67 per acre) and Rs. 10,050.70 per farm (105.46 per cent) and Rs. 4,136.09 per acre), respectively in the first, second and third size groups and in the combined set in the non-beneficiary category.

In absolute as well as relative terms the largest credit gap was experienced by the smallest size group. It was followed by the second size group with the second largest relative credit gap.

Comparing the two categories the percentage and absolute credit gap was found to be much higher in the non-beneficiary category than in the beneficiary category. In both the categories the largest gap was experienced by the smallest size group (71.52 per cent in the beneficiary category and 175.57 per cent in the non-beneficiary category).

Many earlier studies had indicated the crucial role of credit in the adoption of the improved technology. Bhatia (1971) calculated the credit gap for the adoption of the improved technology as 390 per cent over the existing level of capital use. Sharma and Prasad (1971) worked out the capital requirement for the adoption of the improved technology as 195 per cent higher than that needed for the current technology. Dahia (1975) found out the capital requirements for the adoption of the improved technology as 44.7 per cent, 9 per cent and 11.8 per cent over the existing level of capital requirement for the small medium and large farmers. Similar results were obtained for Gangwar and Gakhar (1976), Saini and Sidhu (1976), Murthy et al. (1977) Arora and Prasad (1978) Singh and Dhillon (1980) and Kadian and Singh (1983).

The studies of Moorthy (1972), Subrahmanyam and Patel (1973), Dahia (1975) and Singh and Dhillon (1980) Indicated that the credit gap for the adoption of the improved technology was the highest for the small farmers.

The results and discussion on Linear programming analysis can be summarized as follows:

By using Linear programming, optimum crop plans were developed under the following three situations (A) under existing technology with capital restriction (B) under existing technology with capital restriction relaxed and (C) under improved technology with capital and irrigation restrictions relaxed.

The optimal plans developed under situation A have shown the possibility of increasing income by the re-organization of resources even under the existing technology. The optimal plans could generate an increase in income to the extent of 50.75 per cent in the beneficiary category and 72.18 per cent in the non-beneficiary category. The percentage increase in net income was found to be more in the case of the non-beneficiary category. This indicates that the utilization of inputs in the beneficiary category was more towards optimum than in the non-beneficiary category and there is higher potential for increasing income by optimization in the non-beneficiary category. The optimal plans displaced same quantity of human labour, the entire quantity of bullock labour and kept some portion of the irrigation potential unutilized. Capital was completely utilized by the optimal plans, indicating that capital is the most limiting resource for optimization.

The optimal plans under situation B showed the potential for increasing the farm income in all the size groups of the two categories by the use of additional doses of capital even under the existing technology. Relaxation of the capital constraint could produce an increase in income to the extend of 22.98 per cent in the beneficiary category and 18.75 per cent in the non-beneficiary category over the optimum plan with capital restriction. This indicates that even under the existing technology there exists higher potential for increasing income in all the farms, just by the provision of external finance. There was increased utilization of all the inputs except land after the relaxation of the capital constraint. The increase in input utilization was the highest for irrigation (29.13 per cent and 30.42 per cent in the beneficiary and non-beneficiary categories). Irrigation was completely utilized in both the categories, indicating that after capital, the most restricting resource is irrigation.

Optimization under situation C i.e., by the adoption of credit-technology package showed significant increase in farm income in both categories. Optimum crop plans under situation C has shown the potential for increasing the income to the extent of 80.02 per cent in the beneficiary category and

128.76 per cent in the non-beneficiary category over the optimum plan under the existing technology. The increase in net income was found to be higher in the non-beneficiary category indicating that the technological gap is more wide in the non-beneficiary category than that in the beneficiary category. The introduction of the credit-technology package has shown tremendous increase in the requirement of all the inputs. The highest increase was noticed in the case of irrigation (68.99 per cent and 155.86 per cent in the beneficiary and non-beneficiary categories) followed by working capital (53.80 per cent and 105.46 per cent in the beneficiary and non-beneficiary categories).

