Chapter IV

Results of the field survey

4.1 Climate

The climate is hot and humid in low land areas, which is common for all low lying areas in the country. The exact temperature data are not available for the study area. Generally, the temperature varies from 25^{o}C to 35^{o}C, which reach at the peak in April and May and lowest during December and January.

The rainy season extends from May to October. The annual average rainfall in the study area is 1,145 millimeters with an average monthly precipitation ranging from 26-223 millimeters and 85% of the rainfall is concentrated during May to October.

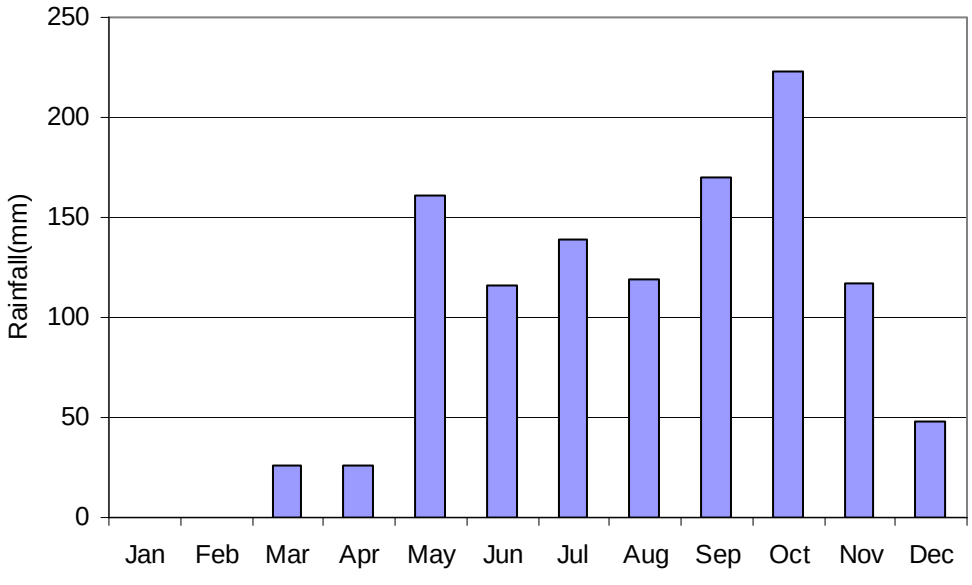

Figure 4.1 Distribution of average rainfall by month in 2004-05 in Takoe province

(Source: Provincial Meteorology and Hydrology Office, 2004-05)

The rainy season starts with the onset of Monsoon in May and attains its peak in October, when heavy rainfall is 241 mm/month (Figure 4.1). The dry season rainfall is usually very low; therefore, crop 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.

4.2 Characteristics of study area

Boeng Tranh Khang Tbong is one of the 11 communes of Samrong district under Takeo province, with total population of 12,112 and is situated about 70 km southwest of Phnom Penh, the capital of Cambodia. The commune covers the total area of 2,719 ha out of which large area 62% is occupied by rice crop followed by 2% non-rice crops, 24% settlement, 1 % reservoir and 11% other uses (Figure 4.2). The status of current farming practices in rice production and other cropping systems with fertilizer management was studied in Beoung Tragnk Khang Tbong commune where the double cropping of rice/other crop is being made. The principle output of this field survey is furnished with a great deal of thought over the changes in knowledge on fertilizer management practices.

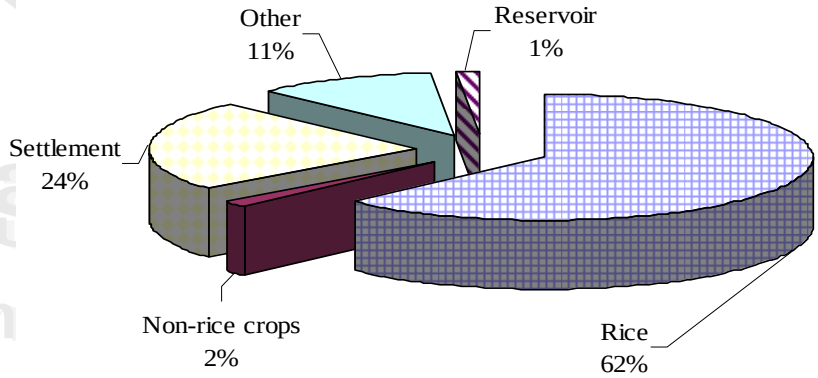

Figure 4.2 Percentage of land used for different purposes in study areas

(Source: AEA, 2004)

