Chapter - VII

Major Findings and Policy Implications

Agriculture is the most important economic activity of the people of Nagaland. The economy’s remarkable feature is that there are no landless peasants in the State. Paddy is the staple food crop of the state and is almost grown in the entire cultivable area, from plain lands (valley land) to the hill slopes. The productivity of rice in the state is low as compared to world average productivity. This study makes a comparison of organic and inorganic rice cultivation by farm size in Dimapur district, Nagaland, to understand the economics of cultivating them across varieties and farm size, based on the input use, cost and return structure, farm size and efficiency relationship, yield determinants, yield gap and constraints and income inequality. Besides, it examines whether organic farming benefits the rural farmers as compared to the inorganic farmers by farm size. Thus the following are the main objectives of the study:

1. to study the cost and returns structure of organic and inorganic rice cultivation by varieties across farm size in the study area;
2. to investigate the determinants of yield of the two rice varieties by farm size;
3. to identify the yield gap and its constraints with regard to the two rice varieties across farm size;
4. to analyse the farm size-productivity relationship of the two rice varieties; and
5. to examine inequalities in net income distribution of the farmers cultivating the two rice varieties.

Out of the 205 villages in Dimapur district, Suhoi and Kuhuboto villages were chosen for the study as these two villages have both the groups of farmers, i.e., one still practising the traditional organic farming and the other group practising the modern inorganic farming using hybrid seeds and improved techniques mostly for commercial purpose. Of the sixteen varieties of rice cropped in Nagaland, Ranjit (inorganic) and Naga Local/Special rice (organic) are the two widely and popularly cropped rice varieties by the farmers in the study area. Therefore the two varieties were chosen for the comparative study. The primary data were collected using pre-
tested schedule from a total sample of 350 farmers cultivating rice during November-December 2013. Census method was adopted to collect data from all the 100 organic farmers cultivating Nagaland Special rice in Suhoi and Kuhuboto villages, Dimapur, Nagaland. In addition, a random sample of 250 inorganic farmers cultivating Ranjit rice variety was also selected from the two villages, as majority of the inorganic farmers cultivated Ranjit rice variety. To examine the farm-size effects, the data collected have been divided into two groups of small farmers (with land ownership of less than 4.95 acres) and the medium farmers (with land ownership 4.95 to 12.36 acres).

Secondary data were also used to describe the profile of the study area. The data for the same were collected from Agriculture Report 2012-13, Director Office, Department of Agriculture, Dimapur District; Office Record 2011-12, District office, Dimapur, Nagaland; Research Station Record Agriculture Department, Nagaland University, Medziphema, Nagaland; Statistical Handbook of Nagaland 2011, Directorate of Economics and Statistics Publishers, Nagaland; Village Record, Village Council office, Kuhuboto Area, Dimapur District for 2011 to 2014.

The objectives of the study were analysed using the statistical techniques like simple averages, ratios, percentages, correlation matrix, log linear production function, simple regressions, F-test, Chow test, Garrett Ranking Technique, Lorenz curve, Robin Hood Index and Gini index.

The major findings and their policy implications derived on the basis of the empirical analyses done are presented in this chapter.

7.1 Major Findings

The major findings of the study are summarized as follows:

1. **Farmer categories:** It was observed that out of 350 farmers, 162 (46.29%) were small farmers and 188 (53.72%) were medium farmers. Under the small farmers group, the number of organic farmers were 50 (30.87%) and inorganic farmers 112 (69.14%). Under medium farmer group, there were 188 total farmers (53.72%), of whom 50 (26.6%) were organic farmers and 138 (73.41%) were inorganic farmers.
The study revealed that out of the total 100 organic land owning farmers, 75 percent were males and 25 percent females. However, in the case of inorganic farmers, there were no female cultivators.

2. **Age and education**: Majority of the total farmers (43.43%) were in the age group of 40-50 years, followed by the age group of 30-40 years. The study also showed that the number of illiterates were three. The number of respondents with high school education were 69.43 percent, higher secondary 17.14 percent and 12.57 percent with college education.