Capital requirement and credit gap for the adoption of the improved technology was also worked out for the two categories and the credit gap was found to the extent of 53.80 per cent in the beneficiary category over the existing levels of use of capital. In both the categories the highest requirement of capital for the adoption of improved technology was found in the smallest size group and consequently these farms experienced the largest credit gap (71.52 per cent in the beneficiary category and 175.57 per cent in the non-beneficiary category). The credit gap was found to be more in the case of the non-beneficiary category than in the case of the beneficiary category. From this it can be infered that, external financial assistance received by the beneficiary farmers have helped them to narrow down their credit gap for the adoption of the improved technology.

5.4.4 Policy implications of the study

In all the optimal plans a general shift from the less remunerative crops to the more remunerative crops was evident. Paddy and tapioca were successively replaced by banana and coconut. In situations B and C even coconut was found to be replaced by banana. So the order of preference with respect to the profitability of cultivation is banana, followed by coconut, tapioca and paddy. That is, the less remunerative crops were replaced by the more profitable commercial crops. This trend indicated by the study was clearly evident in the study area. In Trivandrum district, from 1975 to 1984-'85 there was a consistent reduction in the area under paddy. Area under tapioca was also found to be decreasing. From 1975 to 1984-'85 the area under paddy has decreased by 32.32* per cent and the area under tapioca by 33.06* per cent. The area under banana (including other plantains) increased by 49.62* per cent. Area under coconut decreased by 0.39* per cent. Conversion of wet land into garden land and residential areas may be

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* Source: Farm Guide 1977 and 1987. Published by the Farm Information Bureau, Kerala.

the major cause for the reduction in the area under paddy. Even though the Kerala Land Utilization Act (KLUA) prevents the conversion of paddy fields, conversions are of common occurance.

In the study area many farmers were found cultivating paddy even under loss or relatively low profits. Social factors, consumption requirements of the family and farm animals and the legal problems are preventing them from keeping the land fallow or from the cultivation of other more profitable crops. The main technique that the farmers apply here is that of loss minimization and subsistence farming. That is, cultivation of paddy was not at all taken with genuine interest and in all the occasions the variable inputs like labour, fertilizer, capital and management were diverted to other crop enterprises.

Compared to the price rise of the inputs the relative price rise of paddy (rice) was low and this puts the paddy cultivator into a disadvantageous position. The high labour requirement of the crop and rapidly rising wage rates have made paddy cultivation less and less profitable. All these along with the set backs from crop failures due to scarcity of water more frequently felt during the recent years has made the farmer less and less interested in paddy cultivation.

The social interest of self sufficiency in food grain production clash with the farmers interest of profit maximization. Legal restriction alone cannot prevent the paddy cultivator from converting the land into other profitable enterprises. More over, the paddy farmer cannot be denied justice for the interest of the society. So immediate location specific programmes are necessary to better the relative price parity of paddy crop and to improve the relative profitability of paddy cultivation compared to other crop enterprises. In addition immediate steps are necessary for taking co-operative or collective farming to over come the disadvantages of the very small holding sizes, to introduce selective mechanization which is highly essential to reduce the labour intensity of paddy cultivation. (Here it is worth while to mention that labour was found to be less productive in this study and the labour cost in the study area was one of the highest in the state).

Under these circumstances the paddy farmer is left with only three alternatives i.e. (i) to keep the major portion of the paddy land fallow and to cultivate only a portion of the land to get sufficient production to meet his farm and family requirements (ii) to take alternate non-paddy crops like banana, vegetables or even tapioca or to lease out the land for the cultivation of the same or (iii) to convert the land perennially for the cultivation of coconut. To maintain the balance between food and commercial crops in this region, the only way is to maintain the relative profitability of paddy cultivation with that of the competing crops by an integrated approach involving (i) price support (ii) production bonus (iii) credit facilities in liberal terms and (iv) selective mechanization all of which are to be implemented selectively and judiciously to solve the specific problems in the region.

The currently suspended crop loan system - taccavi loan - (Suspended due to the poor repayment) should be re-introduced with proper modifications to help the paddy farmers to increase the productivity of paddy by adopting modern farming techniques, which involves the increased use of off-farm resources. While re-introducing the taccavi loans, the administrative control is to be entrusted with the technical staff of the agricultural department and the disbursement should be routed through the co-operative banks. This will ensure proper repayment of the loans.

The increase in net farm income after the relaxation of the capital constraint, even in the beneficiary category is of practical significance.

This may be an indication of the capital deficiency felt by the beneficiary farmers even after getting capital assistance.

