

CHAPTER III

CHARACTERISTICS OF THE STUDY AREA

Prior to studying factors that influence adoption of maize varieties, it is essential to know environmental situation in which maize based farming is practiced. So, this chapter is devoted to the characterization of the biophysical, socio-economic and cropping systems in the study area.

3.1 Biophysical environment

Koh Thom district is one of the 11 districts of Kandal province and it lies in the southern part of the province. It shares boundary with Vietnam along Bacsuck River and the national road number 21. Koh Thom district covers 23.5 per cent (42,772 ha) of maize area in Kandal province and has a population of 143,451. It is about 78 km from Phnom Penh, the capital to the border, while Kandal province is 11 km away from Phnom Penh.

There are 118 natural channels in the study area as shown in the Figure 3.1, but most of them become shallow and had no water for irrigation. Farmers who stayed in the area relying on rainfall is referred to those under rainfed conditions and farmers who stayed near the channels that had water for irrigation is referred to those under irrigated conditions.

that is influenced by the North-West monsoon and the rainy season that starts from May and lasts up to October. The rainy season is mainly influenced by the South-West monsoon.

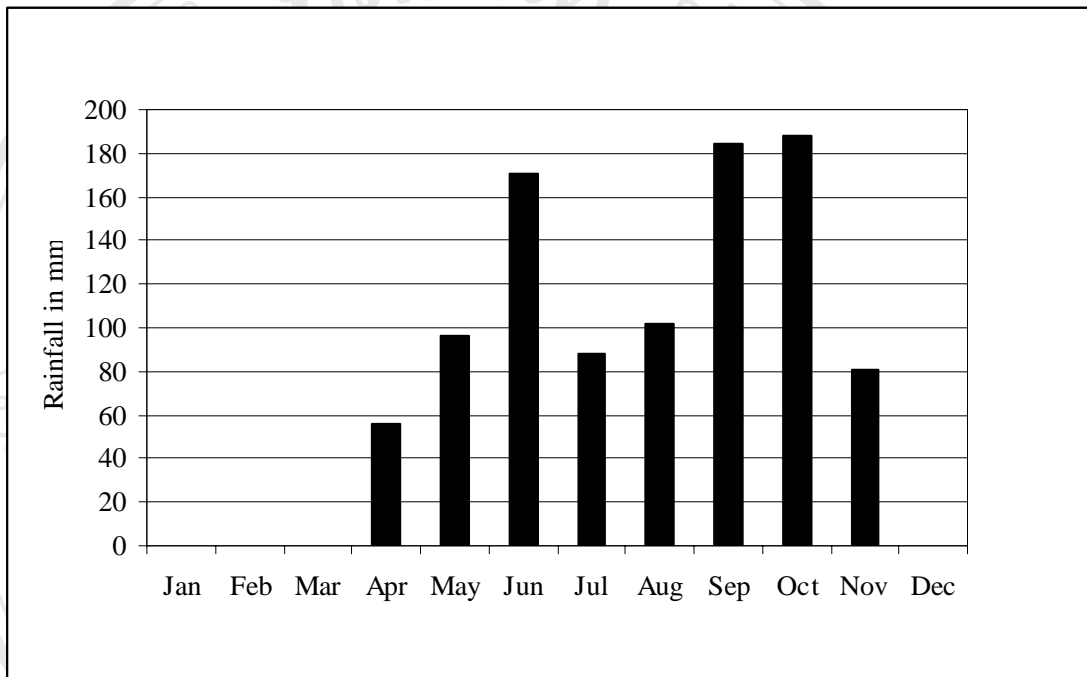


Figure 3.2 Distribution of rainfall of study area

Source: Koh Thom District Meteorology and Hydrology Office, 2004

If we compare the rainfall in 2004 to two previous years, the rainfall in 2004 is lower which is showed in Figure 3.3.