The characteristic of farmer's household of surveyed areas is presented in Table 4.1. The average age of those farmers is around 40. Female respondents in this survey are about 33.3%. In the farming system, women participation is found 30 to 52%. They are involved in different stages of farming. Some housewives are playing a leading role on their family farm. The average household consisted of around 5 members, including 1-2 dependent members. Farmers in survey areas are using reservoir water for supplementary irrigation in early wet season (EWS) rice/crop, and this approach is relatively successful. Average cultivation area is 0.49 ha per household. About 6.6% of the respondents interviewed have off farm jobs to the family members. In most case rice crop was cultivated using manual labor and simple tools except that cattle or buffalo were major source of power for plowing and harrowing. The average household own two draft animal (Table 4.1)

Table 4.1 Characteristics of survey respondents in village

Characteristics	Farmers(n=15)
Average age (yrs)	40
Female respondents (%)	33.3
Average education (yrs)	4.4
Number of dependants (average)	2.6
Number of in household (average)	5.0
Number of draft animal(average)	2
Farmer's training courses attended (%)	15
Average planted area(ha)	0.49
Growing non-rice crops (%)	100
Off-farm jobs (%)	6.6

(Source: Survey, 2005)

4.3 Cropping systems

Rice-based cropping systems predominated in the rainfed lowland. With this ecosystem in the surveyed area, varieties are classified as early, medium or late varieties (Table 4.2). Most of the farming activities are concentrated during the rainy season, mainly for the rice crop starting from May to November (Table 4.2). Farmers start growing early wet season rice in May and harvest in September with supplement irrigation. Medium and late wet season rice starts from June and harvested in

December. Land preparation is practiced at least 2-3 times before transplanting. The animal draft wage ranged from 5000 to 7000 riel/day. A labor requirement is at peak during transplanting and harvesting time, and usually farmers share or hire labor from outside the area. Direct seeding rice is grown from early May and harvested in December and wet season rice from June to December (Table 4.2).

Non-rice crop planted twice in a year. The first crop started from January to February and the second began from late April to late June. Some of the crops are planted in rice fields and in upland areas near the house or water sources. Land area for non-rice crops ranges from 1000 to 4000 m^2.

Table 4.2 crop calendar in the study areas

Crop/Moth	1	2	3	4	5	6	7	8	9	10	11	12
Rice:												
Early wet												
Wet season												
Medium												
Late												
Direct seeding												
Vegetable:												
Watermelon												
Cucumber												
Pumpkin												
Long bean,												
lettuce												
Subsidiary crops:												
Cassava												
Sugarcane												
Mung Bean												
Sweet potato												

(Source: Survey, 2005)

Crops planted in early wet season are mung bean, pumpkin, cucumber, watermelon, cassava, sugarcane and sweet potato while the second pattern has: yard-long bean and lettuce (Table 4.2). Land for non-rice crops is prepared at least three times before planting. Pesticides are commonly used with high rates ranging from 8 to

20 bottles per hectare. Pesticide, which are common used is Folidol (Methyl Parathion the cost averaged 3500 Riels per bottle (4075 Riel =1 U$).

4.4 Rice growing practices

In general, the commune is characterized as one of areas with relatively low agricultural productivity given that it is part of the Prateah Lang soil group, known as soil with little potential to achieve high yields of rice due to its very poor soil fertility (Oberthür *et al*., (1997). Unfertilized rice yields on these soils ranges from 600 kg to 1.40 t/ha (White *et al*., 1997).but, in study area was slightly high. The maximum yield was 2 t/ha and the minimum yield 0.9 t/ha. The average yield is about 1.51 t/ha (Table 4.3).

Table 4.3 Average rice yield (t/ha) in the study areas

	Grain yield
	--t/ha--
Maximum yield	2.00
Minimum yield	0.90
Mean	1.51
SD	0.38
n =15	

(Source: Survey, 2005)

The most predominant methods of crop establishments is transplanting. The first major activity is the preparation of seedbed. Nursery beds are established in the areas where there is good water control.

