CHAPTER IX

SUMMARY OF THE FINDINGS, CONCLUSION AND SUGGESTIONS

Paddy is a stable in the diet for much of the world about 465.55 million tonnes grown annually in global level. Out of this, 30 per cent is grown and consumed in India. The top most leading producers of paddy are India, China and USA. Out of 465.55 million tonnes of food grains production, 99 million tonnes of paddy is produced in India in 2013. It has increased to 103 million tonnes in 2014. The paddy production of Tamil Nadu was 52.09 lakh tonnes in 2005. It rose to 74.58 lakh tonnes in 2012. Its production in Tirunelveli district was 4.59 lakh tonnes in 2012. At the same, banana among the most widely consumed food in the world. Around 98 per cent of global production is grown in developing countries like India, Ecuador, Brazil and China. India’s domestic production alone exceeds the entire world trade, with 19 per cent share of the total production of bananas in the world. The global banana production was 86 million tonnes in 2004. It has increased to 145 million tonnes in 2012. India’s banana production was 14 million tonnes in 2004. It rose to 29.7 million tonnes in 2014. Its production in Tamil Nadu was 3.5 million tonnes in 2012. It has increased to 4.5 million tonnes in 2013. In Tirunelveli district, its production was 2.11 lakh tonnes in 2012. It has increased to 2.15 lakh tonnes in 2013. Further the soil, climate conditions adoption of high yielding varieties and technology are highly
suitable and favourable for banana and paddy cultivation. These are the reasons for selecting paddy and banana crops for the study.

**Findings of the Study**

A random sample of 200 paddy farmers selected from 20 villages in Palayamkottai, Tenkasi, Nanguneri and Ambasamudram blocks in Tirunelveli district. Out of 200 farmers, majority of them 122 (61 per cent) cultivated modern variety of paddy while 78 (39 per cent) of them grew traditional variety of paddy. The farmers in each variety well classified into small and large farmers group. Those farmers are cultivating an area of 5 acres and more were grouped under the large farmer category, while those who are cultivating less than 5 acres of land were classified as small farmers. There were 80 small farmers and 42 large farmers in the case of modern variety whereas in the case of traditional variety 45 and 33 were under small and large farmers group respectively.

The proportionate sampling technique has been adopted to select 200 banana farmers from 25 villages in Radhapuram, Nanguneri, Kalakkadu, Cheranmahadevi, and Ambasarnuthiram blocks of Tirunelveli district. 200 banana farmers were post stratified into two categories on the basis of varieties namely kathali and sakkai. Out of 200 banana farmers, 100 came under the category of kathali and remaining 100 came under the sakkai variety. In each category, the farmers have been divided into two groups namely small and large on the basis of the area under cultivation. The farmers with less than 5 acres of land were grouped as small farmers and farmers with above 5 acres of land categorized as large farmers. In the kathali variety out of 100 farmers, 64 belonged to the small size and remaining 36 belonged to the large size. In
the case of sakkai variety out of 100 farmers, 50 belonged to the small size and the
remaining 50 belonged to the large size. Comparing farmers cultivating paddy
varieties, it is found that overall farmers between age group of 30 and 50 years were
found high in traditional variety (85.90 per cent) while it was 85.25 per cent in the
case of modern variety. Overall farmers cultivating banana varieties, it is found that
overall farmers between the age group of 30 and 50 years were found high in sakkai
variety (66 per cent) while it was 61 per cent in the case of farmers cultivating kathali
variety.

Comparatively, farmers cultivating paddy varieties, it is found high in the
modern variety, the small farmers had a family size of four and six members was 33.6
per cent and the large farmers had a family size of four and six members, it was 17.21
per cent but in the case of traditional variety the small farmers it was four and six
members which constituted 33.34 per cent and the large farmers had a family size of
four and six members, it was 23.08 per cent to the total. The use of family labour was
more in the case of modern variety compared to the traditional variety and when
comparing farmers cultivating banana varieties, it is found high in the kathali variety
of the small farmers had a family size of four and six members was 28 per cent and
large farmers had a family size of four and six members, it was 20 per cent but in the
case of sakkai variety, small farmers had a family size of four and six members which
constituted 22 per cent and the large farmers had a family size of four and six
members, it was 20 per cent to the total. The use of family labour was more in the
case of kathali variety compared to the sakkai variety.
When comparing the number of family members cultivating paddy varieties, it is found high in the modern variety of the small farmers between 2 and 4 members (37.7 per cent) and large farmers between 2 and 4 members (21.32 per cent) but in the case of traditional variety, the small farmers which constituted 30.77 per cent and the large farmers, it was 24.36 per cent to the total. Comparatively, the number of family members cultivating banana varieties, it is found high in kathali variety of the small farmers between 4 and 6 members (22 per cent) and the large farmers, it was 14 per cent but in the case of sakkai variety of the small farmers which constituted 36 per cent and large farmers, it was 15 per cent to the total.

