

V. SUMMARY AND CONCLUSION

Agriculture plays an important role in the process of economic development of India. Besides providing food to the nation, agriculture releases labour, provides savings, contributes to market of industrial goods and earns foreign exchange. However, agriculture was the main contribution to the national income at the time of independence of India. And also, the growth of other sectors depends on this sector and it is the main source of livelihood and food security for a large majority of Indian population. The sector is more useful to the economy directly and indirectly. However, the agricultural sector remains the principal source of livelihood for more than 52 per cent of the population contributing 14.2 per cent to the national GDP. The Indian agriculture sector is now moving towards another green revolution. The transformations in the sector are being induced by factors like new found interest of the organised sector, new and improved technologies, mechanised farming, rapid growth of contract farming, organic farming etc.

The mass production of food through the techniques that define modern agriculture has led to the conventionalization of agriculture in a technocratic approach to agriculture. The intensive farming that characterizes modern agriculture uses a higher amount of labour and chemicals per unit area than any other approach to farming. Much of this labour is mechanised to allow for a much more efficient use of land, providing a higher yield-output to human labour-input ratio. However, this inorganic and mechanized form of agriculture is extremely energy intensive, requiring fossil fuels to power the machines that allow humans to farm on such a large scale. As a whole, the mechanization of farming in today's conventionally industrial agriculture has brought about an approach to farming that is disconnected from the earth and the people it feeds. The growing number of links in the food chain renders it harder and harder to see firsthand the ecological impacts that inorganic farming has facilitating the ease with which we can forget its connection to climate change and food security. The ecological impacts of inorganic farming have been called into question, allowing for the emergence of organic farming as an alternative approach to farming.

Many farmers and consumers thus, have become concerned with the way in which inorganic agriculture is moving. These same people want farming to be sustainable and economically profitable, instead of a few large businesses making all the profit. Organic farming may be able to provide this sustainability through the philosophy that farming should be done in harmony with nature rather than trying to conquer and control nature. At the same time organic farming allows small farmers to be

economically successful and highly productive. The Standing Committee on Environment and Sustainable Development (2000) had this to say about organic farming: "Apart from protection of the environment, biodiversity and ecological equilibrium, organic agriculture is designed to respond to concerns about food quality, human health and animal welfare. It is also intended to protect natural resources and maintain the ecological viability of agriculture resources". With the present changes occurring in the environment, loss of biodiversity and very little new agricultural land to develop it is important that sustainable agriculture becomes the foundation for food production in the future.

Organic farming is seen as a holistic approach to food production, basing its principles of practice on sustainability by focusing on the importance of long-term ecosystem health by excluding or limiting the use of inorganic fertilizers and pesticides. The demand for sustainably farmed and chemical-free foods has provided organic foods with a price premium. Organic farming had to adapt to maintain yields that are competitive with inorganic farming yet remain in line with its sustainability principles. Many farming techniques used by organic farmers have come about as a method of remaining competitive while adhering to the organic farming standards placed upon them. One common concern with farming is the gradual depletion of soil nutrients and soil organic carbon with each passing year of growth on farmland. While inorganic farming would apply inorganic fertilizers abundant in nutrients and organic carbon, organic farming relies on techniques such as crop rotation and the application of manures.

National Programme for Organic Production (NPOP) was launched in May 2000 with the objective of promoting organic farming in India leading to development of a movement among the farmers, agriculture experts and scientists in favour of organic farming in Tamil Nadu. State Department of Agriculture, NGOs, Tamil Nadu Agricultural University and other government and private agencies have started advocating organic farming in major crops. There is considerable latent interest among farmers in conversion to organic farming in Tamil Nadu. But, some farmers are reluctant to convert because of the perceived high costs and risks involved. Those who have converted earn equal income to their conventional counterparts, if premium markets exist for organic produce.