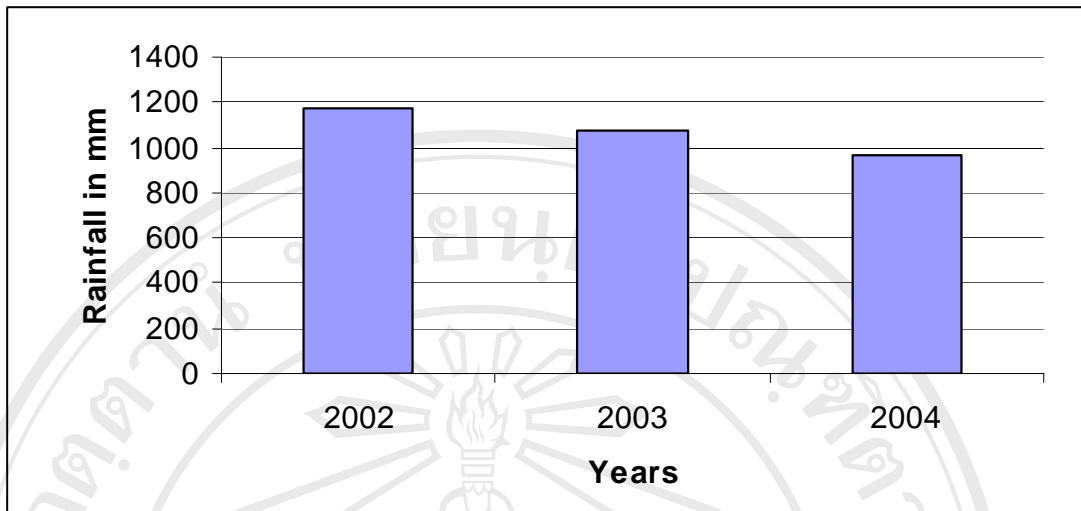
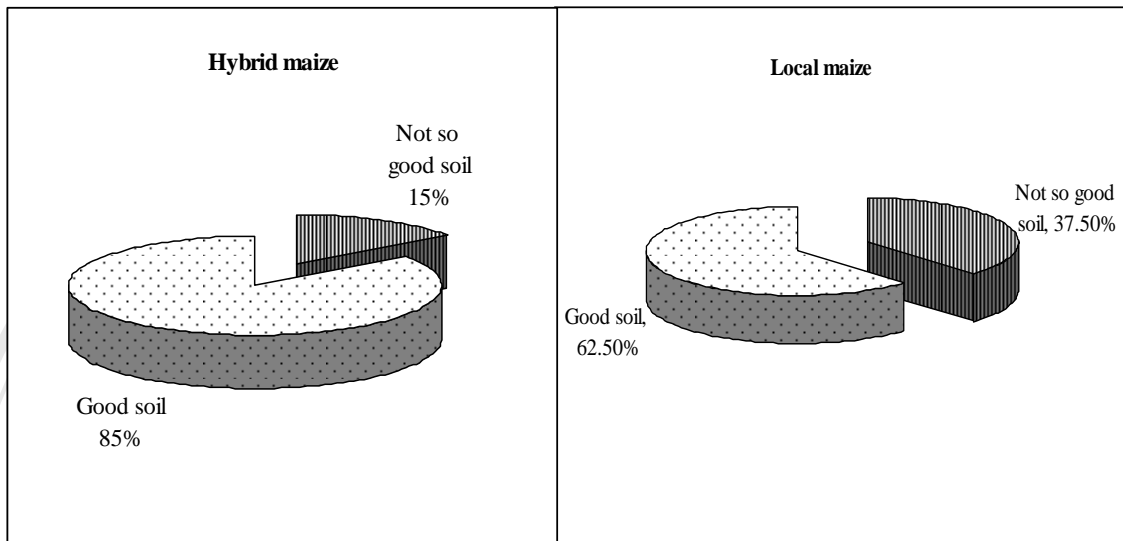


Figure 3.3 Three-year climatic data of study area

Source: Koh Thom District Meteorology and Hydrology Office, 2004

3.1.2 Soil

The study area is located along the Bassac River. It floods every year from late August or early September to December with depth of water ranging from 1.5 – 2.5 m. From information obtained during PRA, it was found that soil in the study area is brown and loamy on the surface layer and light brown and loamy on subsoil. There are many natural channels in the study area. The soil type is classified into Ken Svay soil. It is relatively easy to manage and it has a high potential for agricultural management. From surveyed data as shown in Figure 3.4, 85 percent of hybrid maize farmers had good soil while 62.5 percent of local maize farmers had good soil. Some areas are located upper slope, so water removes some alluvial soil to lower place after flooding. There is not significantly difference between adopters and non-adopters that had good soil.



3.1.3 Distance to Vietnam border

The study area shares boundary with Vietnam and the nearest surveyed commune to the border is Sompovpuon while the futherest surveyed commune to the border is Poubarn commune. The results from field survey in Table 3.1 show that the maximum percentage of nonadopters is 42.5 per cent staying over 28 km from the border, while the maximum percentage of adopters is 52.5 per cent staying near the border less than 3.5 km. There is only 2.5 per cent of nonadopters staying near the border with less than 3.5 km while 7.5 per cent of adopter staying about more than 28 km from the border.

Table 3.1 Distance to Vietnam border

Characteristic	Non-adopters (%)	Adopters (%)	All (%)
Distance to Vietnam border			
<3.5 km	2.5	52.5	27.5
3.6-20 km	32.5	15.0	23.8
21-27 km	22.5	25.0	23.8
>28 km	42.5	7.5	25.0

Source: Survey, 2004

3.2 The agricultural sector

3.2.1 Major crops

There are many crops growing in the study area such as rice, maize, mungbean, soybean, peanut, cassava, sweet potato, vegetable, sesame, sugarcane and tobacco. Rice is a major crop in study area and maize become a second important crop. Table 3.2 indicates that 66 per cent of cultivated area is rice, while 16 per cent of the cultivated area is maize. However, rice is generally grown for home consumption and the surplus is for cash, while maize is generally grown for cash.

Table 3.2 Land use under different crops in study area

Description	Cultivated Area (ha)	(%)
Rice	16,639.0	66.0
Maize	3,983.0	16.0
Mungbean, Soybean, and Peanut	3,920.0	15.6
Cassava	6.0	0.1
Sweet Potato	192.0	0.7
Vegetable	200.0	0.8
Sesame	105.5	0.4
Sugarcane	5.0	0.1
Tobacco	25.0	0.3
Total	25,075.5	100

Source: District Statistics, 2004

3.2.2 Area under different fruit trees

There are four dominant kinds of fruit trees that are planted in study area: the first one is sapodilla covering 313.2 ha, the second banana covering about 152.5 ha, the third mango covering 99 ha and the last coconut covering about 76.8 ha (Table 3.3). Sapodilla, mango and banana were mostly planted in fields of small scale

near or within the vicinity of their house, while coconut and other fruit trees are planted as fences around their houses or in home garden.

