

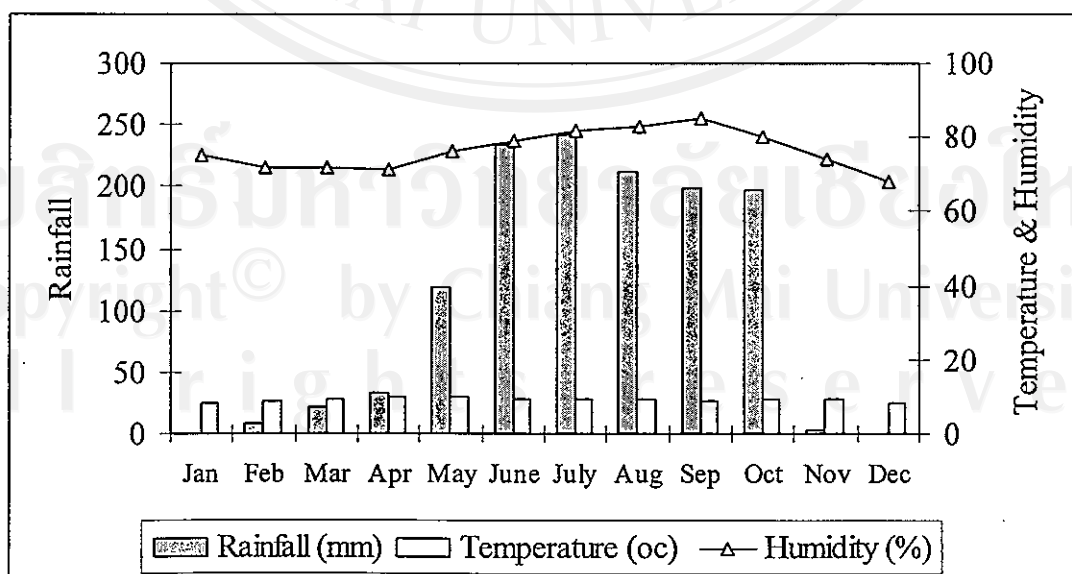
CHAPTER IV

GENERAL PROFILE AND PRODUCTION SYSTEM OF THE STUDY AREA

4.1 Agro-ecological feature

The climate of the study site is characterized by a dry and rainy season. The rainy season extends from May to October. The remaining months of the season is with average temperature varying between 25-30°C and an annual mean temperature of 28°C. The annual average rainfall in the study area was 1,271 millimeters with an average monthly precipitation ranging from 4-241 millimeters and 85% of the rainfall was concentrated during June to October.

The relative humidity ranged from 68-85 percent. The rainy season starts with the onset of Monsoon in May and attains its peak in June and July when heavy rainfall (241 mm/month) is experienced (Figure 2). The dry season rainfall is usually very low; therefore, vegetable cultivation is not possible without irrigation. But the irrigation system is very poorly developed and managed, which poses a problem both in dry and rainy reasons.



Source: Provincial Meteorology and Hydrology Office, 2003.

Figure 2. Distribution of rainfall and temperature by month in Siem Reap province

4.2 Demographic setting

Samraong commune is one of the ten communes of Sotnikum district, Siem Reap province in the North-western part of Cambodia. The commune is divided into nine villages, which are located 41 km south of Siem Reap town. In Sotnikum district there are 1,593 households with total population of 8,315 people comprising 55% female and 45% male (District Administrative Office, Sotnikum, 2003). The finding from field survey shows that 59% of the households are female headed as against the male-headed households of 41% (Table 4).

Table 4. Composition household head by gender

Gender	Botdangkor		North Samraong		Both villages	
	Number	--(%)--	Number	--(%)--	Number	--(%)--
Male	440	41	461	41	901	41
Female	630	59	665	59	1,295	59
Total	1,070	100	1,126	100	2,196	100

Source: Survey data, 2003.

4.3 Socioeconomic setting

In general, people living in the study area have improved their living condition by increasing their income through enhancing the agricultural productivity. There is local organization of farmer and people have a history of working together and a sense of community cohesiveness. Usually, farmers purchase agriculture input such as vegetable seeds, chemical fertilizers, insecticides and agriculture material through the local market of Domdek, which is located at a distance of 5 km from vegetable IPM project village. However, farmers sell their agriculture products either through the middlemen who came to purchase in farmers field or farmer sell their products directly in provincial market at a distance of 39 km.