When comparing farmers cultivating modern variety of paddy, 25 per cent of small farmers had farming experience of 10 to 15 years and 22 per cent of large farmers had farming experience of 10 to 15 years whereas traditional variety of paddy, 32.06 per cent of small farmers had the experience of 10 and 15 years and 19.23 per cent of large farmers had the experience of 10 and 15 years. In the case of kathali variety of banana, 23 per cent of small farmers had farming experience of 10 to 15 years and the large farmers had farming experience of 10 to 15 years whereas in sakkai variety, 18 per cent of small farmers had the experience of 5 to 10 years and 20 per cent of the large farmers had farming experience of 5 to 10 years.

Comparing these two varieties of paddy, in the case of modern variety, 28.69 per cent of small farmers had operational holdings of 1 to 3 acres but 34.43 per cent of large farmers had high operational holdings of above 5 to 7 acres while traditional variety, 34.64 per cent of small farmers had operational holdings of 1 to 3 acres but 42.3 per cent of large farmers had high operational holdings of above 5 to 7 acres.
when comparing banana varieties, in the case of kathali variety, 29 per cent of small farmers had operational holdings of 1 to 3 acres and 36 per cent of large farmers had high operational holdings of above 5 to 7 acres while sakkai variety, 22 per cent of small farmers had operational holding of 1 to 3 acres and 50 per cent of large farmers had high operational holdings of above 5 to 7 acres. Comparing paddy varieties, overall farmers cultivating modern variety was high leased out of land (41.80 per cent) while overall farmers cultivating traditional variety, it was low leased out of land (41 per cent) and comparing banana varieties, overall farmers cultivating kathali variety was leased in of land (58 per cent) while overall farmers cultivating sakkai variety, it was high leased in of land (67 per cent).

The data revealed that the literacy level of 400 heads of the family of both the type of farmers was as high as 84 per cent. It was found that the percentage of respondents with primary level of education was high (16 per cent) for paddy farmers and the share of respondents with higher levels of education was high (22.5 per cent) for the banana farmers. This revealed that the introduction of any new technology will be easy in the study region since educated farmers would accept any new innovation quickly. Overall farmers cultivating modern variety of paddy have the property of land value of Rs.5 lakh and above (25.6 per cent) while overall farmers cultivating traditional variety have the property of land value of Rs.5 lakh and above (38.46 per cent) and overall farmers cultivating kathali variety of banana have the property of farm building value of Rs. one lakh and above (35 per cent) while overall farmers cultivating sakkai variety have the property of farm building value of Rs. one lakh and above (30 per cent).
A study of the input and output structure at mean levels of small and large farmers cultivating modern variety of paddy revealed that small farmers obtained significantly larger yield per acre than the large farmers. In the case of modern variety of paddy, the yield per acre was 2,182.36 kilogram for small farmers and 2,082.47 kilogram for large farmers whereas in the case of traditional variety of paddy, the yield per acre was 2088.12 kilogram for small farmers and 1988.23 kilogram for large farmers. At the same, in the case of kathali variety of banana, the yield per acre was 16.35 tonnes for small farmers and 15.75 tonnes for large farmers whereas in the case of sakkai variety of banana, the yield per acre was 15.75 tonnes for small farmers and 15.25 tonnes for large farmers.

The significant difference between two groups of farmers was found with respect to chemical fertilizers and pesticides. The yield reaped by large farmers was relatively less compared to small farmers in the study area. At the same time, the inputs namely fertilizers and pesticides used by large farmers were found to be higher than their counterpart. Similar results were also observed in the case of small and large farmers cultivating traditional variety of paddy and sakkai variety of banana. But a comparison of the levels of input use and yield obtained per acre by two farmers group in each variety revealed a higher yield and more uses of inputs in the case of modern variety than traditional variety of paddy and kathali variety than sakkai variety of banana. Thus, it is observed that the cultivation of modern variety of paddy and kathali variety of banana required a higher level of fertilizers application and lower level of pesticides due to its greater responsiveness to the output. Further, a small farmer is likely to have a greater interest in maximizing his farm output than the
large farmer and paddy cultivation normally needs a quite close supervision which is easier on small farms. A small farmer is more likely to have an intimate knowledge of his farm land and its requirements. These help to increase the production efficiency on small farmers in both varieties in the study area. Thus, it may be concluded from the analysis that the small farmers were efficient in the use of inputs and they produced more yield than the large farmers. Paddy cultivation in general was found to be labour intensive in the study area. The analysis of utilization of labour in both varieties revealed the fact that the cultivation of modern variety of paddy and kathali variety of banana at large can help to provide gainful employment to the rural population under both farmers group.