All farmers transplanted their wet season rice. On an average, seedlings were 48 days old at transplanting and farmers use 5 to 6 seedlings per hill for transplanting. Hills are generally planted at an average of 20 to 25 cm apart. Some farmers grow traditional varieties like Phkar kngei, Pkhar Malis,and Kraham. However some modern varieties also grown in the area like IR66, IR36, Senpidor, Somali, CAR4, and CAR6.

Approximately, 66 % of farmers used seeds from their own stocks (seed harvested from the previous season), whereas the rest of farmers, about 28%, obtained or exchanged seeds with friends and neighbours and 2% get from government agencies (Figure 4.3).

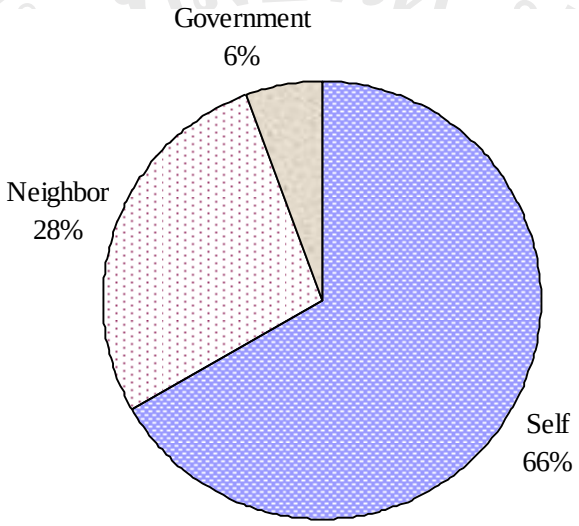

Figure 4.3.Percentage seed receiving from different sources

(Source: Survey, 2005)

The seeding rate used by rainfed lowland rice farmers varies from 50 to 120 kg/ha (Javier1997). Whereas this study (Table 4.4.) found that the seed rate used by farmer varied from 60 kg/ha to 100 kg/ha and average seed rate is about 74 kg/ha.

According to Nesbitt (1997) seed rate generally varies depending on the location and fertility of nursery and the field, germination rate of the seed, and the varieties. Most of farmers reported that higher seed rate will increase crop yield while only a few drew an association with the germination of the seed. Some reported that high seeding rate is important given the unreliable weather conditions. Certain amounts of seedling have to be reserved for replanting after extreme events such as droughts and floods.

Table.4.4.Average seed used (kg/ha) by farmers in study areas

	Seed rate
	----- kg /ha ----
Maximum	60
Minimum	100
Mean	74
SD	11
n = 15	

(Source: Survey, 2005)

Fertilizer used

Most soils are generally low in fertility as a result of continuous cultivation without adequate replenishment of lost nutrients. Rice is grown primarily for its grain and the straw by-product is a valuable source of nutrition to animals. Most of farmer in study areas harvest crops by leaving the stubble about 15 to 20 cm. In case of some short duration varieties there is a tendency to harvest the complete plant (i.e. cut the plant close to the ground leaving no more than 5 cm of straw on the field). Therefore a larger proportion of the nutrients are removed from the field. This result in the relative infertility and nutrient deficient status of a large proportion of Cambodian rice soils.The soils are insufficient in nitrogen, phosphorus and often potassium. Iron toxicity is observed in some soils. In general, soil fertility increases from the higher fields to the lower fields.

Cambodian farmers traditionally apply organic and inorganic fertilizers to replace nutrients lost during the previous crop from the fields, for example, about 82% of rainfed lowland farmers apply fertilizer (Jahn *et al*., 1996; Rickman *et al*., 1995). Application of organic fertilizer (manure) is common practice of the farmers. The first manure application, before seeding, is generally mixed into the soil by harrowing. About one fifth of main fields of farmers are applied with manure for seedbeds at about 1.6 t/ha. Lando and Solieng (1994a) reported that up to 60% of cow manure is applied to nursery bed schedule at 5 to 10 days in advance of first plowing. The remaining manure was used as basal fertilizer that is normally broadcasted into the transplanting field. Application rates vary from 200–300 kg to 2500 kg/ha of

farmyard manure per hectare in nursery. The actual amount depends on the availability of manure. However, this survey only focused on use of organic and inorganic fertilizer in the main field only. A large number of farmers apply inorganic fertilizer between the seedling and booting stages (Jahn *et al*., 1996). Sources of inorganic fertilizer are urea, di-ammonium phosphate (DAP) and 16-20-0 of N: P: K.