At the state level, in Tamil Nadu, 90 per cent of the farmers belong to small and marginal category and their operational holdings accounted for 56 per cent of the total areas. So the small and marginal farmers play a key role in overall development in agriculture and the adoption of scientific

technologies by these farmers needs focused attention. Major efforts are required to increase the productivity of rain fed crops by overcoming the various challenges such as; erratic monsoon rains, soil with low nutrient and organic contents / poor water holding capacity, soil and water erosion, etc. The labour scarcity especially during the peak cropping season is also causing difficulty to the farmers to take-up timely field operations. In respect of agricultural crops, the crop cultivation is taken up in two to three seasons annually. Hence to achieve sustainable development and break-through in agricultural production, continuous concentration on technical advancement, input supply, credit and market supports are required.

In order to retain the farmers especially the younger generation to take up agriculture as a profession, the income from the farm holdings required to be increased considerably. Despite the attention which has been paid to organic farming over the last few years, very little accessible information actually exists on the economic performance of organic farming in Tamil Nadu. Similarly, there had been only a few attempts on comparing efficiency between organic and inorganic farming systems in Tamil Nadu. In view of the above points the investigator had undertaken the study with the following objectives.

Objectives

The major objectives of the study were

- To find out the socio-economic characteristics of organic and inorganic farmers
- To analyse the resource use efficiency of organic and inorganic farming system
- To compare the efficiency of organic and inorganic farming system by technical, scale, cost and allocative efficiencies
- To identify the factors influencing gross returns of organic and inorganic farming system and
- To bring out the constraints as perceived by farmers in operationalising the existing farming systems and to suggest appropriate policy options for enhancing organic farming.

The present study was undertaken in 4 districts namely Vellore, Tiruchirapalli (Trichy), Cuddalore, and Erode. These districts were selected purposively for the present study since they cover almost all area under agro-climatic Zone and all types of soil with good rainfall. Data required for the present study were obtained from primary sources. A pilot survey with a sample of 30 organic farmers in Kanchipuram district had been conducted in the month of December, 2012 to check the

reliability of interview schedule and verified the results. Multistage stratified random sampling method was used to select sample households. List of organic crop growers were obtained from NGOs (vanagam, prabanjam) and list of inorganic crop growers were obtained from tahsil of selected villages. From the list, organic and inorganic cultivators were selected randomly which constitute different farm sizes, to elicit information. First, the sample has been divided into: Red soil - Erode, laterite soil - Vellore, black soil - Trichy, sandy coastal alluvium soil – Cuddalore. Among these districts, a village has been randomly selected and primary data has been collected for the present study from 407 farmers by direct interview method with well-structured schedule prepared for this study in the year between February, 2013 and November, 2013. From the survey data, input-wise costs on human labour, livestock expenditure (fodder and veterinary charges), machinery (power and fuel) charges, seed, fertiliser, plant protection, irrigation and land along with total output data were computed.

Hypothesis tested

The null hypothesis tested in the study included the following:

1. Farmer's decision to adopt or not to adopt organic farming is independent of the explanatory variables.
2. There is no difference between the resource use efficiency of organic and inorganic farming system.
3. There is no significant difference between technical, scale, cost and allocative efficiency of organic and inorganic farming system.

Tools of analysis

1. The parametric Cobb-Douglas production function was applied to determine the resource-use efficiency based on returns to scale and the inputs used by the farmers.
2. To identify the dominant factors which discriminate the gross returns of farming system, Discriminant function was used among the selected villages between organic and inorganic farmer's. Wilk's lambda and 'F' value were used to find out whether the means of the two groups differ significantly. Using canonical discriminant function, coefficient of selected variables in discriminating the groups were found out.

3. The DEAP 2.1 was applied to measure the different forms of efficiency namely technical, scale, cost and allocative efficiency.
4. Since the absolute figures do not provide a definite picture, their relative share of the various items towards total, the investigator had calculated simple percentages. Diagrams were used to show the occupational status, farm size, classification of farming system, number of livestock among farming, impact of organic farming, costs and returns of farming system, resource use efficiency of farming system, technical, scale, cost and allocative efficiencies and relative contribution of variables among the farming system.

