

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The objectives of this study on the adoption of integrated nutrient management practices in irrigated paddy production system; were to identify factors influencing household adoption on INM and to investigate the profitability of rice sector in Sri Lanka. The study was conducted in randomly selected two Agrarian service divisions under the major irrigation scheme of the inter-provincial area in Hambantota district. Households were selected randomly representing each Agriculture Instructor division of the above two divisions; and data were collected through a field survey in May 2009. Logit models were constructed based on a survey to estimate the coefficients and marginal effects to predict the adoption probabilities. Gross margin analysis was conducted in order to investigate the profitability

In the sample of 119 households, only 85% were found as INM adopters in study area. Even though 83% of the surveyed households were adopted in straw application, they were seems to be in the infant stages of technology adoption with regards to paddy husk charcoal, farm yard manure and green manure application. Even the adopters were found to be applying less than the departmental recommendation rates for organic fertilizers for paddy cultivation. As a result; even though they were adopted in INM practices, they were unable to reach the potential yield of their high yielding varieties. This farm level evidence shows that the technology viewed to be unaware or unnecessary by most of paddy farmers. Less motivation was a major factor which affected to the non adoption of most of the

organic fertilizers studied. This may be mainly due to households' perceptions and their reliability on the subsidy scheme for chemical fertilizers.

Even though the majority of the households in both AgS divisions were aware of INM practices; a gap could be identified in both divisions. One of the most probable reasons for the non adoption of those practices was their less motivation to attend those laborious activities. Low labor resources, inadequate resource materials and equipments were among the other major reasons for non adoption. This is not surprising, because incorporation of these organic materials has to be done during the peak period of labor utilization as it coincides with the other agricultural activities, such as land preparation and crop establishment. Paddy farmers in Ambalantota AgS division were more seriously affected by those restrictions. Important information found for the extension service system in study area, was inadequate number of trainings that farmers have received on paddy husk charcoal preparation in both divisions.

As confirmed by logit results; 1% increases of positive perceptions of the household heads leads to increase the probability of their rice straw adoption by 0.8.

Other factor that significantly affected to the straw adoption was the harvesting method. With mechanical harvesting, they can easily spread rice straw throughout their field. But with manual harvesting, farmers have to spend for that purpose again. Therefore mechanical harvesting has become an economically feasible solution to paddy cultivating households for harvesting and also for straw application. With 1% increase of mechanical harvesting, it leads to increase the probability of rice straw adoption by 0.18. Based on these results, household head's positive perception and mechanical harvesting could be noticed as good predictors to improve rice straw

adoption. Not only that, but also it can be predicted that this technology can be easily motivated in commercialized paddy production systems than in subsistence oriented production systems.

But these results were not same with the adoption of the other organic fertilizers. There was heterogeneity with regards to the factors that influence on the other INM adoption practices. While probability of the adoption of paddy husk charcoal was significantly and negatively affected by the type of landownership (LDOWN_2); it was positively and significantly affected to the green manure adoption. This showed a complex impact of the type of landownership on INM adoption. But generally households were more concentrating on soil fertility when cultivating their own lands. While commercialized households were less likely to adopt paddy husk charcoal; they were more likely to adopt green manure application with increased land extent. Both adoption practices paddy husk charcoal and farm yard manure applications were significantly and positively affected by number of trainings participated by the household head. So increased number of trainings with regards to paddy husk charcoal can be considered as a good predictor to enhance its adoption; and more adopters could be found in a less commercialized paddy production system. Again increased number of trainings and extension contacts were good predictors to improve farm yard manure adoption. It can be predicted that good educational background of the household head may increase his probability of green manure adoption; but it was negatively influenced by household income from other sources. Hence, it can be predicted that paddy husk charcoal, farm yard manure and green manure application practices can easily be motivated in subsistence oriented paddy production systems than in commercialized production systems. While the

other independent variables were showing complex impacts on different INM practices; membership of the household head in a farmer organization, his or her extension contacts and positive perceptions could be noticed as good predictors to improve all of the INM practices as priori expected.