   Variety-wise result showed that under organic farmers, majority (48%) were in the age group of 40-50 years. About 77 percent of the organic farmers had high school education, followed by higher secondary education, college educated and only three percent illiterates. Under inorganic rice farmers, majority (55.2%) were in the age group of 30-40 years. Most of the inorganic farmers (66.4%) also had high school education, followed by higher secondary and college education. There were no illiterate respondents among the inorganic farmers.

3. **Input-output structure**: An overview of the input-output structure of the two rice varieties revealed that among all the inputs, the highest and significant difference was found for fertilizer (chemical for inorganic and organic manure for organic rice varieties). Next, output showed a significant difference between the two varieties. The analysis showed an evidence of a definite superiority of inorganic rice variety over the organic rice in terms of the average yield acquired per acre. Seeds per acre required for inorganic and organic rice cultivation was almost same. The average requirement of human labour for inorganic cultivation was less than required for organic rice cultivation, with t-test showing a significant difference. Bullock labour used per acre was almost the same for both the varieties. Use of pesticides was observed to be less by inorganic farmers. The irrigation cost was also observed to be higher for organic farmers than for the inorganic farmers.

   Across farm size under both organic and inorganic rice farming, the level of most of the inputs application was higher for small farmers for both organic and inorganic rice cultivation. The cause for more intensive use of inputs by small farmers
is because they are cultivating mainly for domestic consumption purposes, unlike the medium farmers who also cultivated for commercial purpose. However, the output yield was found to be higher for the medium farmers under both rice varieties.

The average quantity of seeds used per acre by small and medium farmers for organic rice cultivation was almost same. The bullock pair and human labour hired were also found to be similar. Small farmers applied more of organic manure than the medium farmers. Both small and medium farmers used indigenous pesticides to protect plant, which was more for small farmers than the medium farmers. The average irrigation cost was observed to be higher for the medium farmers than the small farmers. Output yield was also higher for medium farmers than for the small organic rice farmers.

As for inorganic rice farming, it was observed that application of inputs like seeds, pesticides, irrigation cost and human labour per acre was more for the small farmers compared to the medium farmers. However, inputs like chemical fertilizer was observed to be used more by the medium farmers than small farmers. The output yielded per acre was also higher for medium farmers than for the small farmers.

4. **Labour requirement:** The cost-return structure clearly showed that the cultivators of inorganic rice employed relatively more number of labourers and incurred a higher labour cost than the organic rice farmers. Of all the farm activities, the highest number of labourers was employed for harvesting by both the rice cultivators. It was also observed that in the case of organic rice cultivation, 46 percent of the total labour employed was family labour, whereas for inorganic rice cultivation it was only 29 percent, and the rest were hired labour. The composition of male and female labour employment showed that for both the rice varieties farming, only female labourers were employed for weeding, whereas for both plant protection activity and irrigation only male labourers were employed by both organic and inorganic farmers. Whereas for all other activities, both males and females were employed.

The farm size-wise cost and returns structure revealed that the expenses on total labourers employed by the small farmers for various farm activities were higher. For both the groups of organic farms, the composition of male and female labourers
was almost similar for activities like land preparation, sowing and transplanting, application of fertilizers and manure. Under inorganic farming, the total cost incurred on employing labour was observed to be higher for medium farmers than for the small farmers. The ratio of male and female labourers employed under inorganic farmers was also almost similar for all the farm activities across both the farm size groups, except in weeding, irrigation, plant protection activities and harvesting activities.

5. **Cost and returns structure:** The cost structure showed that for both organic and inorganic rice cultivation, the total variable cost was observed to be higher for inorganic rice farmers as compared to the organic farmers. In particular, human labour cost, fertilizer cost and interest on fixed capital were observed to be more for inorganic farmers. However, bullock labour cost, seeds cost, irrigation cost, interest on working capital, and imputed rent on land were found to be more for the organic farmers. For both the rice varieties, expenditure on human labour accounted for a major share of the total cost, followed by rent.

The returns structure revealed that inorganic rice variety yielded relatively higher quantity of rice and revenue per acre. The total variable cost incurred and the net income earned per acre by the inorganic rice variety were also comparatively higher than for the organic rice variety. Thus, it is concluded that the inorganic rice variety had performed better than the organic rice variety in terms of both total yield and profits earned per acre.