Table 3.3 Land use under different fruit trees in study area

Description	Cultivated Area (ha)	(%)
Banana	152.5	22.60
Coconut	76.8	11.40
Longan	1.5	0.20
Mango	99.0	15.00
Milk Fruit	2.0	0.30
Sapodilla	313.2	46.40
Jack	4.0	0.60
Custard Apple	0.5	0.07
Orange	3.5	0.50
Guava	19.5	3.00
Total	672.5	100

Source: District Statistics, 2004

3.2.3 Animal raising

Animal raising is very popular in the area, especially cattle. Nearly every household has at least one cattle; it is just in a small scale. Table 3.4, cattle are mostly kept for cash income rather than for plowing. The main market for those cattle is Vietnamese market across the border. Cattle are exported every year and price of those cattle depend on the market forces.

Table 3.4 Livestock population

Description	Number of animal (head)
Total Cattle	16,467
Cow	5,588
Draught Cattle	4,751
Total Buffaloes	197
Buffaloes (Female)	88
Buffaloes (Draught)	53
Total Pigs	15,758
Pigs (Female)	221
Poultry	157,143

Source: District Statistics, 2004

3.3 The maize subsector

3.3.1 Land use for maize

Maize has been produced for a long time in the study area as it has good environmental conditions for the maize production. But, maize area varied from year to year as shown in Table 3.5 from 2000 to 2004. There was declined in maize area by 36 per cent from 2000 to 2002, but it started increasing by 45 per cent from 2002 to 2004. Maize area in the rainy season is nearly ten times more than in the dry season in 2004 because there is limited access to irrigation.

Table 3.5 Maize productions in study area

Description	Maize area in rainy season (ha)	Maize area in dry season (ha)
2000	3,431	87
2001	2,587	54
2002	2,191	54
2003	3,770	350
2004	3,983	399

Source: District Statistics, 2004

3.3.2 Popular maize varieties

From Table 3.6 we can see that most popular crop of maize is variety 919 (75 per cent) of the households for hybrid maize and for local varieties farmers are only by colors of the grains as yellow and white maize varieties. The local varieties have smaller ears but are sticky and sweet compared to the hybrid varieties. Further details of different hybrid maize varieties and their percentage usage by farmers are presented in Table 3.6.

Table 3.6 Percentage of hybrid varieties grown in the study area

Varieties	Number of Households	(%)
919	31	75.0
14	1	2.5
10	2	5.0
818	1	2.5
999	1	2.5
White Maize	5	12.5