In this study, cost A is included the cost of human labour, bullock and machine labour, fertilizer, pesticide, seeds, farm manure, irrigation and interest on working capital and cost C is comprising of the cost A, rent for land and interest on fixed capital. The analysis of cost and returns structure in the farmers cultivating modern variety and traditional variety of paddy revealed that the small farmers received higher gross returns of Rs.43,742.84 with cost A Rs.30,040.26 and cost C Rs. 33,140.90 while large farmers received gross returns Rs.43,856.17 with cost A Rs.31,132.59 and cost C Rs.33,993.21 in the case if modern variety. The small farmers received higher gross returns of Rs.42,248.38 with cost A Rs.26,532.32 and cost C Rs.29,632.96 while large farmers received gross returns of Rs.41,869.71 with cost A Rs.26,978.87 and cost C Rs. 29,727.25 in the case of traditional variety. In the case of kathali variety of banana, the small farmers received higher gross returns of Rs.1,28,190.36 with cost A Rs.51,906.29 and cost C Rs.71,225.30 while large farmers
received gross returns of Rs.1,21,362.60 with cost A Rs.49,200.33 and cost C Rs.67,835.79 whereas in the case of sakkai variety of banana, the small farmers received higher gross returns of Rs.1,11,230.42 with cost A Rs.52,038.26 and cost C Rs.69,014.72 while large farmers received gross returns of Rs.1,14,018.51 with cost A Rs.48,654.84 and cost C Rs.65,613.42. Thus, it is inferred that the modern variety of paddy and kathali variety of banana yielded higher returns in physical and monetary terms and it is found to be more profitable than the traditional variety of paddy and sakkai variety of banana in the study area. It was also observed from the analysis that large farmers spent higher amount per acre and received lesser net returns compared to small farmers in both varieties. The variable cost formed about 91 per cent of the total cost in both varieties. Human labour, the major cost component, accounted for more than 40 per cent of the total cost. The pattern of other input expenditures was almost similar for the two varieties. Thus, it may be concluded from the analysis that the yield per acre of small farmers was significantly higher than that of the large farmers. This may be due to the more intensive use of inputs and better personal supervision and farm management by small farmers.

An examination of the economy of paddy cultivation showed that each rupee spent resulted in a benefit of Rs.0.32 in the case of small farmers and a benefit of Rs.0.29 in the case of large farmers cultivating modern variety of paddy whereas in the case of traditional variety of paddy, it was Rs.0.42 for small farmers and 0.41 for large farmers. It was Rs.0.80 for small farmers and Rs.0.79 for large farmers in the case of kathali variety of banana and Rs.0.71 for small farmers and Rs.0.74 for large farmers in the case of sakkai variety of banana respectively. It indicated that this
could be the outcome of better economy and institutional position of small farmers compared with those of large farmers in the study area. Comparing the nature and the extent of per acre net income distribution, it was observed that the concentration frequencies in the distribution per acre net income effected was positively skewed for both small and large farmers in each variety of paddy and banana. In the case of modern variety of paddy, the higher concentration is found in the average net income is Rs.10,000 to Rs.20,000 (40 per cent) for small farmers while it is Rs.10,000 to Rs.20,000 (35.72 per cent) for large farmers whereas the average net income is Rs.10,000 to Rs.20,000 (40 per cent) for small farmers while it is Rs.10,000 to Rs.20,000 (39.39 per cent) for large farmers. In the case of kathali variety of banana, the higher concentration is found in the average net income is Rs.55,000 to Rs.65,000 (39.06 per cent) for small farmers while it is Rs.45,000 to Rs.55,000 (55.56 per cent) for large farmers whereas in the case of sakkai variety of banana, the average net income is Rs.35,000 to Rs.45,000 (44 per cent) for small farmers while it is Rs.35,000 to Rs.45,000 (36 per cent) for large farmers. The analysis of yield gap revealed the existence of a gap between the potential and actual yield per acre for both farmers group in each variety. The yield gap was found higher in the case of large farmers than in the case of small farmers.

The Garnet’s ranking technique was applied to identify the major constraints to the attainment of potential yield and it was found that severity of disease, pest attacks and water shortage were identified as major constraints for both small and large farmers cultivating modern variety of paddy and kathali variety of banana. In the case of traditional variety of paddy and sakkai variety of banana, small farmers have
reported that the inadequate credit facilities and water shortage to be the main constraints to maximum yield. Similarly, majority of large farmers have identified water shortage as a major constraint. Thus, it may be concluded that severity of diseases, inadequate credit facilities and water shortage were identified as major constraints in the study area.