Farm-wise cost structure for organic rice cultivation showed that the total variable cost incurred by the small farmers was more than the amount spent by the medium farmers. Expenditure on inputs for organic rice cultivation showed that for small farmers the variable cost formed more than two-third of the total cost. However for the medium farmers, the variable cost was nearly three-fourth of the total cost. For both the farm size, human labour constituted the major cost component. Rent was observed to be the next important item of expenditure for the both the farm size. Expenditure on bullock labour, organic manure, pesticides, irrigation cost, interest on fixed capital and rent differed significantly between the two farm size. The analysis indicated that although small farmers incurred a higher cost of cultivation, the medium farmers obtained higher net returns.
The farm-wise input cost of the inorganic farmers exhibited almost similar pattern under both the farm size groups. Variable cost formed about three-fourth of the total cost for both the farm size. Expenditure on human labour constituted the major cost, followed by rent. Like for the organic rice cultivation, per acre monetary returns and the net returns for inorganic farmers differed significantly between the small and medium farmers. Among the input cost, human labour cost, bullock labour cost, pesticides, irrigation cost, interest on fixed capital and rent differed significantly between the two farm size. The study indicated that unlike the organic farmers, small farmers had incurred a higher cost of cultivation, and obtained higher net returns in the case of inorganic farmers.

6. **Farm size-efficiency relationship:** The relationship between farm size and yield was observed to be positive and significant for organic farmers, implying that an increase in acres of land being used for rice cultivated increases the output produced. The relationship between farm size and productivity for inorganic farmers also showed a positive but insignificant relationship. However, a negative and significant relationship was found between farm size and labour used per acre for both organic and inorganic rice cultivation, indicating diminishing marginal returns. The relationship between farm size and average variable cost and average total cost also showed a negative significant result for both the organic and inorganic rice farmers, implying economies of scale.

7. **Purchase and sales market channels:** The study revealed that the producers of organic rice variety purchased the raw materials for their production activity from two main sources, i.e., local market and government outlet (50% each). Majority of the small organic farmers purchased raw materials from the government outlet, whereas most of the medium farmers used local market. In the case of inorganic farmers, majority of them used local market, followed by government outlet and the private agents. The same trend was observed for both the small and medium inorganic farmers.

Majority of both the organic and inorganic farmers sold their output to the private agents. The main cause behind this behaviour could be due to the absence of
proper regulated market. Few of the organic farmers were observed to be selling their output to the consumer directly.

8. **Debt details**: The debt details for both the organic and inorganic rice farmers showed that most of the organic farmers took debt compared to inorganic farmers. Of the total debt holders, majority borrowed from friends, for a period of one year. The mode of repayment for majority was whenever income received.

9. **Accessibility to extension services**: Out of the total 350 organic and inorganic rice farmers, majority of them had no access to extension services. In the case of organic farmers, 50 percent used the extension services, of whom majority were medium farmers. However, among the inorganic rice farmers, only 24 percent used the extension services. This also means that most of the farmers had no access to the extension services. Its accessibility to the small farmers and medium inorganic farmers was also low.

10. **Correlation analysis**: The correlation matrix showed that under organic rice farming, inputs like human labour and capital flow were a significantly correlated with yield at one and five percent level. In the case of both the small and medium organic farmers, inputs like capital flow and net return were significantly correlated with yield at one percent level. It was also observed that human labour had a significant positive correlation with the dependent variable yield. Very few variables were slightly more correlated with yield in the case of medium farmers. Whereas, capital flows and net returns were more correlated in all cases.

    Under inorganic rice farming, the correlation matrix showed that all the six inputs, except capital flows had a significant correlation with the yield. For inorganic small farmers, human labour, fertilizer and capital flow were significantly correlated with yield at one percent level. However for inorganic medium farmers, only human labour showed a positive significant correlation with yield. The matrix also showed that of all the six inputs for the combined inorganic farmers, fertilizer and net return were positively correlated to yield. In this case, the degree of correlation between capital flows and net returns was slightly higher for all farmer categories.
11. **Yield determinants:** The yield function result for total organic farmers, showed that all the six explanatory variables jointly caused 27 percent of the variations in yield. The variables human labour, fertilizer, pesticides and net return had positive impact on yield. However, only human labour had a positive and significant effect on yield. Whereas, capital flow, irrigation cost and farm size were negatively and significantly related to the dependent variable. In sum, human labour is observed to the most influential factor, indicating that employing more human labour contributes to increased organic rice yield. The overall regression model emerged significant at one percent level.