Major findings

The major findings emerged from the study are summarised as follows:

A. Socio-economic characteristics of the sample

- For the purpose of the study, the four districts of Tamil Nadu namely Trichy, Erode, Cuddalore and Vellore based on the prevailing soil type conducive for organic farming were selected. Of the total 407 sample respondents, 65.36 per cent were organic farmers and 34.64 per cent were inorganic farmers.
- About 28.01 per cent of farmers fell under the age group between 41-50 years and only 33 per cent belonged to the age group below 30 years. About 96 per cent of farmers under inorganic farming and 67 per cent of organic farmers were in the productive age group of 41-60 years.
- Population across the sample area showed that the proportion of male members was more when compared to female members. Among the sample households the age group 41-50 years was most populous with 18.06 per cent falling in this age group which was followed by age group of 21-30 years (16.48 per cent) and age group 31-40 years (16.36 per cent). Organic farmers accounted more members in the age group of 51 years (20.56 per cent) which indicated more lifespan because of healthy life. The male population among organic households out-numbered inorganic farmers. The dependents of the sample households consisted of infants and children below the age group of 10 years. The number of dependents in the sample household was on an average 22 per cent of males and 19.63 per cent of females.
- Of the total sample respondents surveyed, 65.6 per cent farmers were literate, out of which 47.17 per cent had completed secondary education while 5.90 per cent farmers were graduates. The

literacy rate among inorganic farmers was found to be lower (26.2 per cent) as compared to organic farmers (38.7 per cent).

- In the sample farmer households out of the total literates, mixed level of education between the members were observed. Among inorganic farmer households up to secondary education the females (73.94 per cent) dominated males (68.62 per cent). But after this level of education, it was reversal. In other words, male population outnumbered the female population in terms of higher secondary, under graduation and post graduation which in turn brought the same trend at the overall farming system households.
- Among organic farmer households, females outnumbered males in secondary education and illiteracy and drop-outs were found to be more. The number of illiterates was found to be more among the farms varying between 44.74 per cent and 55.26 per cent among inorganic and organic families respectively i.e. they did not possess any formal or informal education and 166 infants (9.86 per cent) were yet to be enrolled in schools.
- Of the total sample farmers, 70.51 per cent belonged to Hindu religion and the remaining 29.48 per cent belonged to other religions. Both organic (63.53 per cent) and inorganic (83.69 per cent) farm households had majority of Hindu population in the selected sample.
- Among the sample farmers only 2.95 per cent belonged to forward community. The distribution of sample households community wise showed that 32.68 per cent of them belonged to scheduled caste, followed by the most backward community (31.20 per cent). Both the castes together accounted for 63.88 per cent and the remaining fell under backward and forward communities. Majority (36.47 per cent) of organic farmers belonged to most backward community and most (50.35 per cent) of the inorganic farmers belonged to scheduled caste.
- Joint family system was prevailing in the selected sample households in which 65.11 per cent were favouring it and the rest formed nuclear family system. Among the sample households, 61.28 per cent of organic farmers and 72.34 per cent of inorganic farmers belonged to joint family system.
- Both organic and inorganic farmer households had 65 per cent of family size up to four members in sample region. Also, only 2.70 per cent of the total sample farmer households had more than eight members and 31.94 per cent accounted for a medium size family of 5 to 7 members.
- Majority of the sampled farmers (65.36 per cent) had their main occupation as agriculture, while agriculture + business were low (10.56 per cent). The organic farmers had agriculture as their sole

occupation accounted for 71.43 per cent and for inorganic farmers it was 53.90 per cent among the regions studied. Agriculture + service were found to be more (31.20 per cent) under inorganic farming.