4.3.1 Land use

Samraong commune is characterized by flat land with the total area of 2,153 hectares of which 91% represents rice land, 2% vegetable cultivation area, and 7% of

land area is used for human settlement (Figure 3). While the farmers predominantly grow rice, fruit trees like mango, milk fruit, jackfruit, and guava can be seen in the home garden. Other crops like maize, sugarcane, mungbean, soybean, groundnut, tomato, and cabbage are also grown in rice based cropping systems. Among these crops, cabbage is the main source of household income.

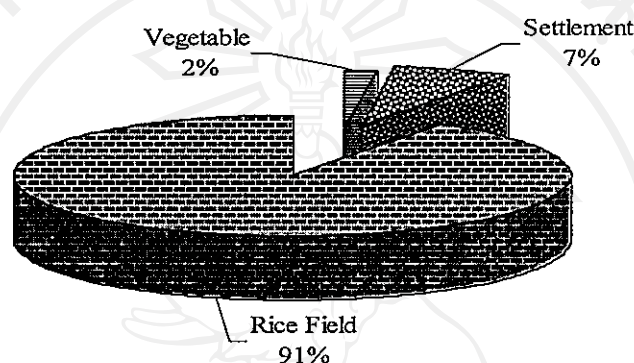


Figure 3. Percentage of land used for different purposes in Samraong commune

Farmer's land classify into three groups such as Agriculture land, Vegetable land and Settlement. Agriculture land is mainly used for cultivation of rice in rainy season and sometimes grow vegetable after rice harvest. Similarly vegetable land was largely designed for cabbage production for cash and household consumption. Settlement land is mainly for construction and establishment of other public services.

Table 5. Land use information of Samraong commune

Village	Agriculture	Vegetable	Village	Total	Vegetable land in each village (%)
	-----(ha)-----				
Angkugn	250	10	14	274	4
Botdangkor	222	8	12	242	3
Svay Chhrum	156	7	11	174	4
Krang Kachhay	195	5	14	214	2
Samraongtaboung	216	5	11	232	2
Samraongcheoung	390	2	28	420	*
Stueng	260	1	27	288	*
Betmeas	156	2	12	170	1
Thnorl Chek	120	3	16	139	2
Total	1,965	43	145	2,153	

*Less than one percent

Sources: Siem Reap Provincial of Agricultural, Forestry and Fisheries Dept., 2003.

The result in Table 5 above indicated that vegetable is grown in all the nine villages. While the agriculture land and village land of Botdangkor village is smaller than Samraongcheoung village, vegetable is grown in larger area in Botdangkor (8 ha) than Samraongcheoung.

4.3.2 Income sources

The main source of income in the study area is cabbage followed by off-farm activities. The annual average income for IPM farmer in Botdangkor is 675,000 Riel and non-IPM farmer-1 is 518,500 Riel, both from Botdangkor village and non-IPM farmer-2 is 482,500 Riel for Samraongcheoung village.

The annual income of IPM farmer is 30% higher than non-IPM farmer-1 and 40% higher than non-IPM farmer-2. In both villages, cabbage contributed to 94% for IPM farmer and 90% for non-IPM farmer-1 of total income in case of Botdangkor village and 91% for non-IPM farmer-2 in Samraongcheoung village. Cabbage is major source of income among the IPM farmers and non-IPM farmers, while IPM farmers derive higher proportions of income by applying IPM practices to manage in their cabbage growing (Table 6).

Table 6. Source of annual income in both villages

Farmer	Annual income	Cabbage income	Other income	
	-----(R)-----	-----	(%)	-----(R)----
IPM	675,000	633,610	94	41,390
Non-IPM -1	518,500	469,220	90	49,280
Non-IPM -2	482,500	439,505	91	42,995

Source: Survey data, 2003.

This lower cash income of both groups of non-IPM farmers was mainly due to the poor production practices like poor crop management for pest and disease control and excessive the use of pesticides and chemical fertilizers leading to increased production cost.

4.3.3 Utilization of income

In general, income of farmers is spent through three major categories of expenses as shows in the Figure 4 below. On an average a family utilises above 75% of the total income in purchase of household consumables, clothing, farming, education and other miscellaneous expenses.