The result in the Table 4.5 shows that farmers apply farmyard manure form 200-660 kg/ha mixing with inorganic fertiliser including urea (46-0-0) and 16-16-8-13, DAP, and 16-20-0 (compound fertilizer containing N-P_2O_5-K_2O-S). They broadcast and incorporate into the soil to 15-20 cm depth just before transplanting as a basal dose. Very few farmer used inorganic fertilizer DAP and 16-20-0 as basal in average 20 kg/ha (Table 4.5).

More urea and 16-16-8-13 were used than 16-20-0 and DAP. The height price was one of the reason for less used of 16-20-0 and DAP. Most of the farmer reported that urea and 16-16-8-13 were the best fertilizer for enhancing rice growth and increasing rice yield. In addiction, there was concern about adulterated fertilizer being sold in the place of 16-20-0 and DAP in the market.

Table 4.5 Average amount used (kg/ha) of fertilizer in different types

	Urea	16-16-8-13	DAP	16-20-0	FYM
	---------- kg/ha ----------				
Maximum	50.00	100.00	25.00	25.00	667.00
Minimum	25.00	50.00	15.00	15.00	200.00
Mean	34.00	67.00	20.00	20.00	490.87
SD	11.00	19.00	7.00	7.00	165.60
%	100	70	15	15	100
n =15					

(Source: Survey, 2005)

Urea (46-0-0) and 16-16-8-13 are commonly used by farmers in the study areas. The rates applied of urea ranged between 15 kg/ha to 50 kg/ha, while the 16-16-8-13 fertilizers ranged between 50 to 100 kg/ha (Table.4.5)

Nevertheless the way they apply fertilizer is different in terms of stage production and type of fertilizer used. Farmers use urea (46-0-0) by splitting 50% for basal and the remaining 50% using as topdressing (Table 4.6). About forty percent of farmers use urea (46-0-0) fertilizer for topdressing at tillering stage, while sixty percent of farmer use urea fertilizer for topdressing at panicle initiation (Table 4.6).

The amount of applied fertilizer is still low for the rainfed lowland soils. Farmers primarily apply N and P. Most rainfed lowland farmers apply fertilizer only once or twice for early-maturing rice. The number of applications depends on the fields and water status. The farmers do not apply fertilizer when fields are dry or contain too much water.

Table 4.6 Average amount used of fertilizer (kg/ha) in different type and number of farmers practicing different mode at each stages

	Urea basal	Tillering stage	Panicle initiation
	---------- kg /ha ----------		
Maximum	50.00	16.76	50.00
Minimum	16.70	33.33	25.00
Mean	23.30	25.67	30.91
SD	8.40	7.66	7.24
n =15			

(Source: Survey, 2005)

It is also found that the most popular fertilizers used by farmers for non rice crop are urea (46-0-0), and 15-15-15. Looking at the normal use of fertilizers for non-rice crop, farmers used cow dung at rat an average of 5-6 t/ha and 15-15-15 at rate 100 kg/ha for basal. After that they apply urea (46-0-0) at rate 25 kg/ha by mixing with 15-15-15 at rate 100 kg/ha as top dressing.

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 time. They lacked understanding of the role of elements consisting in fertilizer playing in supporting the plant growth.

4.4.1 Fertilizer related constraints in rice cultivation

Interview with farmers identified several problems affecting rice production (Table 4.7). They reported that their soil become very poor and the rice yield is very low due to insufficient use of fertilizer. Mostly farmers mentioned that due to lack of cash and no availability of credit they can not buy fertilizer as per their requirement. They stated that they need credit to buy fertilizer, but it is very difficult to get. Also the price of fertilizer increases during growing season approached but the price of rice decrease after the harvesting.

Some farmers also complain about the poor quality of fertilizer, because the yield of rice sometime do not increased as expected with fertilizer application, and the soil in their field became hard (Table 4.7). Farmers attributed this to effect of adulterated fertilizer. However, it may also be due to the used of inappropriate types or rate of fertilizer or inappropriate timing of fertilizer application.

Table 4.7 Constrain to fertilizer used in rice cultivation

Constrain to fertilizer used on rice	%
No money available to buy fertilizer	60
Credit not available to buy fertilizer	13
Labor shortage	13
Distant house to field	20
Distant of market for fertilizer	27
Poor quality of fertilizer	27
n =15	

(Source: Survey, 2005)

The condition of local road was problem for the farmer who reported that they great difficult to transportation fertilizer and other material to their field and harvested rice back to their house.