- The monthly family income of the sample households showed that it was high for organic farmers (₹ 25,001 and above). About 20.88 per cent of farmers had a family income of less than ₹ 5,000 in which organic farmers constituted 27.07 per cent of the total 266 organic farmers. The reason was that some farms are in initial stage of conversion. In case of inorganic farming, 36.17 per cent earned an income of ₹ 20,001- 25,000 followed by an income above ₹ 25,001(31.20 per cent). Almost 31.20 per cent of total sample farmers also earned above ₹ 25,000.
- The non-farm expenditure depending upon the income level also varied across the sample areas. The per capita expenditure for non-farm activities was found to be high among the organic farmers (36.84 per cent) while 26.24 per cent of inorganic farmers spent less than ₹ 3,000. All the farmers together on an average spent ₹ 7,001 – 10,000 per month as living expenses.
- Among the sample respondents, 50 per cent of organic farmers and 40.4 per cent of inorganic farmers had a minimum of 10 years experience in their field. Only 6.40 per cent of organic farmers and 6.88 per cent of inorganic farmers had experience more than 30 years.
- About 44 per cent of organic farmers had opined that their soil health had improved which they had realised by soil testing and higher yield in the long-run. About 10.90 per cent of farmers had opined that they realised through visual observation. About 84 per cent of respondents were of the view that quality of the farm products also had improved apart from better taste.
- Organic farmers had lot of pre-harvest contractors (36.80 per cent) for selling their products. Among inorganic farmers, majority (70.20 per cent) of them sold their produce in local market. About 18.80 per cent of organic farmers and 7.80 per cent of inorganic farmers consumed their own cultivation. At overall level, 32.68 per cent of farmers sold their products in local market.
- Source of information revealed that 32.33 per cent of organic farmers learnt about the system of organic farming from their neighbours and forefathers and only 17.67 per cent were educated from agents like NABARD, NGOs etc. The second major source pertained to the training provided (27.82 per cent) and further the interaction revealed the third factor responsible according to the farmers as media (23.31 per cent).

- Out of 266 organic farmers only 53 per cent were in debt whereas out of 141 inorganic farmers 85.8 per cent were in debt. The main source of borrowing was bank since it offers loans at low interest rates. To meet unforeseen changes in their expenditures prime lenders in the sample region were moneylenders (37.40 per cent).
- Of the total livestock in the sample area, cow (46.49 per cent) was the most dominant and preferred domestic animal. About 84.50 per cent of livestock were possessed by organic farmers since the farmers realised the importance of livestock contribution to agriculture while inorganic farmers possessed only 15.50 per cent.
- As regards the farm size, 36.12 per cent of the study area was of farm size less than 2.5 acres which formed the majority of the sample. Classification according to farming system showed that out of 407 farmers, majority (39.72 per cent) of inorganic farmers belonged to small farm size (2.5 to 4 acres) while majority (35.71 per cent) of organic farmers fell under the category of marginal farmers. Only 1.72 per cent of the total sample comprised medium size farmers.
- The total land area operated by sample farmers was 1369.71 acres, out of which the rain fed land formed 42.53 per cent and 57.47 per cent was irrigated. About 50.71 per cent of inorganic farmers and 59.30 per cent of organic farmers were farming under irrigated condition. Only 40.70 per cent of organic farmers and 49.29 per cent of inorganic farmers were farming under rain fed condition.
- Per capita land holding across the rainfed and irrigated conditions ranged between 0.24 and 3.78 acres in case of organic farming and it ranged between 0.3 and 1.77 acres in case of inorganic farming. When the sample as a whole was taken together, the per capita land holding was 6.09 acres.
- About 30.50 per cent of total sampled farmers were cropping maize of which organic farmers formed the majority with 37.55 per cent. Among the inorganic farmers, 37.53 per cent were cropping plantain and turmeric followed by paddy (27.71 per cent), groundnut (14.40 per cent), sugarcane (10.97 per cent), coconut (4.93 per cent) and maize (4.46 per cent). Under organic farming, after maize, 15.44 per cent, 14.18 per cent, 13.76 per cent, 13.08 per cent and 5.98 per cent of groundnut, turmeric and plantain, paddy, sugarcane and coconut respectively were cultivated.
- Cropping intensity under inorganic farming system was high in the cultivation of maize (3213.92 per cent) and low for plantain cultivation (239.56 per cent) whereas the cropping intensity recorded

under organic farming system was high for plantain (171.65 per cent) and low for maize (103.21 per cent).