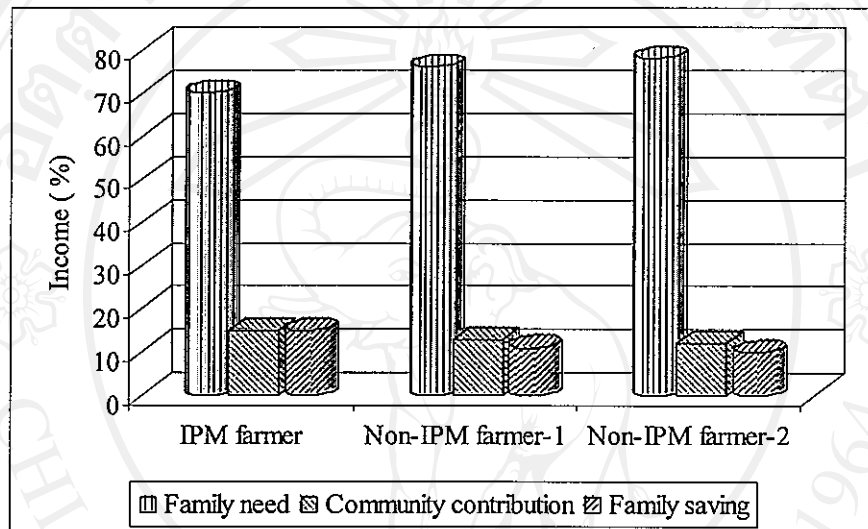


Figure 4. Utilization of farmers' income

Every household on an average contributes 14% of their income for community activities like annual offerings to the local deities, renovations of community infrastructures and community gathering. After meeting such social obligations farmers do keep some money aside to be used for unforeseen or difficult situation that a family might face, such as sickness and natural disaster. Thus on an average IPM farmer saves 15% of the income, while non-IPM farmer-1 saves 11% and non-IPM farmer-2 saves 10% of their income on individual.

4.4 Vegetable production

Cambodia's economy is largely based on agriculture. Approximately 80% of the population lives in rural areas. The vegetable area was estimated at 37,747 ha during 1998 with an annual production of 217,258 tons. It contributes about 1.5% and

2% of all crop and rice area, respectively. Vegetables contribute nutrients for human growth, thus it is an important component diet in home consumption. Per capita availability of vegetables from commercial vegetable production is only 20 kilogram per annum, considerably lower than the recommended level of 73 kilogram per annum (MAFF, 1999). Vegetables are the short-term crops, which can be produced within 1.5 months, and generate the main source of income for household and also make full use of land and family labor in the study area.

Generally, farmers grow vegetables around homestead where water source is available year around (CIDSE, 1997). The cultivation of vegetables is influenced by the microclimate, soil characteristics, fertility and seasons. However the cultivation of vegetable is more intensive in the region due to the market demand. Many varieties of vegetables (pod, leafy, fruit and root) are cultivated throughout year but the most abundance can be observed during the period from November to April.

4.4.1 Cabbage production

Cabbage is one of the preferred vegetable for consumption as it contains vitamin and mineral. The Latin name for cabbage is *Brassica oleracea* Var. *botrytis*, member of the family Crucifers (Praasterink, 2000).

The plant

Cabbage is a biennial herb, 40-60 cm tall at the mature vegetative stage. Mature plants have a strong ramified. Basal leaves in rosette of 7-15 sessile out leaves, upper leaves in a compact flattened globule to ellipsoid head, 10-30 cm in diameter, formed by a great number of overlapping fleshy leaves around the single growing point (Shams *et al.*, 1999).

Nutritional value and uses

Cabbage has a good nutritional value. Per 100 g of fresh edible portion in contains on an average of 91 g of water, protein 16 g, carbohydrates 6 g, fiber 0.8 g, Ca 55 mg, Fe and also consumed fresh.

Soil and climate

Cabbage grows best at average daily temperature of 15-20°C and a diurnal variation of at least 5°C. Soil should be well provided with organic material and have good moisture-retaining properties. A pH of approximately 6.0-7.0 is generally considered as best for cabbage. Because of the shallow root system, cabbage needs a regular supply of water throughout the growing season either by rain or irrigation.

Varieties

The majority of farmers in the study area prefer to grow KK-Cross (F₁) that is heat tolerant and early maturing. The recommended varieties of cabbage for cultivation in Cambodia are (KKVRC 1996, cited in Shams *et al.*, 1999):

- KK-Cross (F₁): Takii Seed Co.
- KY-Cross (F₁): Takii Seed Co.
- Talix (F₁): Royal Sluis

4.4.2 Cropping pattern

The main cropping pattern in Botdangkor and Samraongcheoung village is rice-based cropping system. There are no natural water resources in this village so the moisture for crops is fully dependent on the rainfall. Most of the farming activities are concentrated during the rainy season, mainly for the rice crop start growing from May to November (Figure 5).