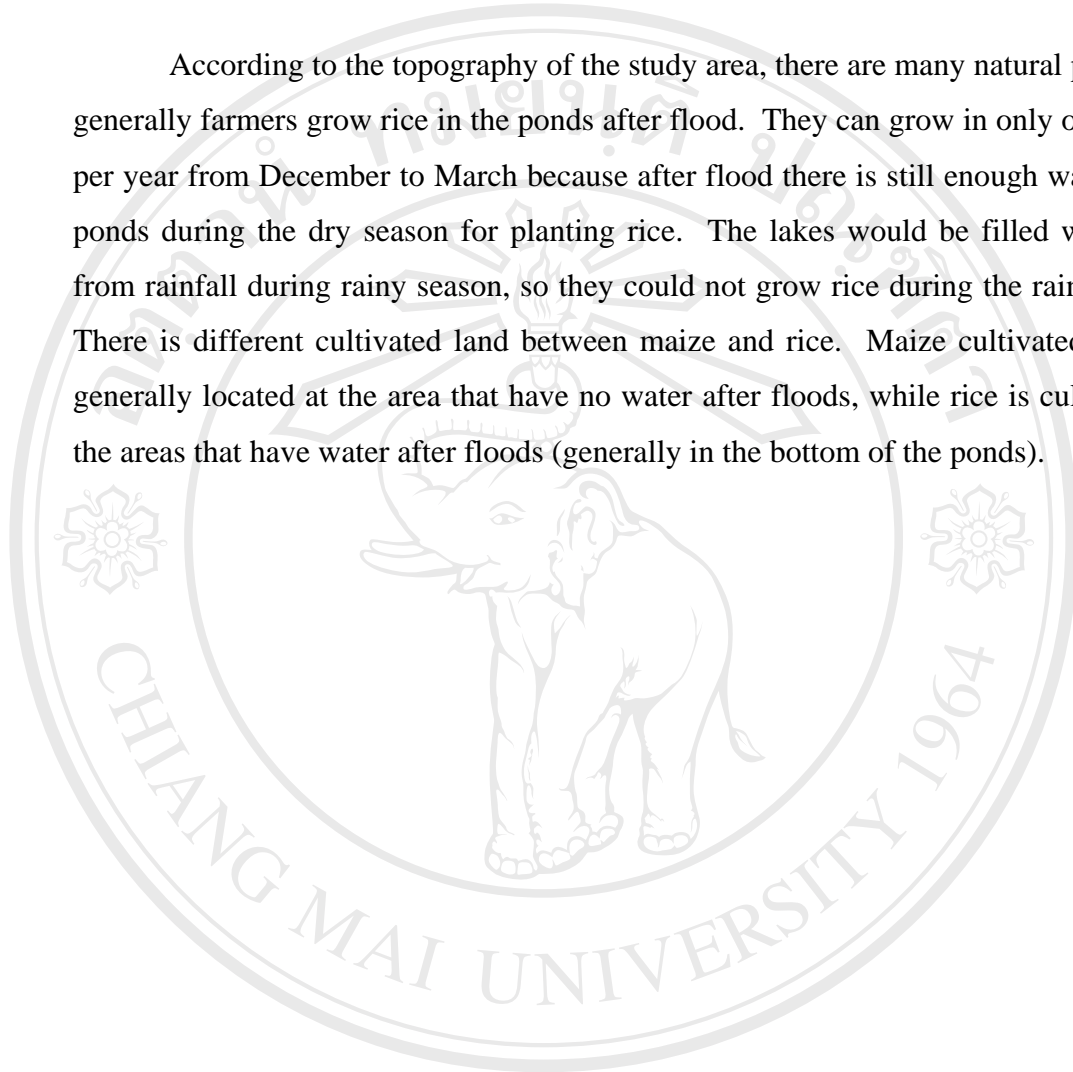
Source: Survey, 2004

3.3.3 Maize-based cropping pattern

Crop enterprise consisted of rice and non-rice production which vary according to agro-ecological condition. Indeed, rice is a dominant crop in the cropping systems in the study area and maize become the second important crop. Seventy-five percent of maize areas surveyed in this study are in rainfed area and have only one cropping season during the early rainy season when planting starts from April or May in rotation with mungbean and/or soybean (Figure 3.5). Both local and hybrid maize varieties are grown in the rainfed conditions. Only in few irrigated areas that farmers plant two or three crops of maize per year. There is only hybrid maize varieties are grown under irrigated conditions. Farmers generally plant maize in rotation with mungbean and/or

soybean. Few farmer plants maize mixed with rice crop or fruit trees, especially for those that do not have enough land for cultivation.

According to the topography of the study area, there are many natural ponds and generally farmers grow rice in the ponds after flood. They can grow in only one season per year from December to March because after flood there is still enough water in the ponds during the dry season for planting rice. The lakes would be filled with water from rainfall during rainy season, so they could not grow rice during the rainy season. There is different cultivated land between maize and rice. Maize cultivated area are generally located at the area that have no water after floods, while rice is cultivated in the areas that have water after floods (generally in the bottom of the ponds).



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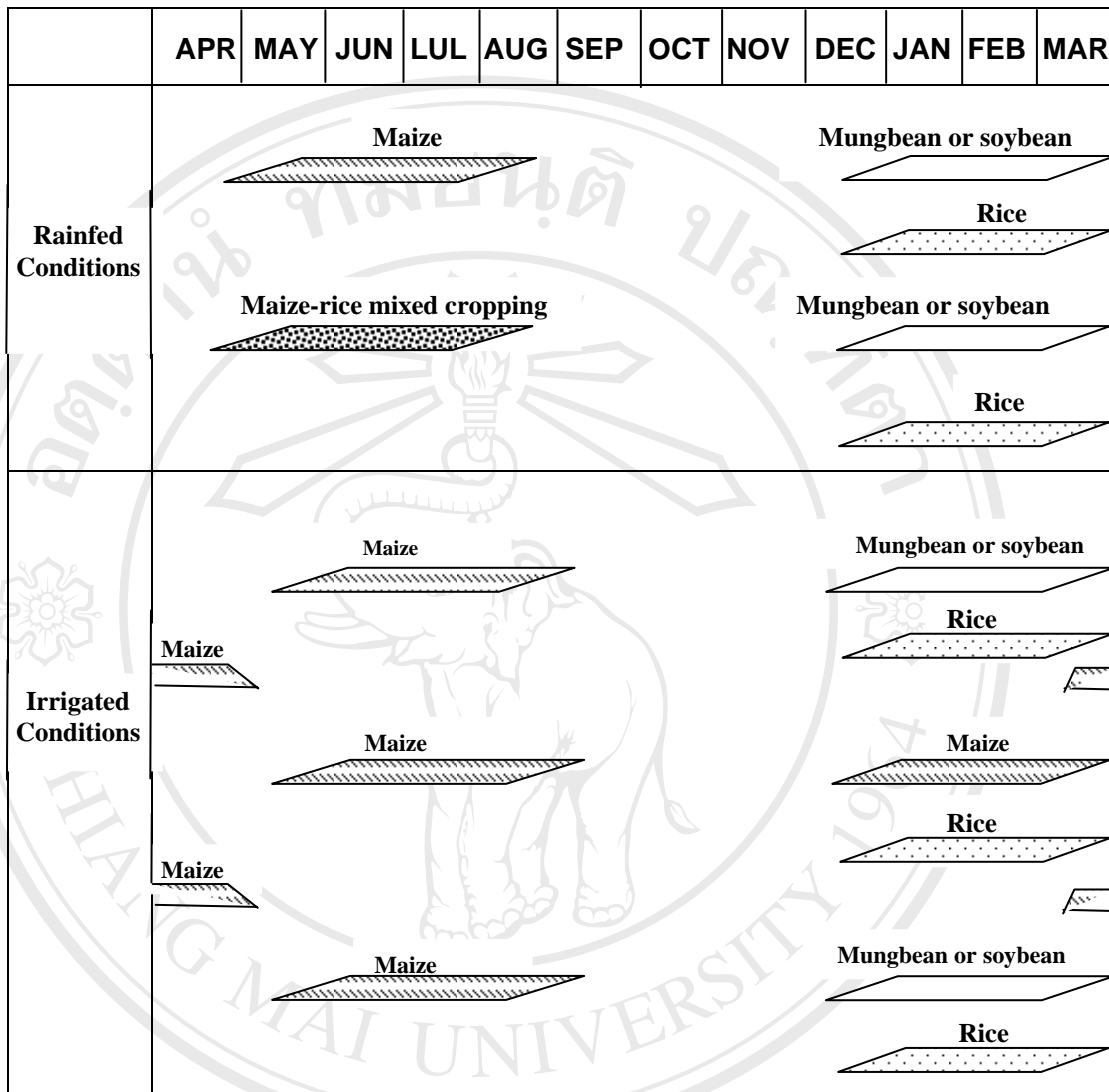


