

## CHAPTER VII

### CONCLUSIONS AND RECOMMENDATIONS

#### 7.1 Conclusions

This study was undertaken in Koh Thom district in 2004 which is dominated by rainfed conditions (75 per cent of the surveyed households is under rainfed condition) to identify characteristic of maize based farming system, to assess the profitability and factors affecting the adoption of hybrid maize varieties.

Based on the information from the field survey, maize is grown for cash income and a small percentage is consumed by the households. Local maize varieties are grown in rainfed condition only, while hybrid maize varieties are grown under both rainfed and irrigated conditions. Local maize is grown one time per year in rotation with mungbean and/or soybean and sometimes as a mixture with rice. Hybrid maize is grown from 1 to 3 times per year in rotation with mungbean and/or soybean and/or growing maize all the seasons, and sometimes as a mixture with rice or fruit trees.

65 per cent and 57.5 per cent of the households had household heads for adopters of hybrid maize varieties and nonadopters with age over 40 years, respectively. The majority of the adopters and nonadopters (75 and 70 per cent respectively) of hybrid maize varieties attained the primary school. Seventy five percent of adopters and nonadopters had 2-3 laborers available in their family. About 98 per cent of the surveyed households stayed in their villages more than 11 years. About 42.5 per cent and 45 per cent of adopters and nonadopters respectively had grown maize for more than 20 years. About 75 per cent of both adopters and nonadopters had size of land holding per household from 1 to 3 ha. Regarding existing maize area, 55 per cent of adopters had from 0.5 ha to 1 ha, while 52.5 per cent of nonadopters had less than 0.5 ha. On land tenure of maize, 95 per cent of adopters and 97.5 per cent of nonadopters had their own land. For household income,

70 per cent of adopters and 60 per cent of nonadopters got income from 2,500,000 – 5,000,000 Riel/year. About 52.5 per cent of adopters stayed near Cambodia-Vietnam border about less than 3.5 km from the border, and 42.5 per cent nonadopters stayed far from the border about more than 28km.

Erratic rainfall, flood, irrigation, lack of concerned institutions, high cost of seed and pest management are the problems of maize production in the study area, while water source, geography, soil fertility, access to market and credit are the potentials of the maize production.

The results of enterprise budget analysis shows that farmers growing hybrid maize varieties had higher average yields and earned higher profits than farmers growing local varieties. The average yield for hybrid maize varieties under rainfed condition was 4,113 kg per ha while local maize varieties achieved a yield of 1,704 kg per ha with a difference of 41 percent. The average yield for hybrid maize varieties under irrigated condition was 6,994.7 kg per ha with a different of 70 percent over hybrid maize under rainfed condition. Regarding farmers growing local maize varieties, there is no significant difference between return to gross margin of white maize sold as fresh ears and yellow maize sold as dry grain. For hybrid maize varieties, white hybrid maize sold as fresh ears provided more profit than yellow hybrid maize sold as dry grain, but not in significant level. Moreover, there is limited demand of maize output sold as fresh ears, while the demand for maize output sold as dry grain has no limitation.

Considering the cost of production, the farmers growing hybrid maize varieties faced more cost than farmers growing local maize varieties. Under rainfed condition and sold as dry grain, hybrid maize farmers faced a cost of 927,688.7 Riel for cultivating a ha of land, while local maize farmers sold as dry grain incurred a cost of 591,877.5 Riel for the same unit of land with a difference of 57 percent. The average cost of local maize sold as fresh ears was 501,520 Riel per ha with a difference of 18 per cent lower than local maize varieties sold as dry grain. For

irrigated condition, cost of hybrid maize varieties sold as dry grain was 2,223,020 Riel per ha with a difference of 17 per cent over hybrid maize sold as fresh ears.

Regarding gross margin under rainfed condition and sold as dry grain, hybrid maize varieties was 686,664 Riel per ha with a difference of 3.1 times over local maize varieties having 221,528 Riel per ha. Gross margin of local maize sold as fresh ears was 278,480 Riel per ha with a difference of 1.3 times over local maize varieties and sold as dry grain. Under irrigated condition, gross margin of hybrid maize sold as dry grain was 854,633 Riel per ha with a difference of 1.2 times lower than hybrid maize sold as fresh ears under the same condition.

After including other income from corncob and thinned plants, under rainfed condition and sold as dry grain, gross margin of hybrid maize varieties increased up to 719,567 Riel per ha and gross margin of local maize increased up to 416,883 Riel per ha with a difference of 73 per cent. Gross margin of local maize sold as fresh ears increased up to 530,480 Riel per ha with a difference of 27 per cent over local maize varieties sold as dry grain. Under irrigated condition, gross margin of hybrid maize sold as dry grain increased up to 916,186.5 Riel/ha with a difference of 9.3 per cent lower than hybrid maize sold as fresh ears without any other income.