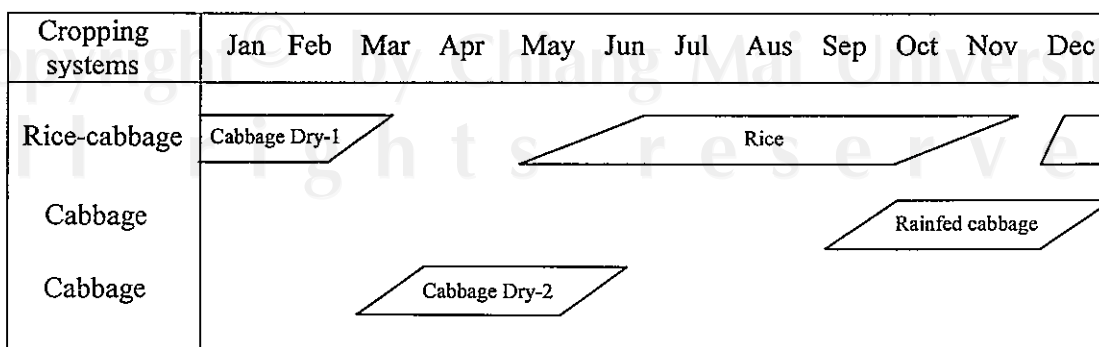


Figure 5. Cropping pattern in Samraong commune

Cabbages are usually planted in 3 different times according to farmers' choice. In Rainy season (rainfed cabbage), people grow cabbage from September to December; Dry season-1 for growing cabbage starts in December after rice harvest to March and Dry season-2 from March to June when there is water in the ponds. All farmers in the study area usually grow their cabbage for the period of the rainy season from September to December in different plot during planting rice.

4.4.3 Farmers' practices

Based on the information from the survey of vegetable production in selected villages the farmers' practice in cabbage production is explained in following sections.

Land preparation

The cabbage fields are ploughed and harrowed only 1-2 times with 10-15 cm deep and keep the soil exposed to the sun for a period of 1-2 day only. Sometimes, they grow crops immediately after preparing field on the same day.

Seedbed

The seedbed is prepared in the village in the homestead or in the high land. Cabbage farmers plough their seedbed fields well. The field is dried well before sowing seeds. The size of seedbed is varies from farmer to farmer. However, most of seedbed is 0.8-1.0 m in width and 10-11 m in length. The sowing density is 2 g or 700-1,000 seed/m² of the bed. Farmers also use the thumb rule of 1 tablespoon of seeds/seedbed. After sowing seeds, the seedbed is covered with straw or hey chopped into small pieces. After 3 days of sowing, when seeds start germinating, straw or hey is taken out.

Irrigation is very important of nursery management. Farmers apply water to seedbeds 2-3 time/day. Cover the seedbed when raining. If the seedling shows sing of nitrogen deficiency liquid nitrogen fertilizer is applied at 2 g of urea/1 liter of water. The planting space and density is not well considered. The spacing used by farmers is

only 30 cm for cabbage plant. Farmers are of the opinion that the more the plants they would grow in the field the higher would be the yield. The majority of farmers are grown cabbage on the beds, while only few farmers transplanting seedling in the full field.

Fertilizer use

It was reported that farmers do not have uniform fertilizer application procedures. Some farmers used cow dung of 7-8 t/ha on an average as basal application, while some farmers apply 15-15-15 and 16-20-0 as basal fertilizer. Almost all chemical fertilizers were used for top dressing with different dosages at different stages of crop without thinking of type of fertilizers, required dosage at the right stages and right time. They lacked understanding of the role of elements consisting in fertilizer playing in supporting the plant growth.

The most popular fertilizers used by farmers are urea (46-0-0), DAP (21-0-0), 16-20-0 and 15-15-15. Farmers used a lot of chemical fertilizers without thinking of the negative impact on the soil and of economic return. Looking at the normal use of fertilizers in cabbage, farmers used cow dung at an average of 7.5 t/ha and 15-15-15 at 100 kg/ha for basal fertilizer and urea at 430 kg/ha, DAP at 300 kg/ha, 16-20-0 at 300 kg/ha and 15-15-15 at 215 kg/ha as top dressing in which they applied 6-10 times for the crop cycle.

Pesticide application

Cabbage growers are very heavily dependent on the use of pesticide as exclusive means to control insect infestation. Majority of farmers applies pesticide 5-6 days after transplanting. They mixed (cocktails) 3-5 types of extremely toxic chemicals to spray their crops with high dose from 30 ml to 90 ml/17 liter of water. The frequency of application is usually one spray in each 3-7 days depending on the intensity of infestation.

They sprayed crops from 8 to 20 times according to the life cycle of crops. Farmers sprayed pesticides without wearing protective clothes and the method of

spraying could be harmful to their health and environment. The commonly used pesticides on cabbage are Folidol, Foxentol, Metaphos (*methyl parathion*); Phosdrin, Fitor, Lockphos (*mevinphos*); Marathon (*methamidophos*); and Thiodan (*endosulfan*).