In both beneficiary and non-beneficiary categories, the highest credit gap for the adoption of the improved technology was experienced by the smallest size group. This is an indication of the much needed capital assistance to the smallest size group of farms. This indicates the necessity of giving the highest priority for assisting the small farmers in all the institutional financing programmes.

5.4.5 Limitations of the study

The result from linear programming analysis obtained in this study, suffer from certain limitations. When perennial crops like coconut are involved, quick adjustments in the area under that particular enterprise is not possible. The only adjustment that is possible is that of diverting the variable inputs. The optimality recommended by this study should be viewed with this aspect in mind. More over the production from such enterprises are highly dependent on the genetic character of such crops and this factor is highly variable due to the cross pollinated nature of the crops (especially coconut). So the net margins generated in one situation may not hold good in another although similar situation.

In addition, the inherent limitations of the L.P. technique like linearity of input-output relationship, remain in this study. More over while developing the optimal plans in this study the risk factor due to the high susceptability of certain crops to climatic changes (especially banana) and the risk due to the heavy capital investment in a single enterprize, the management problems, the marketing problems due to the increased production etc. were not accounted due to the difficulty in measurement. All these factors are to be considered to have a realistic understanding of the results of this study.

5.5 Problems faced by the debtors and the financing institutions and the suggestions and recommendations

During the investigation, the detailed discussions with the farmers and the officers of various banks revealed many problems associated with the present system of institutional financing in agriculture. The problems faced by the farmers and that faced by the financing institutions are discussed in two sections. The suggestions and recommendations which may be helpful in solving these problems, are given in the third section.

5.5.1 Problems faced by the farmers

1) Many farmers complained about the delay in sanctioning of loans, wastage of time and money in getting the loan and in completing the formalities required by the banks. Many, also complained about the corruption and brokerage prevalent in many schemes, especially in I.R.D.P. loans which involve a substantial element of subsidy.

2) Problems due to the delay and complications involved in getting the necessary certificates from the Government agencies. For example getting tax receipts and possession certificates from village officers, encumbrance certificates from Sub-Registrar office, 'Pattayams' from Tahasildars etc. For an ignorant farmer all these processes involves brokerage and bribing

3) Problems due to farmers ignorance regarding law acts and banking procedures

4) Farmers also complained about the inadequacy of loans and untimely supply of credit

5) Problems due to the improper implementation of the crop insurance programme. In many cases the insuring agency escaped without paying the insured amount even if the case of crop damage was genuine.

These problems, associated with the present system of institutional finance in agriculture are cited by the farmers in the beneficiary category. The following table indicate the different problems and the number of farmers affected.

Table 5.41 Problems faced by the farmers in the present system of institutional finance in agriculture

Sl. No.	Problems faced by the farmers	Number of farmers affected
1.	Lengthy procedures and inordinate delay in loan sanction	30
2.	Difficulty in getting the necessary certificates	23
3.	Loans are inadequate for the purpose	18
4.	Supply is untimely	6
5.	Improper implementation of the crop-insurance scheme	4
6.	Bribing is involved	3
7.	Ignorance of law acts and banking procedures	2

5.5.2 Problems faced by the banks

1) Lack of adequate qualified staff for the implementation, supervision and follow-up of agricultural financing programmes

2) Dual financing: Multiplicity of bank branches and lack of co-ordination among banks result in dual financing, i.e. more than one bank financing a particular farmer for the same purpose.

3) Mass lending: The mass lending policy resulted in drastic increase in the number of borrowal accounts, which inturn resulted in heavy work load and poor followup. Poor followup reduced the quality of financing and resulted in partial or complete misutilization or diversion of the loan amount

4) Unhealthy competition among banks to achieve the targets resulted in dual or duplicate financing

5) Lack of income oriented and economically viable schemes

6) Lack of credit worthiness of the borrowers

7) Loan recovery problems

a) Wilfull default: This may be of two types

i) Default of loans, after the utilization of the amount for the proposed purpose, but the farmer may be hesitant to repay the amount due to the expectation of moratorium. Indiscriminate and frequent moratoriums on loans, by the governement - which are actually politically motivated - cultivate among the borrowers, expectation of moratoriums, writing off of agricultural debts etc. This will result in the default of loans.

ii) Default of loans after the misutilization of the loan amounts. During the investigation it was found that in some cases the farmers obtain loans by producing fake certificates, with the knowledge of the block authorities, (especially in the case of I.R.D.P. loans) and after paying good amounts as bribes, and utilize the amounts for purchase of real estate, payment of personal debts etc. In most cases these loans were not properly repaid.

b) Default due to crop failures

Due to the vagaries of weather, the farmer may fail to get the expected returns, from his crop. Even if the crop is covered by the crop insurance scheme, the irregularities in the implementation of the crop insurance programme make the farmer unable to get his insured amount. This finally will result in the non-repayment of the loan.