Figure 3.5 Maize-based cropping patterns in the study area
 Source: Survey, 2004

3.3.4 Farmers' field practices in maize production

Land preparation: Land preparation generally starts from the early rain of the year in April or early May for rainy season. And there are different practices between irrigated and non-irrigated conditions. The land is plowed only one time and then farmers start planting for irrigated condition, while non-irrigated condition do it two times before planting. However, land preparation is not done during second season from late December to early January; farmers start planting maize after floods because

during the time land is still soft and wet. Land preparation are done by neither tractors or plowing using a pair of oxen controlled by a person.

Planting: Planting is done from late April to early May. There are different practices between hybrid and local maize growers. For hybrid maize, farmers plant their maize using spade to dig hoe at distances of either 25-30 x 70 cm, with around 20-25 kg of seed (2 seeds per hill) and around 11 people per ha . While local maize is planted putting the seed by following furrow at distances of either 60 x 80 cm, using around 30 -35 kg (6-8 seeds per hill) of seed and 2 people per ha.

Weed control: In general, both two hand-weeding and hilling up are done on local maize crop using hoe and plough, respectively. The first weeding is done about two weeks after planting and second weeding is done about two weeks after the first weeding, weeding and thinning are done at the same time by keeping only 4 plants per hill. While, hybrid maize growers use both pesticides and hand-weeding to control weed.

Fertilizer application: It was reported that local maize growers in the study area apply neither organic nor chemical fertilizers because they think that the soil is alluvial and good as shown in Table 3.1. While hybrid maize growers do not use organic manure, but they apply chemical fertilizer at the rate of 25 kg/ha for non-irrigated condition and about 250 to 300 kg per ha for irrigated condition. So, the amount of chemical fertilizer application varies between irrigated and non-irrigated condition for hybrid maize.

Plant protection: Generally, Cambodian maize farmers rely on rainfall and natural agriculture. However, some of the farmers turn to modern agriculture since hybrid varieties have been introduced to them. This means that they rely on chemical fertilizers and pesticides for their maize production. Local maize growers do not use any pesticide to control pest. Though there has been no pest outbreak, farmers now

start complaining that their yield is declining since the hybrid maize have been grown in their villages.

Harvesting and post-harvest practices: Harvest is done in the months of late August or early September and it is manually using family and hired labor. For selling as fresh ears, harvesting is responsibility of buyers, while selling as dry ears, harvesting is the responsibility of the growers. Maize farmers who do not want to sell it immediately after harvesting, they would keep it as the whole ears after husking. They then dry it by piling it up at the 0.5 m high in their house on its grated floor, to allow enough aeration.

Shelling is done by either machine or manual with knife only when the output is to be sold. For farmers who have maize yield around 1 ton they tend to shell by hands with a labor shelling at a rate of 100kg grain per man day.

3.3.5 Socio-economic characteristics

The study area is divided into eleven communes and 93 villages. Rice, maize, mungbean, and soybean are the four major crops in the district. The commune-wise population, number of households and maize area is presented in Table 3.7.

Table 3.7 Administrative division and population, Koh Thom district

No	Communes	Population (no.)	Households (no.)	Maize area (ha)
1	Chher Khmao	10,582	1,932	92
2	Chroy Takeo	9,175	1,854	509
3	Kampong Kong	11,914	2,297	525
4	Koh Thom Kor	7,086	1,266	158
5	Koh Thom Khor	7,692	1,473	231
6	Lerk Dek	15,768	2,669	21
7	Purban	10,674	2,076	417
8	Prek Chrey	13,474	2,351	509
9	Prek Sdey	19,258	3,641	476
10	Prek Thmey	18,552	3,700	650
11	Sompaopon	19,276	3,620	395
Total		143,451	26,879	3,983

Source: District statistics, 2004

3.3.6 Farm size

Farmers in the study area generally have different cultivated fields for rice and maize. Within the farms the low lying lands are kept for rice crop due to proximity to natural channels, while land away from channels usually are raised and therefore used for maize cultivation. The average size of owned land per household is mostly ranged from 1-3 ha, which covers 75 per cent of the surveyed households. 21 per cent of the households has land size less than 1 ha, while 4 percent has land size more than 3 ha (Figure 3.6).

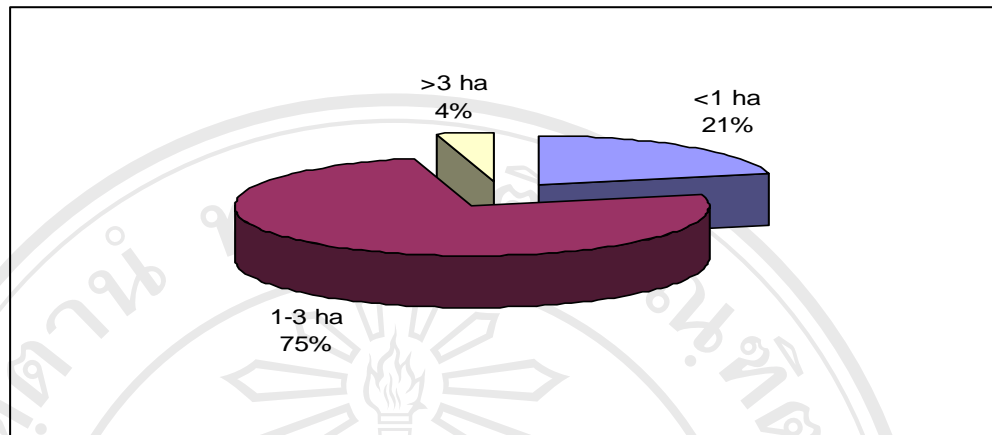


Figure 3.6 Percentage distributions of farm size in study area
Source: Survey, 2004