- Majority (65.68 per cent) of the sample farmers spent less than ` 500 for livestock and only 11.44 per cent of farmers spent more than ` 1000. Majority (75.11 per cent) of the organic farmers spent less than ` 500 since they rely on organic crop by-products like hay, wood, solai in case of sugarcane, tavidu from rice, groundnut kodi as fodder to the livestock which is healthy and nutritious. Around 28 per cent of inorganic farmers spent more than ` 3,000 for fodder and veterinary expenses.
- The application of descriptive statistics revealed that deviations from the mean were higher for organic farming than for inorganic farming in case of gross returns. The deviation from the mean in expenditure on land and labour was more for inorganic farming and for all other expenditures the mean value appeared to be greater for organic farming. The coefficients of variations were higher for gross returns, land, plant protection and irrigation in case of organic farming than they were for inorganic farming. The variability among inorganic farming system that was explained by labour employed, usage of livestock and fertiliser was much higher than that of the variability as explained by either organic farming or overall farming system. The percentage of variation due to land was higher in organic farming than inorganic farming or overall farming system. The variability in overall farming system that was explained by machinery, seed, plant protection, irrigation and gross returns was much higher than that of the variability was explained by either inorganic farming or organic farming system.
- With regard to the expenditure incurred on different items showed that among the inorganic farmers out of the total amount spent about 20.74 per cent was spent on land preparation followed by marketing (18.52 per cent), plant protection (12.65 per cent), weeding (11.85 per cent) and irrigation purposes (11.11 per cent) while organic farmers spent more on marketing or transporting (24.29 per cent) their produce followed by weeding (16.75 per cent), land preparation (15.91 per cent) and plant protection (14.24 per cent). The total cost of cultivation required for organic farming was less than inorganic farming by ` 1560. It was 11.56 per cent less over inorganic farming.
- Among the sampled organic farmers, 30.22 per cent of the sampled farmers earned below ` 5000. Also, 39.10 per cent of organic farmers were earning less than ` 5000 per month. In case of inorganic farming, 20.57 per cent of farmers were able to earn above ` 25,000 while 16.54 per cent

of organic farmers earned the same by organic farming. More number of organic farmers (44) when compared to inorganic farmers earned above ` 25,000 since many of them had not applied chemical inputs to their farm.

- Organic farmers were reducing cost by producing their own inputs in the farm with perishable waste, cow dung, dry leaf, sambal, ragi thattu, earthworm, jeevamurutham, panchakavya, herbal inputs and composting.
- The gross returns realized per acre were ` 22,698.39 for inorganic farming and ` 13,315.69 for organic farming respectively. Though the cost of cultivation for inorganic farmers was high (` 13,500), the net returns from inorganic farming was more with ` 9,189.39 in the sampled area.

B. Cobb-Douglas production function

- The results of Cobb-Douglas production function showed that under organic farming, expenditure on land, labour, livestock, fertiliser, irrigation, plant protection and seed was positively related and significant. The value of the function co-efficient for organic farming 1.56 showed increasing returns to scale. Hence, one per cent increase in expenditure on land, livestock, fertiliser, seed, irrigation and plant protection would lead to 0.199, 0.179, 0.215, 0.051, 0.057 and 0.506 units increase in the returns from organic farming respectively.
- For inorganic farmers, expenditure on labour, livestock, plant protection, irrigation and machinery were insignificant which showed inadequate use of inputs. Expenditure on fertiliser was negative but significant which was due to excess usage of the fertilisers than the recommended level. The function coefficient 0.93 (sum of co-efficients) showed decreasing returns to scale. Thus, one per cent increase in the expenditure on land, labour, machinery, seed and irrigation would fetch to 0.921, 0.008, 0.102 and 0.081 units increase in the returns from inorganic farming.
- Cobb-Douglas production function applied to analyse the resource use efficiency revealed that under organic farming, land, labour, fertiliser and irrigation were under-utilized and expenditure on machinery demonstrated that it was over-utilized. The inorganic farmer's under-utilised land and expenditure on fertiliser and irrigation were over-utilized.