Sensitivity analyses on enterprise gross margin for dry grain before including other incomes from corncob and thinned plants showed that gross margins for local maize farmers were more sensitive to yield and price changes than hybrid maize farmers in rainfed condition. This may be due to higher yields obtained by the hybrid farmers. But the gross margins of hybrid maize were more sensitive to yield and price changes than local maize farmers after including other incomes from corncob and thinned plants. This may be due to lower cost of production of local maize and more additional incomes from corncob and thinned plants obtained by the local maize farmers. For hybrid maize in irrigated condition, its gross margins were more sensitive to yield and price changes than hybrid maize in rainfed condition. This may be due to higher cost involved with the hybrid maize in irrigated condition.

The results of logistic regression of adoption of hybrid maize varieties in Kandal province indicated that the overall goodness-of-fit measured by significance of Chi-square (Omnibus Test of Model Coefficients) statistic is high. The percent of correct prediction is good (93.8 per cent). Besides, the Hosmer and Lemeshow test shows that the model adequately fits. All of the independent variables in the model, four influence the adoption of hybrid maize. The most important factor is the tendency to follow their neighbors. Percentage of tendency to follow their neighbor of adopters is higher than non-adopters. The other two important factors are the cultivated maize area and the access to irrigation. The last and fourth important factor is the distance to Vietnam border. While other factors included in the model that did not have any influence on the adoption of hybrid maize in significant level were: age of household head, labor availability in the family, education of household head, farm income, farm size, length of stay in the village, years of experience in growing maize, and soil fertility.

## **7.2 Recommendations**

Based on the findings of this study, policy implications and future research direction can be derived as follows.

1. Growing of hybrid maize is more profitable than that of local maize with or without including other incomes from corncob and thinned plants. Sensitivity analyses showed that gross margins for local maize farmers were more sensitive to yield and price changes than hybrid maize farmers in rainfed condition before including other income from thinned plants and corncob. This may be due to lower yields obtained by the local maize farmers. After including the other income, hybrid maize is more sensitive to yield and price changes than that of local maize. This may be due to lower cost of production of local maize and more additional incomes from corncob and thinned plants obtained by the local maize farmers. Since the lower cost of production in local maize is less sensitive or more stable. It is recommended that

better market opportunities and road infrastructures are necessary to expand hybrid maize areas. The government should make efforts to improve such facilities.

2. The most important factor having maximum influence on adoption of hybrid maize is the tendency to follow their neighbors. The farmers are unlikely to grow new varieties or adopt new innovation unless they see for themselves in their neighborhood and there is a possibility of farmer-to-farmer extension. So there is an urgent need to set on-farm demonstrations and trials in the villages to convince the farmers about the suitability of the new varieties or innovation.

3. The two second most important factors that influence the adoption of hybrid maize are: the access to irrigation and cultivated maize area. This suggests that there is a need to renovate and construct irrigation infrastructure so as to provide access to irrigation to the growers, and since area under cultivation matter, government intervention is needed bring more land under hybrid maize.

4. The last and fourth factor influencing the adoption of hybrid is the distant to Vietnam border. This is related to access to market and the tendency to follow their neighbors as Vietnamese farmers are in close proximity for the farmers. That is why, in the far away places that are remote to the influential Vietnam border, farmers do not easily adopt the hybrid maize. Input cost is higher for the remote farmers due to transportation cost and they sell their produces at lower prices compared to ones that close to border. This implies that better market opportunities and road infrastructures are necessary to expand hybrid maize areas. Agricultural extension plays a key role in developing of demonstration and testing programs in the area and develop model.

5. During the time of survey, some of the local maize growers were facing pests problems which hybrid maize growers did not and so this might have affected the outcomes of this study to some extent. So, it is recommended that studies in the future should compare both maize types in healthy conditions.

6. Since the introduction of hybrid maize varieties, the local maize varieties are not popular because it is susceptible to pests and diseases. There is some risk that local maize may be disappearing in the future. Therefore, it is suggested the pests and diseases problems faced by local maize growers should be addressed by agricultural extension workers and researchers.

7. Survey questionnaire for future studies should include the level of access to technical advice. The results from this study showed that all the surveyed households had access to technical advice, but other results show that tendency to follow their neighbors and distance to Vietnam border are the important factors influencing the adoption of hybrid maize varieties. It seems that availability of information is poor. Information like "what" and "how much" they had learned from their neighbors, agricultural retailers or extension workers were not known. "What" and "how much" how of the technical advice they can follow was also not known.

8. Future studies should determine demands of local and hybrid maize output because profitability details alone without reference to market information is insufficient for farmers to make informed decision regarding what varieties to be grown.