Farm size, human labour, animal and machine power, fertilizer use had co-efficient with numerical values less than unity. This revealed that the use of these resources was in the rational region of production and they significantly contribute to the farm production. The $\Sigma \beta_i$ indicated the returns to scale ranged between 1.1858 and 1.2708. It supported the assumption of constant returns to scale in the determination of the Frontier Functions and by minimizing linear sum of residuals. The estimated more than unity value of the paddy farmers might be due to the fact that the excluded factor inputs varied more proportionately with the changes in the included factors.

The sum of production elasticities $\Sigma \beta_i$ ranged from 1.339 to 1.340 only. This indicates increasing returns to scale. This shows the superiority of the banana farmers over that of paddy farmers. The intercept term for the frontier function is nearly 30 per cent higher than the Ordinary Least Square (OLS). This indicated that the best practiced production function has shifted neutrally from the average production function. This shift might be due to the techniques chosen to estimate the frontier function. The estimate of $\gamma = 0.7319$, which is statistically significant indicates that the variation of farm yield from the maximum feasible yield was mainly due to the
differences in the use of the best practices of production. $\sigma_u^2 = 1.6913$ and different from zero implying that the symmetric error $\nu i$ is not the predominant error.

The distinction of mean efficiency could be accepted at 5 per cent of probability. The overall mean value of efficiency is 0.67 and 0.72 for paddy farmers in Corrected Ordinary Least Square (COLS) and maximum likelihood estimator (MLE) methods. The efficiency ratings for the overall measures of technical efficiency ranged from 40 per cent to 100 per cent with 10 and 20 farmers in paddy exhibiting full efficiency. The distinction of mean efficiency could be accepted at 5 per cent of probability. The overall mean value of efficiency is 0.697 and 0.695 for banana farmers in corrected ordinary least square and maximum likelihood estimator methods. Taking the corrected ordinary least square method it could be seen that 40.25 per cent of the banana farmers and 47.5 per cent of the paddy farmers are operating below their respective mean efficiency levels. In both two farms, 17.50 per cent of the farmers operated with 0.90 of efficiency. The heterogeneity in management skills, production practices and facilities available in farms could explain the distribution of technical efficiency. On the whole as far as the paddy farmers are concerned, training, awareness of latest technologies and frequent interactions with co-farmers and experts will reduce the inefficiency in the technical efficiency among these farmers.

The relative economic efficiency in the context of the Cobb-Douglas production function and the unit output profit function is judged by testing whether the unit output profit of the two groups differed from one another significantly. Given equal access to inputs and technology, the paddy farmers and the banana farmers were
expected to have equal relative economic efficiency. The hypothesis of equal economic efficiency of paddy and banana farmers was tested as $H_0: \alpha_0 = 0$. The hypothesis implied that $\ln A^1 - \ln A^2 = 0 \Rightarrow A^1 = A^2$. This implied that $A^1 = A^2$ and $k^1 = k^2$ profit functions and variable factor demand functions of paddy and banana farmers coincide. Thus, the results of the test of absolute price efficient paddy and banana farmers showed that the null hypothesis cannot be rejected at 5 per cent level of significance implying that the paddy farmers maximized their profit in relation to the levels of use of the variable factors of production. This showed that the banana farmers also have maximized their profit in relation to the levels of the use of the variable factors of production.

The parameters of the estimated Stochastic Frontier production function (corrected ordinary least square) seemed to be almost equal to those of the ordinary least square except the intercept term. Similarly, the maximum likelihood estimated parameters are greater than that in the other two methods. The advantage of using parameter $\gamma$ is that it varies between 0 and 1 while $\lambda$ varies from 0 to $\alpha$. The estimate of $\gamma$ (indicator of the relative variability of $u_i$ and $v_i$) was 0.832 and was significant at one per cent level of probability. This indicated that the deviation of farm’s yield from the maximum feasible yield was by the farmer’s failure to use the best practices. Here $\sigma u^2=1.465$ different from zero implied that the symmetric error $\theta_i$ is not the predominant error.