C. Discriminant Analysis

- The discriminant function applied to find out the factors influencing gross returns of the organic and inorganic farming system revealed that the variables such as expenditure on fertiliser and irrigation were significant and had positive signs indicating that these variables had higher discriminating power for overall farming system. Under inorganic farming, land, fertiliser and labour was significant at one per cent level. Further, expenditure on irrigation exhibited significant difference at five per cent level. Expenditure on plant protection, land, irrigation, livestock and fertiliser under organic farming system were significant. In case of organic farming system, land, seed and irrigation made negative contribution and in case of inorganic farming system, labour, machinery and seed exhibited negative contribution.
- The relative contribution of each of the variable as discriminators between the different levels explained that under inorganic farming system, expenditure on labour was the most dominant factor with 68.59 per cent followed by fertiliser, irrigation, plant protection, machinery and seed with 15.02 per cent, 10.20 per cent, 2.80 per cent, 1.76 per cent and 0.96 per cent respectively. In case of organic farming, expenditure on irrigation was the dominant factor with 64.25 per cent followed by fertiliser (18.21 per cent), machinery (6.72 per cent), labour (5.86 per cent), livestock (2.34 per cent) and plant protection (2.04 per cent). Expenditure on irrigation was the first dominant factor to determine the gross returns of overall farming system and it alone contributed 77.91 per cent. Next to Irrigation, expenditure on plant protection contributed 6.56 per cent followed by expenditure on fertiliser (5.40 per cent), labour (3.88 per cent), land (2.86 per cent), livestock (2.02 per cent), machinery (1.06 per cent) and seed (0.31 per cent).

D. Data Envelopment Analysis (DEA)

- DEA approach to calculate technical, scale, allocative and cost efficiencies of farms in selected districts of Tamil Nadu were compared between organic and inorganic farms. Under Constant Returns to Scale (CRS) production technology, mean technical efficiency for organic and inorganic farming were 0.440, 0.367 and under Variable Returns to Scale (VRS) production technology the scores recorded were to the extent of 0.752 and 0.785 respectively. The results of both farming system, especially with CRS assumption, showed that there were substantial inefficiencies in the agricultural production activities in the sampled areas during the survey.

- Scale Efficiency (SE) results revealed that in both groups the average efficiency were 78.1 per cent and 79.8 per cent respectively and thereby suggesting that scale efficiency was close to unity for each DMU (farms). These results implied that scale inefficiency was not present among the farms and since the farms were very small, scale economies could only be realized by larger farms. Only 61.44 per cent of organic farmers and 38.55 per cent of inorganic farmers were operating under Constant Returns to Scale (CRS) production technology which showed the efficiency of organic farming system over inorganic farming system.
- The cost efficiency of farms revealed that under Constant Returns to Scale (CRS) production technology, organic and inorganic farms were efficient to the extent of 19 per cent and 48 per cent respectively. Under Variable Returns to Scale (VRS) production technology the farm were more efficient to the extent of 24.3 per cent and 43.3 per cent respectively.
- The farmers under inorganic farming system had a mean Allocative Efficiency (AE) level of 0.476 under CRS production technology and 0.544 under VRS production technology. In the case of organic farming system, mean allocative efficiency of 0.497 under CRS production technology and 0.608 under VRS production technology could be observed in the selected sample areas. More efficiency DMU farms were observed in VRS production technology compared to CRS production technology.
- Estimates of allocative efficiency indicated that, on average, organic farmers could reduce the cost by 1.012 units under CRS production technology (0.645 units under VRS production technology) by taking into account the input prices. The inorganic farmers could bring down cost by 1.101 units under CRS production technology (0.838 units under VRS production technology).

E. Constraints faced by the farmers

- About 22.16 per cent of inorganic farmers were very serious about the drawbacks of approaching government for subsidies. Obsolete methods of production, poor irrigation, labour problem, non-availability or high cost input, no proper technical assistance and inadequate financial assistance were some of the reasons expressed by the sample farmers for low yield of farm output. The other major constraints faced by the inorganic farmers were power failure (16.76 per cent), credit risk (11.93 per cent) and non-availability or costly inputs (10.51 per cent). The constraints like water

pollution and labour problems were tolerable. About 24.24 percent of inorganic farmers had opined that they did not have market risk and less spoilage during storage.