5.5.3 Suggestions and recommendations

1) There must be adequate number of qualified technical staff for the proper implementation of the agricultural financing programmes

2) There must be proper co-ordination among banks to avoid dual financing

3) Loans should be adequate for the purpose and should be supplied in the right time.

4) The procedure for getting loans should be simplified

5) Instead of the target oriented approach which is now followed in agricultural financing, a need based approach should be followed

6) Benefit of subsidy should be linked with prompt repayment. This will also help in preventing unscrupulous elements taking advantage of the ignorant farmer by pocketing a portion of the subsidy

7) Instead of advancing loan for a single purpose the 'Basket approach' of financing needs to be adopted so as to meet the consumption needs of the farmers family also

8) While planning the credit programme and fixing the targets the banks should take into account the needs and constraints of the locality where the programme is to be implemented

9) The crop insurance scheme should be made effective in protecting the farmers during the unanticipated reductions in income due to crop failures. At present, the extent of crop damage due to natural calamities are assessed in an entire padasekharam (group of paddy fields) based on sample surveys. Crop damage is not assessed on individual cases. So the farmer will be eligible for the claim only when the entire padasekharam is affected. More over the extent of damage assessed, based on sample surveys in a padasekharam will always be less than the damage caused for many of the individual farmers for whom the damage may be complete. An alternative proposal is to assess the extent of crop damage in all the individual cases and for this the service of the field staff of the agricultural department may be utilized. So proper modifications in the rules governing the payment of claims are to be made to ensure insurance cover in the case of all genuine claims.

10) By using mass contact methods the farmers should be made aware of all credit programmes implemented by the banks, the procedure for applying for loans and the amount of subsidy involved etc. This will help in reducing the brokerage and corruption crept into the implementation of these programmes.

Summary

SUMMARY

This study on capital productivity and role of finance in technological changes in agriculture was conducted in the selected panchayats of Trivandrum rural block of Trivandrum district, Kerala. The main objective of the study was to estimate the productivity of capital and to understand the role of finance in the adoption of the new agricultural technology. Multistage random sampling technique was adopted for the study and the two panchayats randomly selected - Chettivilakom and Ulloor - formed the first stage units. The second and fifth wards of Chettivilakom and the first and fourth wards of Ulloor were finally selected as the penultimate stage units for sampling. The major crops grown in the study area are paddy, coconut, tapioca and banana. Two samples of size 35 each forming a total sample of 70 cultivators were selected at random. The first sample was that of beneficiaries who have availed agricultural loans from any of the institutional agencies during five years prior to the reference period and the second sample was that of non-beneficiaries. The reference period of the study was taken as the agricultural year 1985-'86. The main items of observation were, the use of inputs and the generation of output, farm and non farm income, kind and quantum of capital

assistance received if any and problems faced by farmers in general and in particular in getting assistance from the institutional financing agencies. Apart from tabulated ratios, percentages and the students 't' test for comparing the means, production function analysis and linear programming were the main analytical tools used for the study. A macro level study was also conducted in the institutional financing agencies in the study area, to understand the system of institutional finance followed and to evaluate the nature and quantum of assistance granted by these agencies.

The minimum size of operational holding for sample selection was fixed as 0.5 acres. The selected sample was categorised into three size groups viz. first, (between 0.5 and 1.25 acres) second (between 1.25 and 2.5 acres) and third (above 2.5 acres).