Therefore these farm, farmer, farm household characteristics and technology-associated attributes can be used as entry points to enhance technology adoption. A significant difference of the adoption of INM practices could also be found between two AgS divisions. Higher percentage of households in Ambalantota, were adopted in INM technology than Lunama households. Significantly higher extension contacts, mechanical harvesting and owned land extent cultivated may be the driving forces behind this situation at Ambalantota AgS division. Even though the households in Lunama AgS division were well empowered with farmer organizations and having significantly longer period of membership; it seemed that they were unable to get maximum benefits through that social capital.

According to gross margin analysis; it showed that paddy cultivation has become a profitable enterprise for both adopters and non adopters. But one of a key lesson learned through the survey was; without subsidy for chemical fertilizers, tenant or leased households are most vulnerable for less profitability. Especially tenant households in Lunama AgS division are the most vulnerable group for less profitability. Even though both INM adopters and non adopters would yield negative gross margin; adopters may gain less loss compared to the non adopters in study area.

In light of these conclusions, following recommendations can be made.

7.2 Recommendations

Since the majority of paddy cultivating households in both divisions were educated and cultivate their own fields, more attention can be focused on long term soil fertility improvement measures. Hence; the application of INM strategies in paddy production could be enhanced easily throughout the study area.

Therefore effective trainings, demonstrations and information delivery through intensification of existing extension service system, more efficient use of the support of non governmental organizations with regards to supplying necessary equipments coupled with farmer organizations will make it easier to improve farmers' motivation to adopt those practices. Therefore the government should start playing an active role in strengthening extension efforts to increase the flow of information to farmers in this regards. Public policy and institutional arrangements can play a critical role by creating awareness through practical trainings and educational programmes on the benefits of INM; following DOA recommendations and use of various methods of technology transfer would indeed help to solve this problem.

In addition to these aspects; if scientists succeed in identifying relatively low-cost labor saving technologies targeting easy application of organic fertilizers; financial profitability of these systems can further be improved. Therefore taking measures to increase the availability of appropriate machinery and technology; as well as providing low cost quality inputs, such as organic fertilizers and seed paddy through farmers' fields will be useful.

Facilitating mechanization in harvesting will lead to minimize the cost of paddy production drastically. Therefore to increase the profitability of rice sector under less commercialized environments; it should be concentrated to take suitable

measures to reduce the cost of inputs and hired labor through economically feasible mechanical techniques. The long term effects of this mechanization on farming systems also should be investigated.

At the same time; a good marketable structure with reasonably increased price for the production will also be important. Production systems well equipped with a rich social capital of farmer organizations; can be used to improve agri-businesses in those areas through those organizations. Not only that, but also the important role that farmers' organizations can play in promoting integrated soil nutrient management also should be considered. Further improvement of government paddy purchasing scheme and taking farmer organizations to be involved in those practices will be very useful.

Enhancing farmers' awareness on the risk status of the unsubsidized environment for chemical fertilizers also will play a critical background for the progress of this adoption process. Therefore, to be profitable at a non subsidized condition; more concentration should be paid on the non owner (tenant or leased) households which constitutes nearly 35% of the sampled households in both divisions. Guiding them to adopt INM practices with more institutional attention and also taking measures at the same time to get the assistance of their land owners will be more useful for making them to adopt those practices.

Even though the government has decided to enhance INM practices in paddy production by restricting chemical fertilizer subsidy for farmers who use organic fertilizer and materials; proper implementation of this decision is still questionable. Therefore it should have to be well supervised to achieve the desired benefits. There is a clear need for systematically limiting this subsidy on chemical fertilizers through

subsidizing the use of organic sources; and it will encourage the use of INM practices in paddy production.

Main challenge facing with this implementation, will be the perceptions of cultivators. Improving positive attitudes of paddy farmers with this regards, will be a good motivation to reach the desired target. Making these INM techniques to create a win-win situation; where farmers are able to reduce the cost of production, provide environmental benefits and at the same time to increase their yields through these practices should be main targets in paddy production systems for the next decade. Joint collaboration of research and extension staff will be very useful to achieve those desired goals in near future.

In addition; taking efforts for developing this approach to a site specific nutrient management (SSNM) will lead to raise the profitability of rice production; such technologies can also help to reduce negative environmental impacts of using high level of chemical fertilizers. Enhancement of soil testing services island wide will be well effective in this regards.