- About 14.60 per cent of organic farmers were ignorant about new techniques of farming and they did not have government subsidies. About 13.41 per cent of organic farmers have reported spoilage during storage since they do not have proper warehouse and refrigeration facilities. About 19.36 per cent of organic farmers opined that they do not have credit risk.
- Taking in to account the whole sample farmers, the important constraints faced by both the organic and inorganic farmers in production front were irregular subsidy and they sought for government intervention.

F. Motivational factors determining conversion to organic farming

- Based on various suggestions in conversion to organic farming, 27.73 per cent expressed lack of technical knowledge and they need technical assistance. Under organic farming, the farmers expressed their unhappiness on the lengthy procedure and formalities in certification and demanded simple procedures in order to save their productive time. Regarding credit facilities, 8.89 per cent of organic farmers were of the opinion that necessary steps should be taken to further reduce the prevailing differential interest rate to encourage more farmers to avail credit facilities and 17.31 per cent demanded relaxation in price. About 16.80 per cent of the inorganic farmers demanded availability of inputs on time to convert themselves to organic farming. Most of the farmers gave no suggestion and they expressed their inability as most of them were illiterates. Therefore, they could not give any suggestion either in favour of or against organic farming.

Conclusion

The discriminant function analysis on collected data revealed that the variables such as expenditure on labour, land, livestock, machinery, plant protection and irrigation were significant which indicated that these variables had higher discriminating power between organic and inorganic farming system. Cobb-Douglas production function revealed that under organic farming, expenditure on land, labour, livestock, fertiliser, irrigation, plant protection and seed were significant and it showed that there was scope to increased usage of these inputs. The organic farmers in the area underutilised some resources whereas the inorganic farmers in the area over utilised the same resources. The results thus showed that appropriate adjustment was required for optimum allocation

of resources and to maximise the revenue from organic farming. For all the farmers, technical, scale, cost and allocative efficient DMUs were more under Variable Returns to Scale (VRS) production technology than under Constant Returns to Scale (CRS) production technology in the sampled areas. Also it was very clear that inefficiency could be due to the existence of either increasing or decreasing returns to scale. This finding explained the fact that the main problem of both groups was their inability to allocate inputs in the most cost minimizing way rather than using the inputs in a technically efficient way.

Policy recommendations

Based on the findings of the study, the following recommendations are made for increasing productivity of sustainable cultivation practices and to strengthen organic farming.

1. It is found that farming system followed by farmers are of varied nature, however there is need for training on integrated farming systems. It is suggested that special training along with demonstrations should be organised for the benefit of farmers in different regions.
2. It is necessary to motivate farmers to adopt livestock based farming system suitable to the specific regions for efficient allocation and proper utilisation of resources.
3. Efforts may be strengthened to provide quality and high yielding variety seeds, so that farmers will replace seed regularly and productivity can be improved.
4. The human labour should be used judiciously so that it would be cost effective. The use of Farm Yard Manure (FYM) and organic fertilizers should be increased.
5. In order to promote organic farming, it is necessary to harness the market as far as possible by developing infrastructure facilities, refrigerated warehouse facilities and implementing market oriented agricultural activities.
6. Credit availability at reduced interest rates should be made accessible to farmers since credit risk was one of the constraints faced by both type of farmers.
7. The procedure for certification must be simplified
8. A policy implication of this study is that there is enough potential for farmers to increase agricultural production and net profits. The study recommends that the government should

further invest in public education and strengthen extension services because extension visits constitute important determinants of productive efficiencies.

Areas for further research

Following are some of the thrust areas of research which needs special attention in future in Tamil Nadu in selected areas which are specific in nature.

- The analysis about factors determining the absolute and relative economic profitability of organic farms;
- The cost and benefit structures of organic farms in different areas, with a view to provide advice to the farmers;
- The impact of future agricultural policies on organic farming;
- Relationship between organic farming and environment;
- The economic viability of direct marketing and on-farm-processing.