All the four major crops grown in the study area viz. paddy, coconut, tapioca and banana were taken for the analysis. The mean level of input use and generation of output were compared between the beneficiary and non-beneficiary categories using the students 't' test. The inputs considered for this analysis were (1) human labour in mandays (2) fertilizer in Kilograms of NPK nutrients (3) cost of irrigation in rupees and (4) other capital in rupees (which includes the cost of manures and plant protection). The output was compared in value terms. The results indicated that the farms in the beneficiary category were using significantly higher quantities of all the inputs (except human labour in banana and other capital in paddy) than the farms in the non-beneficiary category. The averages of the value of output per acre were also found to be significantly higher in the beneficiary category compared to the non-beneficiary category for all the crops.

To estimate the productivity of capital which is used up in different farms in the production process, linear production functions were fitted for all the crops. The variables considered were (1) farm size expressed in acres (2) human labour expressed in mandays per acre (3) Fertilizer in kilograms of NPK nutrients per acre (4) cost of irrigation in rupees per acre and (5) other capital in rupees per acre. The dependent variable was value productivity (value of output per acre) expressed in rupees.

The regression fitted were found to be significant in all the cases. Among the variables, 'Farm size' was found to have an inverse relationship with the value of output in the case of paddy and coconut, in the beneficiary category. 'Human labour' was found to be less productive in the study. In almost all of the cases 'Fertilizer' showed significant positive contribution to the output. 'Irrigation' was also found to be highly productive. The variable 'Other capital' was found to have significant contribution to the value of output in the case of coconut and tapioca. But for tapioca the Marginal Revenue (MR) of 'Other capital' was found to be less then one rupee indicating that the investment was not worthwhile. The results of the regression analysis indicated that 'Fertilizer' followed by 'Irrigation' are the most productive forms of capital and diversion of capital ffrom 'Human labour' in favour of 'Fertilizer' and 'Irrigation' may be helpful for increasing the net farm income. The results also indicated that in the beneficiary category the smaller farmers are operating more efficiently than the larger farmers especially in the case of paddy and coconut.

To estimate the credit gap for the adoption of the improved technology, optimal crop plans were developed using linear programming technique. Wet and garden land, human labour and bullock labour in the first and second crop seasons, irrigation and working capital, were the major constraintsidentified in the study area. Optimization was done under three situations viz. A - Optimum crop plan under the existing technology with the existing levels of resources, B - Optimum crop plans under the existing technology with capital borrowing activity to the extent of 50 per cent of the available capital and C - optimum crop plans under the improved technology with the relaxation of the capital and irrigation constraints.

The optimum plans under situation A could generate an increase in income to the extent of 50.75 per cent (Rs. 1,978.82 per acre) in the beneficiary category and 72.18 per cent (Rs. 2,049.74 per acre) in the non-beneficiary category, showing that the input use was more towards optimum in the beneficiary category and there is higher potential for increasing income by optimization in the non-beneficiary category. The surplus quantity of inputs present after the optimization (other than land and capital) indicated the inefficient utilization of inputs in the existing plan.

Optimal plans under situation B indicated the potential for increasing the net farm income to the extent of 22.98 per cent (Rs. 1,349.75 per acre) in the beneficiary category and 18.75 per cent (Rs.916.83 per acre) in the non-beneficiary category, over the optimum plans under situation A. This indicates that even under the currently practised technology there exists high potential for increasing income in both the categories, just by the provision of external fiance.

There was increased utilization of all the inputs and the highest increase was noticed in the case of irrigation.

Optimization under situation C has indicated the potential for increasing the net farm income to the extent of 80.02 per cent (Rs. 4,701.20 per acre) and 128.76 per cent (Rs.6,295.41 per acre) in the beneficiary and non-beneficiary categories, respectively, over that under situation A. The higher increase in net farm income in the non-beneficiary category indicates that the widest technological gap is existing in the non-beneficiary category and that the capital assistance received by the beneficiaries might have helped them to narrow down their technological gap. The introduction of the credit - technology package has increased the requirement of all the inputs and the only resource that was left under utilized was second season human labour. The difference in capital requirement between situation A and C was worked out as the credit gap and it was 53.80 per cent (Rs.2,585.87 per acre) and 105.46 per cent (Rs. 4,136.09 per acre) of the available capital in the beneficiary and non-beneficiary categories, respectively. In both the categories the largest credit gap was experienced by the smallest size groups indicating the much needed capital assistance to the smaller farmers.