3.3.7 Cultivated maize area and land tenure of maize

In general, the distribution of cultivated area is between 0.5 - 3 ha in the study area (Koh Thom district office, 2004). However, the distribution pattern for the surveyed households for maize is much lower. Table 3.8 shows that the farm holding area for maize production per household is 43.8 percent in less than 0.5 ha category, 47 per cent in 0.5 - 1 ha category, and only 8.8 percent in more than 1 ha category. Maximum percentage of adopters and nonadopters are in the cultivated maize area per household group of 0.5-1 ha with 55 per cent and less than 0.5 ha with 52.5 per cent, respectively. 96.3 per cent of the surveyed households have their own land for maize production.

Table 3.8 Cultivated maize area and land tenure of maize in study area

Characteristic	Non-adopters	Adopters	All
Existing maize area per household	%	%	%
<0.5 ha	52.5	35.0	43.8
0.5-1.0 ha	40.0	55.0	47.5
>1.0 ha	7.5	10.0	8.8
Land tenure of maize (Own land)	97.5	95.0	96.3

Source: Survey, 2004

3.3.8 Characteristic of the farm household

There are 26,879 households in the study area and 84 per cent of the households are farm households (see Table 3.9) and total population is 143,984 people, 52 per cent of the population is women.

Table 3.9 Total population and households in study area

Description	Unit	Number	(%)
Population			
Total Population	person	143,984	100
Women	Person	74,673	52
Households			
Total Households	household	26,879	100
Farm Households	household	22,551	84

Source: District statistics, 2004

Age of households' head: The survey in the study indicated that 61 percent of the households' heads are over 40 years of age, 29 per cent are in between 30 to 40 years of age and only 10 per cent are below 30 years of age as shown in Figure 3.7. There is no significant difference between ages of adopters and non-adopters.

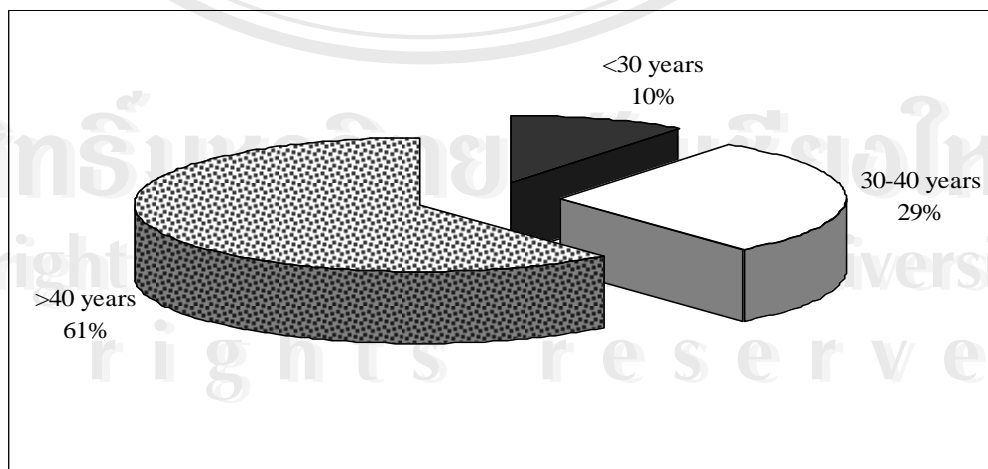


Figure 3.7 Percentage distributions of age categories

Source: Field Survey, 2004

Education of households' head: The survey result shows that 72.5 per cent of the household heads have primary education, 13.8 per cent have secondary, only 2.5 per cent have higher secondary and 11.3 per cent is illiterate (Table 3.10).

Household labor: Table 3.10 indicated that 77.5 per cent of households have between 2-3 working person available for agricultural activities, 18.8 per cent have more than 3 working persons available for agricultural activities and 3.8 per cent have labor less than 2 working persons. So most households have 2 to 3 working persons available for agricultural work and labor supply is sufficient for agricultural work except during planting for hybrid maize and harvesting season when some laborers are hired.

Table 3.10 Education of households' head and labor available in the family in study area

Characteristic	Non-adopters (%)	Adopters (%)	All (%)
Education of household head			
Illiteracy	15.0	7.5	11.3
Primary level	70.0	75.0	72.5
Secondary level	12.5	15.0	13.8
Higher secondary level	2.5	2.5	2.5
Labor available in the family			
<1 person	5.0	2.5	3.8
2-3 person	77.5	77.5	77.5
>4 person	17.5	20.0	18.8

Source: Survey, 2004

Length of stay in their village: Table 3.11 shows that farmers mostly stay in their villages for more than 10 years. 48.8 percent of the households have their length of stay in their villages from 10-40 years and 50 per cent have stayed for more than 40 years in the village. Only 1.3% of households stayed in the villages for less than 10 years. The percentage of adopters that stayed in the village from 10-40 years is 47.5

and that of non-adopters is 50. The percentage of adopters that stayed in the village for more than 40 year is 50 and it is the same for non-adopters too (Table 3.11).