Regression result for the small organic farmers revealed that 25 percent of the variations in yield was caused jointly by the six independent variables. However, of all the six variables, only capital flow had negative and significant effect on yield. Although fertilizer, pesticides and irrigation had a positive impact on rice yield, their influences were statistically insignificant. The regression model for organic small farmers emerged significant at five percent level.

As far as the medium farmers are concerned, all the six variables together explain around 67 percent of the variation in the yield. Human labour, pesticides and net returns had a significant effect on yield. Pesticide had a negative significant impact on the dependent variable. Human labour and net returns contributed positively to yield increase. The regression model for the medium farmers was statistically significant at one percent level.

The yield determination analysis for inorganic farmers revealed that all the input variables together caused about 23 percent of variations in the yield of inorganic rice under the first model. Except for capital flows, rest of the variables showed a significant impact on the dependent variable. Fertilizer showed the highest positive and significant impact on yield. However, inputs like human labour and pesticides showed a negative significant impact on yield. The regression result of the second model (which included farm size as one of the independent variables) revealed that all the seven variables together cause about 29 percent of variations in the yield. Here, inputs like human labour, fertilizer, irrigation, net returns and farm size had significant impact on yield. Of them, fertilizer again was the most influential factor.
Human labour had a negative and significant impact on the yield. Both the regression models were statistically significant at one percent level.

The yield function result for the small inorganic farmers showed that all the inputs together caused about 45 percent of the variations in yield. Inputs like fertilizer, capital flow and net returns had a positive significant impact on yield. But, human labour showed a negative significant impact. Of all the three significant inputs, fertilizer proved to be the most influential factor, followed by capital flows and net returns. The regression model for inorganic small farmers was statistically significant at one percent level.

The yield function analysis for the inorganic medium farmers revealed that all the six variables together caused only eight percent of the variations on yield. Only human labour had a positive significant impact on yield, whereas capital flows had a negative and significant impact on yield. This model was found to be statistically significant at 10 percent level.

The chow test results showed that a structural difference existed between the yields of organic and inorganic rice varieties, and between small and medium farmers under both the varieties.

12. **Experimental station input-output structure and returns:** The experimental station’s input-output structure and returns of both the rice varieties shows that the average requirement of human labour in the experimental station is more for organic cultivation. Chemical fertilizers applied at the experimental station for inorganic cultivation was 30 kgs. per acre, and the organic manure applied was 141 kgs. per acre for organic cultivation. The pesticides used per acre at the experimental station was similar for both organic and inorganic farming, and so was the average quantity of seeds used per acre. The irrigation cost per acre was also observed to be equal for both types of farming. However, it was observed that the total cost incurred is higher for inorganic rice cultivation as compared to the organic rice cultivation. The net income received was also observed to be higher for inorganic rice cultivation. This indicates that at the experimental station also inorganic farming is more profitable as compared to the organic farming.
13. **Yield gap and constraints:** Yield gap I and II analyses show the existence of difference between their respective yields under both the rice varieties. The study shows that yield gap-I (i.e., the difference between the experimental station yield to the potential farm yield) was more for organic rice variety. However, in the case of yield gap-II, which is the gap between the potential farm yield and the actual farm yield, inorganic rice variety was observed to have higher gap as compared to the organic rice variety. When looked from the farm size point of view, yield gap-I and II were found to be higher for small farmers for the inorganic rice varieties. Whereas, only yield gap-I was higher for organic small rice farmers.