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*Originals not seen

Appendices

Appendix-I Schedule for farm survey

1. Name and address of the farmer:

2. Size of the family and income from sources other than agriculture

Sl. No.	Name of the member of the house hold	Relation to the respon- dant	Age	Sex	Occupation		Monthly income	
					Main	Sub- sidi- ary	Main	Sub- sidi- ary
1.								
2.								
3.								

3. Extent of holdings

Sl. No.	Particulars	Wet land (cents)	Dry land (cents)	Garden land (cents)	Total (cents)	Remarks
1.a	Area owned (*)					
b	Area leased out (-)					
c	Area leased in (+)					
d	Net area operated					
2.	Total area not cultivated					
3.	Net area cropped (1d - 2)					

4. Cropping patterns

Sl. No.	Crops grown	Variety	Area under					Source and mode of irrigation	Number of trees and age for perennials
			Wet land		Dry land	Garden land			
			I	UI		I	UI		
1.	Seasonals								
2.	Annuals								
3.	Perennials								

I - Irrigated

UI - Un-irrigated

5. House hold expenditure

Sl. No.	Particulars	Quantity in kg or numbers or rupees per				Rate per unit	Total amount per year
		Day	Week	Month	Year		
1.	Food						
a.	Rice						
b.	Wheat						
c.	Pulses						
d.	Sugar/Jaggery						
e.	Oils						
f.	Milk						
g.	Egg						
h.	Meat						
i.	Fish						
j.	Vegetables						
k.	Fruits						
l.	Other food items						
2.	Clothing and foot wear						
3.	Rent						
4.	Fuel and lighting						
5.	Education						
6.	Medicine						
7.	Travel						
8.	Recreation						
9.	Beverages						
10.	Taxes						
11.	Tobacco						
12.	Liquor						
13.	Others, if any						

6. Inputs and costs

Wage rate: Men - Women -

Crop and season	Seeds and sowing/planting								
			Human labour employed				Bullocks labour used/tractor power		
	Quantity of seed	Price per unit	Hired		Family		Number of days or hours for tractor power	Charge per day	Total cost
			M	W	M	W			

Crop and season	Manuring and fertilizer applications								Inter culture labour charges				Irrigation					Number of hours of operations of machinary
	Item	Price per unit	Quantity		Labour				Hired		Family		Hire charges	Labour charges				
			FP	P	Hired		Family							Hired		Family		
					M	W	M	W	M	W	M	W		M	W	M	W	

FP - Farm produced

P - Purchased

Crops and season	Plant protection							Miscellaneous							Harvesting (labour charges)				Remarks
	Item	Price per unit	Quantity	Labour				Item	Price per unit	Quantity	Labour				Hired		Family		
				Hired		Family					Hired		Family						
				M	W	M	W				M	W	M	W	M	W	M	W	

7. Output and Returns.

Crops and season.	Total Products				Total value			Remarks
	Main produce		Biproducts		Main Product	Biproduct	Total	
	Quantity.	Price	Quantity.	price				

8. Sources of finance for current farm expenses

Items	Amount (Rs.)	Source of finance		
		Owned		Borrowings
		Current income	Past savings	
1. Purchase of seed				
2. Purchase of manure				
3. Purchase of fertilizers				
4. Wages to hired labour				
5. Bullock labour charges				
6. Hire charges for irrigation				
7. Purchase of pesticides				
8. Hire charges for plant protection implements				
9. Other expenses if any				

9. Past borrowings before the reference period

Sl. No.	Source	Amount	Purpose	Security	Interest rate	Year	Duration	Amount overdue	Amount outstanding

10. Borrowings during the reference period

Sl. No.	Source	Credit demanded	Credit obtained	Type of loan	Purpose	Security	Interest rate	Repayment schedule	
								Period	Amount

11. Utilization of credit

Purpose	Amount utilized				
	1	2	3	4	5
1. Investment in Agriculture (crop and purpose)					
a.					
b.					
c.					
d.					
2. Business					
3. Relending					
4. Consumption and other house hold needs					
5. Payment of old debts					
6. Marriage & related ceremonies					
7. House construction					
8. Education					
9. Miscellaneous					

12. Reasons for default if any:

    1. Failure of crop
    2. Crash in prices
    3. Diversion of the loan amount to other unproductive purposes
    4. Others, if any.