Table 3.11 Length of stay in the villages

Characteristic	Non-adopters (%)	Adopters (%)	All (%)
Length of stay in the village			
<10 years	0.0	2.5	1.3
10-40 years	50.0	47.5	48.8
>40 years	50.0	50.0	50.0

Source: Survey, 2004

Years of experience in growing maize: People have long experiences of growing maize in the study area, some more than 20 years. 43.8 per cent of households have had experiences growing maize of more than 20 years, 33.8 per cent have 10-20 years of the experience, while 22.5 per cent have less than 10 years of the experience as shown in Table 3.12. The maximum percentage of adopters and non-adopters are in the years of experience in growing maize group of over 20 years with 42.5 and 45, respectively.

Table 3.12 Years of experience in growing maize

Characteristic	Non-adopters (%)	Adopters (%)	All (%)
Years of experience in growing maize			
<10 years	22.5	22.5	22.5
10-20 years	32.5	35.0	33.8
>20 years	45.0	42.5	43.8

Source: Survey, 2004

3.3.9 Family income

Generally, source of farmers' income in study area are from cattle raising, crop production, fruit trees and off-farm sources. From households survey results in Table 3.13 indicate that the percentage of adopters in the family income group of less than 2,500,000 Riel is 15 per cent and that of non-adopters is 22.5 per cent. Maximum percentage of adopters and non-adopters are in the family income group of 2,500,000-5,000,000 Riel with 70 and 60 per cent, respectively.

Table 3.13 Family income in the study area

Characteristic	Non-adopters (%)	Adopters (%)	All (%)
Family income			
<2,500,000 Riel	22.5	15.0	18.8
2,500,000-5,000,000 Riel	60.0	70.0	65.0
>5,000,00 Riel	17.5	15.0	16.3

(Source: Survey, 2004)

1US\$ = 4,075 Riel (March 2005)

There are no significant differences found in terms of total household income of local and hybrid maize farmers. Local maize farmers generated 69.4 per cent of the total household income from on-farm activities. While, hybrid maize farmers generated their income 88.3 per cent of the total household income from on-farm activities. Both local maize farmers and hybrid maize farmers raise livestock as other main source of household income comparing to other incomes, and it account for 34.5 to 35.2 per cent of the total household income (Table 3.14).

Table 3.14 Source of household income per year

Criteria	Local Farmers (N = 40)	Hybrid Farmers (N = 40)
Household income (Riel per year)	3,455,775	3,933,780
Standard deviation	1,293,850	1,450,584
Off-farm income (%)	30.6	11.7
Income from crop production (%)	15.9	27.3
Income from maize (%)	4.1	13.2
Income from fruit trees (%)	14.8	10.6
Income from animal raising (%)	34.5	35.2

1US\$ = 4,075 Riel (March 2005)

3.4 Institutional development

3.4.1 Access to technical advice

Maize growers in the study area do not much receive technical support from the government or non-government organizations based in the locality. Nevertheless, private companies, namely Monsanto, An Giang and Ngoc Tung based in Vietnam play an important role in maize production in the study area because farmers are their customers for inputs like chemical fertilizers and pesticides. The survey results presented in Table 3.15 show that 100 per cent of hybrid and local maize growers had access to technical advice. There are many sources of information which are available to both hybrid and local maize growers. Maize growers in the study area get new technologies of growing maize through their neighbors, agro-chemical retailers and publication papers of these companies. Some of the farmers living near the border have new technologies through participation in training courses organized by the companies as well. Training courses are organized by sending the companies' agencies to train head of villages, agro-chemical retailers and some farmers in study area on crop production and technical know-how to use chemical fertilizers and pesticides.

3.4.2 Access to output market

During the harvesting season, middlemen go to the farmers place to purchase products of fresh ears or grain maize. Mostly maize was exported to Vietnam as dry grain while fresh ears are mostly for local markets. Usually, Vietnamese middlemen buy dry grain of maize for exportation to Vietnam while Cambodian middlemen buy fresh ears for local retail. Table 3.15 presents access to output market of maize, both hybrid and local maize growers as 100 per cent because they can sell their maize output at any time that they need money. Farmers have Grain maize is sold as wet or dry weight. The survey found that farmers living in the commune near the border mostly sell their output immediately as wet weight after harvesting within five to seven days, while the others living far away from border mostly sell it as dry weight and sells it a month or two after harvesting. The buyers do not have any tool to measure the moisture content in the grain, but they estimate through their experience only.

Table 3.15 Access to technical advice, input and output markets, and credit

Characteristic	Non-adopters (%)	Adopters (%)	All (%)
Access to technical advice	100.0	100.0	100.0
Access to input market	100.0	100.0	100.0
Access to output market	100.0	100.0	100.0
Access to credit	100.0	100.0	100.0
Access to irrigation	22.5	80.0	51.3

Source: Survey, 2004

3.4.3 Access to input market

The study area extends about 37 km from Cambodia-Vietnam border along the national route Number 21. People can travel from place to place by land routes or waterways. There are many things imported from Vietnam by the entry border: hybrid

seed, chemical fertilizers, pesticides, etc. So, people can buy seed or agro-chemical inputs from agro-chemical retailers in their village or neighbor villages. While local maize seed are always kept for the next season by local maize growers. As farmers keep their own seed, the need to buy from the outside do not arise. They can buy it from either their neighbors or from markets. Table 3.15 shows that both hybrid and local maize growers have 100 per cent access to input market.