The Garrett ranking results of the bio-physical reasons for yield gap revealed that water control was given the first rank by both organic and inorganic farmers. Second rank was given by the organic farmers to insect, followed by weeds, variety and then soil fertility. The Garrett ranking results of the socio-economic reasons of yield gap by both organic and inorganic farmers showed that both the groups of farmers ranked cultural practices as the first and most important constraint of yield gap. In the case of organic farmers, the second rank was given to risk aversion, which was ranked seventh by inorganic farmers. Credit, input availability, institutions, economic behaviour, knowledge and traditions were ranked third, fourth, fifth, sixth, seventh and eighth respectively by organic farmers, whereas they were ranked second, third, eight, fourth, fifth and sixth by the inorganic farmers respectively.

The Garrett ranking of the other problems faced by both the groups of farmers showed that low price, low profit, lack of transport facilities, lack of extension services, lack of irrigation water and marketing problem were the major constraints for low productivity of the two rice varieties cultivation.

14. **Income inequality across rice varieties and farm sizes:** The study showed that income inequality existed between organic and inorganic rice cultivators, as well as between both small and medium farmers groups under both rice varieties. The Gini Index and Robin Hood Index results showed that inequality was relatively greater among the organic farmers as compared to inorganic farmers. From the farm size perspective, under both rice varieties income inequality was observed to be higher
among the small farmers as compared to the medium farmers. Finally, the F - test results indicated that significant difference existed between net returns of both the rice variety cultivators, as well as between both the farm size farmer groups of the two rice varieties.

15. **Determinants of decision on choice of rice cultivation method:** The result of choice of production method regression analysis showed that farmers with better education, more net return, and higher percentage of marketable surplus out of the total output produced were more into inorganic farming. However, the variable sex of the farmers showed a positive impact on the dependant variable indicating that female cultivators were more into organic farming. Land ownership also showed a positive significant impact on the dependent variable indicating that farmers owning lesser acres of land were more into inorganic farming. Finally, the variables like farmer’s experience and farmer’s attitude towards agri-chemicals showed a positive significant impact on the dependent variable. Finally the overall regression model was statistically significant at one percent level.

16. **Farmers’ attitude towards environmental problems:** The table on farmers’ attitude towards environmental problems revealed that organic farmers were more concerned about protecting the environment, which may have been the major cause of cultivating rice by using organic production method by them.

**7.2 Policy Implications**

Some of the important policy implications derived from the study are as follows:

1. Paddy being the staple food of the state, one need to draw the attention towards cultivating paddy through organic farming and help the organic farmers to earn more in order to improve their standard of living.
2. Appropriate steps should be taken to motivate more educated youths to take up organic farming.
3. In order to make paddy organic cultivation economically viable, labour requirements needs to be reduced to decrease labour cost through selective mechanism. Thus government needs to support the farmers to meet the labour
requirements through formulation of a package for adopting advanced mechanism.

4. One should concentrate in increasing the total cropped area through increase in cropping intensity and by bringing under cultivation the fallow land which covers around 9.36 percent of the land in the state.

5. With the rising input cost, the government needs to take a better look at the pricing policy for food grains.

6. Increasing the paddy cultivation requires large investments in rural infrastructures like road, electricity, irrigation, storage faculties, wholesale and retail markets. Hence, policies need to be identified for a state like Nagaland, where most of the farmers belong to marginal, small and medium farmers, for investments in infrastructure and technologies.

7. Proper marketing channels and marketing policies are necessary to increase the income of the farmers. Regulated market could be established in each subdivision of the district, so that the farmers can earn higher returns from their yields.

8. Government should also take proper steps to spread awareness about the ill-effects of pesticides and the importance of adopting alternative method of pest control through mass media programmes.

9. Extension services should be reached to a wider section of the farmers, so that they can increase their land productivity. This would also contribute to narrowing down of yield gap I and II.

10. Information and communication technology (ICT) should be popularised among the farmers, so that they can benefit from regular information dissemination on price of raw materials and output; availability of raw materials; importance of organic cultivation; formal credit facilities; ways and means of controlling pests, weeds and soil problems; plant diseases and means of controlling them; government policies for farmers; latest technologies and others.

Thus, it can be concluded that every inch of paddy land is precious from the economic point of view. So steps needs to be taken to protect the fertility of the soil and encourage the paddy organic cultivators by making paddy cultivation
economically viable through adoption of advanced technologies, promoting agricultural knowledge and up-to-date market intelligence.