Insect pest

Insect pests are the main problems on vegetable production faced by farmers. There are many types of insect pests damaging different vegetable groups. This problem is the most threatening for the farmers. They could lose their crops as they have limited knowledge on effective measures to control insect pests.

The major insects of cabbage are webworm (*crocidolomia binotalis*), diamondback moth (*plutella xylostella*), flea beetle (*phyllotreta* sp.), armyworm (*spodotera litura*) and cabbage sawfly (*athalia* sp.). The most serious of cabbage in Cambodia, the larvae of diamondback moth is a surface feeder. It creates window like damage to leaves. Damage is confined to areas between veins. The flea beetle cause damage on young cabbage leaves during night and fresh weather.

Disease

Besides insect pests there are many different kinds of disease that damaged the vegetable crops. Some farmers were not successful in growing the cabbage because they had serious problem with diseases. Farmers have no means to control diseases when they infested the crops.

Therefore, they gave up growing crops in the infested field. The major diseases infestations in cabbage as claimed by farmers are leaf spot, bacterial soft rot, and white mould.

The pressing constraint is farmers' inability to identify the causes and the symptoms of diseases on cabbage, so they could not make decision to take appropriate action to protect their crops. Therefore, in some places, farmers stopped growing cabbage.

Harvesting

In general, farmers harvested and sold vegetables to the market 1 to 2 days after spraying pesticide. The yield is commonly low at 15-18 t/ha and the economic return is also low because of high input use.

4.4.4 Constraint in farmers' practices

Many constraints and limitation have been identified during field survey. These are as show in the following:

Seedbed preparation

Seedbed is not well prepared especially in the wet season due to lack of understanding about the effect caused by the weather condition and lack of appropriate technique to make a well-protected seedbed and to protect the seeding. Consequently farmers faced problem of shortage of healthy seedling to grow in the open field for the required period.

Fertilizer utilization

The concern is farmers used very little organic fertilizer. Few farmers used small amount of cow dung as basal fertilizer and they did not use compost and green manure. Farmers lacked technique to make clean and well-decomposed compost to be used in their field.

Every farmer used chemical fertilizers, but they have limited knowledge about the role of elements consisting in fertilizer playing in supporting the plant growth. More importantly farmers lacked understanding about applying right dosage at the right stages and in the right time.

Insect pest

The problem is farmers have limited knowledge about insect life cycle and the factors that have influence on insect resurgence. Significantly they cannot clearly identify which one is the harmful insect and which one is the natural enemy, while

they don't know about the essential role of the natural enemies in making eco-system balance.

One more problem is farmers were using a lot of chemical pesticide to spray the crops and the same products have been used repeatedly for long period of time. Farmers did not observe and analyse the field situation critically before making a decision to take action. They lacked knowledge on the use other alternative methods in pest management. Farmers have not practiced botanical insecticide and biological control.

Disease

The main difficulty is farmers do not have any knowledge about the nature of disease and the effective control methods. Farmers generally are not able to identify the pathogen causing the disease, the sources of the pathogens, the favorable factors contributing to the disease development and the damage symptoms. As a result farmers have no idea on how to control disease in their field.

Pesticide utilization

Farmers mixed different types of pesticides (2-5 products) and sprayed many times (8-20 applications/crop cycle). The use of heavy pesticides in class Ia and Ib have been classified as extremely hazardous product by WHO.

Farmers are dependent on advice from sellers who have no technical knowledge about products as well as about pest problems. It is dangerous that farmers did not use protective clothes during pesticide application and they paid less attention to the risks associated with pesticide on health and environment. They left the pesticide containers near the field or sometimes dumped into the canal.

Harvesting

It is very dangerous for consumers since farmer used pesticide on their cabbage until the harvest time, resulting into heavy pesticide residual.

Marketing

Farmers usually sold their product to the middlemen as wholesale, but sometimes they transported the product and sold in the local markets by themselves. The main problem related to marketing their product is the price factor. The price is always low at the time of harvest when the supply in the market is high due to the peak harvest season. This is due to many farmers growing the same crop at the same time. Another urgent concern is the quality judged by consumers based on the product's appearance and it is low compared to the products imported from Thailand and Vietnam.

In this regard the locally grown vegetable cannot compete with the imported products. The last but not least concern is that the middleman and customers did not care about contamination of the product with chemicals. This leaves farmers with marketing disadvantage. The middlemen and the consumers, they do not care much about the chemically produced vegetables. The average price of cabbage is 600-800 Riel per kilogram.