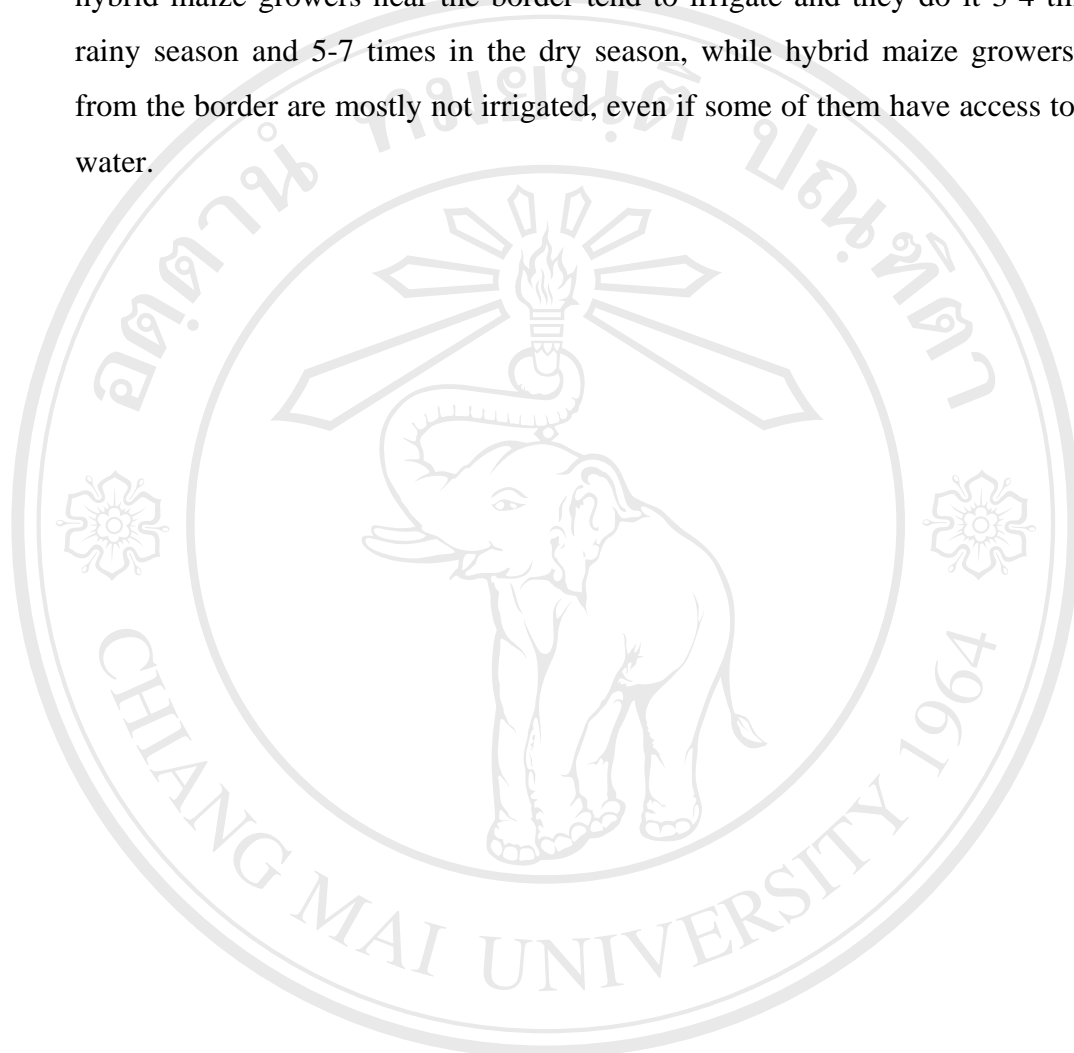
3.4.4 Access to credit

There are two types of credit: cash and borrowed capital like fertilizer. In general, farmers in the study area borrow money from Association of Cambodian Local Economic Development Agencies (ACLEDA) or from informal credit to fulfill their requirement as regards to livestock raising and other miscellaneous expenditure besides crop production. For maize and other crop production, farmers mostly depend on borrowed capital such as seed, chemical fertilizer and pesticide from agro-chemical retailers in their village. They have to pay it back after harvesting with an interest rate of 6.3-6.7 per cent, 8.3 per cent and 10 per cent per season (Table 4.3) for seed, chemical fertilizers and pesticides, respectively. The data from survey (Table 3.15) shows that 100 per cent of hybrid and local maize growers have access to credit. Only hybrid maize growers borrowed capital for maize production because local maize growers generally do not use any chemical fertilizer or pesticide.

3.4.5 Access to irrigation

Table 3.15 shows that only 51.3 per cent of all surveyed maize growers in study area had access to irrigation even if they have access to Bassac river and 118 natural channels. However, most of these channels become shallow and flow at a higher level than Bassac draining out water to the river during seasons when there is a scarcity of water. 80 per cent of hybrid maize growers had access to irrigation, while 22.5 per cent of local maize growers have access to irrigation. Local maize areas are not irrigated generally even if farmers have access to water because they think local maize is tolerant

to drought. For hybrid maize, there are different practices between hybrid maize growers in areas near the Vietnamese border and far away from the border. Mostly, hybrid maize growers near the border tend to irrigate and they do it 3-4 times in the rainy season and 5-7 times in the dry season, while hybrid maize growers far away from the border are mostly not irrigated, even if some of them have access to irrigation water.



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