The economic behaviour of the farmers in the two groups in the study area was examined in terms of the economic efficiency of cultivation using profit functions and factor demand functions. The efficiency ratings for the overall measures of
technical efficiency ranged from 40 per cent to 100 per cent with ten and twenty farmers in paddy exhibiting full efficiency. The overall mean value of efficiency of paddy farmers for the two groups was 0.67 and 0.72 and the mean value of banana farmers for the two groups was 0.697 and 0.695. Taking the corrected ordinary least square method it could be seen that 40.25 per cent of the farmers in paddy and 47.5 per cent of the farmers in banana operated below their respective mean efficiency levels. In both the groups, 17.50 per cent of the farmers operated with 0.90 level of efficiency. The heterogeneity in management skills, production practices and facilities available in farms would have been the reasons for such distribution of the technical efficiency.

The relative economic efficiency in the context of Cobb-Douglas production function and unit output profit function was judged by testing whether the unit output profit of the two groups differed from one another significantly. Given equal access to inputs and technology the paddy farmers and banana farmers were expected to have equal relative economic efficiency. The result showed that the null hypothesis of equal economic efficiency could not be rejected at 95 per cent level of significance. The co-efficient of $D_1$ was not significantly different from zero at 95 per cent level of significance implying that the relative economic efficiency was the same among the farmers of both the groups.

The results of the analysis further showed that the null hypothesis of equal relative price efficiency of farmers of both the groups cannot be rejected at 5 per cent level because the estimates of $\lambda$ did not differ significantly from zero as the value of Chi-square was not significant. Hence it could be inferred that the farmers of the two
groups had to same degree of profit maximization. The results also showed that the farmers of both the groups maximized their profit in relation to the level of use of the variable factors of production. The analysis further indicated that they were equally technically efficient. A test for constant returns to scale in use of factors of production confirmed the equal relative efficiency production based on the validity of profit maximization among the two farmers group.

**Policy Options**

- The results of paddy farmers showed that the co-efficients of human labour and fertilizers were significant in influencing the yield of paddy. But in the case of banana farmers’ farms size was alone found to influence the yield of banana. Hence, appropriate extension strategy should be developed to train farmers about the level of use of these inputs to increase the yield of banana.

- It was found that about 40 per cent of the farmers in both the crops operated below the mean efficiency levels. The mean efficiency levels were only around 0.65 for both types of farmers. This necessitates in improving the management skill of the farmers by proper training and in the adoption of package of practices in full by the demonstration and education. This is supported again by the results on inefficiency for both the groups.

The study indicated that the farms were operating at constant returns to scale. This will not attract investment in both the sectors. Hence, production strategies should be developed to achieve increasing net returns to scale to enable the farmers to continue their crops in both the sectors. On the basis of the analysis of the relative economic efficiency of the two farmers group cultivating modern and traditional varieties of paddy and farmers cultivating kathali and sakkai varieties of banana, the hypothesis of equal economic efficiency of small and large farmers was rejected. The
results showed that small farmers were economically more efficient than large farmers due to their attention, own field work and low cost of production. This may be due to the more intensive use of inputs by them and better personal supervision at every stage of cultivation. Thus, it may be concluded from the analysis that small farmers were both technically and allocatively more efficient than large farmers in both varieties. Further, both farmers were found to operate under constant returns to scale.

Conclusion

Given the importance of the seed, fertilizer and technology in agriculture to increase food grain production and the need to increase the food grain production further in the future to meet the needs of the growing population it has become necessary to examine the performance of farms in relation to their technical and allocative efficiencies. There is a general belief that only a few farmers are able to exploit the potential of the new production technology. But the average farm yield of crops in general was below the potential. These productivity differences might have been mainly due to lack of use of recommended and or optimum practices and partly due to technical inefficiency i.e, farmer’s knowledge on the technology.

This study came to be concluded from the analysis that small farmers are economically more efficient than large farmers irrespective of varieties of paddy and banana cultivation in the study area. This could be due to the better supervision and more efficient farm management favoured by the smaller size of operational holdings. This indicated that apart from efficient allocation of sources, direct supervision and farm management are crucial determinants of economic efficiency.
Suggestions

This study is suggested based on the findings that the extension service officials may improve technical efficiency by advising the farmers on input application at the proper time is recommended. The farmers in the study area were of the opinion that they could not achieve the maximum yield due to severity of diseases and pest attacks. It is suggested that the farmers should be educated, properly to apply the pesticides at the prescribed level and this may be done through the agricultural department officers, attached to the local government bodies. Non-availability of credit was the other constraint. It is suggested that financial institutions should revitalize and revamp the existing credit facilities in the study area. So that the farmers could get timely credit for undertaking improved cultivation practices. The rate of interest for agricultural loans should be reduced. During the flood and drought periods loan amount must be waved entirely. Further, the crop insurance amount should be provided early as possible every year. Of course, salient measures shall be implemented for protecting farmers lead to agricultural growth. It is a welcoming one.