13. Problems faced by farmers regarding the availability of credit, procedures involved etc.

14. Suggestions for improvement

For non-borrowers:

15. Reasons for not availing loans from institutional agencies

    1. No need of credit
    2. Lengthy procedures
    3. Banks are at distance
    4. Defaulting of previous loans
    5. Credit availability from private money lenders
    6. Afraid of legal procedures
    7. Flexible terms of money lenders
    8. Other reasons

Appendix-II Activity wise disbursement of loans for agriculture and allied activities in Trivandrum district

Activity	Amount disbursed (rupees in lakhs)		
	1983	1984	1985
Agriculture and allied activities	2571.07	3511.29	3830.77
Agriculture	2288.55	3241.05	3376.91
Crop loans	1630.71	2176.99	2501.29
Irrigation	177.51	56.06	127.61
Farm equipments	16.41	58.44	14.25
Plough animals	6.84	9.57	
Long term loans	180.31	100.05	165.41
Plantation loans		391.79	248.33
Others	277.04	448.15	320.02
Allied activities	282.52	270.24	453.86
Dairy	184.36	157.36	122.22
Poultry	45.32		
Fisheries	18.54	60.03	79.91
Bio-gas programme	-	-	35.65
Others	34.30	52.85	216.08

Source: Trivandrum district Annual Action Plan (AAP) 1984 to '86 published by the Indian Overseas Bank.

Appendix-III Scale of finance of loans for agricultural purposes for the year 1986 for Trivandrum district

Purpose	Amount (Rs.)
Crop loan/Short term loans	
Paddy (per hectare)	5,350/-
Tapioca (per hectare)	3,750/-
Coconut (per hectare) (Rs.35/- per yielding tree, 175 plants per hectare)	6,125/-
Banana (per hectare) (Rs.20/- per plant, 1000 plants per hectare)	20,000/-
Pulses (per hectare)	1,500/-
Vegetables (per hectare)	15,000/-
Ground nut-intercrop (per hectare)	2,250/-
Betel vine (3 cents) (300 vines in 3 cents)	2,400/-
Irrigation	
Irrigation well	4,750/-
Valkulam	1,500/-
Rennovation of well	1,500/-
Pumpset (2 H.P.)	4,600/-
Pump house	1,500/-
Storage tank	3,000/-
Agricultural implements	
Tractor	1,00,000/-
Tiller	45,000/-
Sprayer	900/-
Other agricultural implements	1,000/-

Purpose	Amount (Rs.)
Plantation	
Coconut (per acre)	8,100/-
Rubber (per hectare)	22,000/-
Land development	
Soil concervation - levelling/ bunding etc. (per hectare)	5,400/-
Kayal reclamation (per hectare)	35,000/-

Source: Trivandrum district Annual Action Plan (AAP) 1986, published by the Indian Overseas Bank

PRODUCTIVITY OF CAPITAL AND ROLE OF FINANCE IN TECHNOLOGICAL CHANGES IN AGRICULTURE IN TRIVANDRUM DISTRICT

By

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ABSTRACT OF THE THESIS

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ABSTRACT

This study on capital productivity and role of finance in technological changes in agriculture, was carried out using data collected from sample holdings selected from the second and fifth wards of Chettivilakam panchayat and first and fourth wards of Ulloor panchayat under Trivendrum Rural Block in Trivandrum district, Kerala, through multistage random sampling technique.

Two samples of size 35 each were selected, the first being that of beneficiaries of agricultural loans and the second being that of non-beneficiaries. The data collected from the two samples were analysed size group wise using production function analysis and Linear programming to estimate the productivity of capital and to generate optimum crop plans under existing and improved technologies.

Fertilizer followed by irrigation came out to be the most productive forms of capital. Labour was found to be less productive. Productivity was found to be more in the smaller farms of the beneficiary category.

Optimal crop plans developed using Linear programming had shown the potential for increasing the farm income even under the existing technology, by the re-allocation and judicious use of the existing

resources. Provision of additional dose of capital showed the possibility of increasing the net farm income in substantial levels even in the existing level of technology. Adoption of improved technology with adequate capital has shown much higher potential for increasing the farm income and this increase was more in the non-beneficiary category. The credit gap for the adoption of the improved technology was also found to be more for the non-beneficiary category and in both the categories the credit gap was found to be the highest for the smallest size group.