4.4.2 Farmers knowledge and strategies to manage soil and fertilizer

Most of farmers were not aware of soil type on their farm according to Cambodian Agronomic Soil classification (CASS) (White *et al*., 1997) (Table 4.8).

This may be due to effect of farmer training course conducted in these areas where 15% of farmer had attended the course (Table 4.1). However, all farmers recognized different in texture (sand or clay), compaction, and ease information of their soil. The farmer in the study areas almost all farmer applied inorganic fertilizer in their field. They reported that fertilizer is very important for obtaining satisfactory yield, and that without inorganic fertilizer they expected insufficient rice for family consumptions.

Very few farmers accessed in formation directly from government and Non Governmental Organizations (NGOs). Most farmers applied fertilizer according to their own decision-making rule or following with their neighbor (Table 4.8).

Table 4.8 Farmer knowledge about soil and fertilizer to increase yield (% household responded)

Question about soil and fertilizer	%
Recognizing of soil group using CAS classification	0
Follow the recommend rate of fertilizer	0
Applied fertilizer when field has no standing water	13
Applied the same kind of fertilizer and amount very year	93
Able to recognized the fake fertilizer	7
Discussion of fertilizer issue with extension	7
Discussion of fertilizer issue with NGOs	0
Discussion of fertilizer issue with neighbor and their own decision making	60

(Source: Survey, 2005)

Farmers have their own strategy to increase the rice yield. About 40% of farmers used organic fertilizers with or without inorganic fertilizer, 33% want to use more inorganic fertilizer, and 27% want water control, and 13% weed and insect control (table 4.9).

Table 4.9 Farmers strategy to increase yield (% household responded)

Strategy for increasing yield	%
Use organic fertilizer with or without more inorganic fertilizer	40
More inorganic fertilizer	33
Better water control	27
Weed and insect control	13
n=15	

(Source: Survey, 2005)

4.5 Income sources

In this study farmers, obtained income mostly from three main sources: rice animal production and non rice crops (Figure 4.4). The annual average income for farmer is 2,679,000 Riel (1U$ = 4075 Riel). The main source of income is rice, which about 30% of annual income. Cattle and non rice crops are second source of income contribute about 20 percent (Figure 4.4). Chicken and pig the third income source about 13 percent and follow by off farm 4 percent. Off farm activities included: palm production, small trading, motor taxi, and work at garment factory.

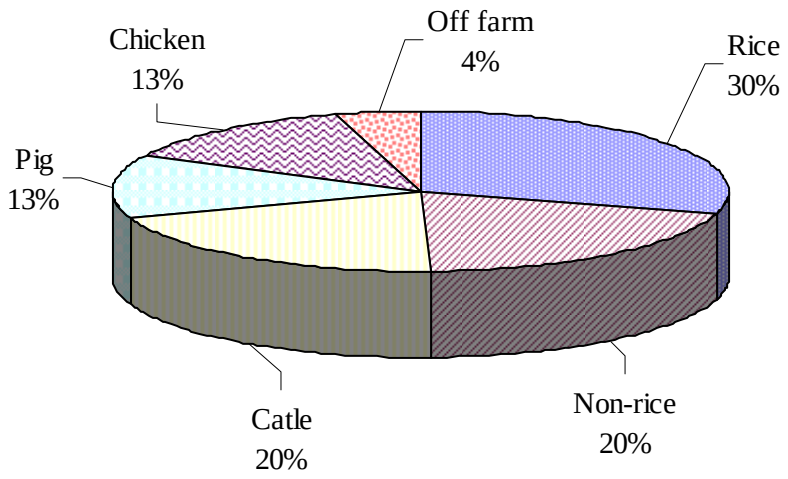

Figure 4.4 Sources incomes in study area

(Source: AEA, 2004)

Most farm household's posses a small number of domestic animals. These include chicken, ducks, pigs, and cattle. Chicken and dug are generally raised for egg and meat consumption while the pig and cattle provide a value able for cash income. There is significant potential for diversification of whole farming systems to facilitate the generation of cash income for the farmers in the study area.

4.6 Utilization of income

In general, income of farmers is spent through three major categories of expenses as shows in the Figure 4.6. On an average a family utilizes above 41% of the total annual income in purchase of food items followed by 15% agriculture input, 4% health care, 11% education, 8% cloths and 21 % other miscellaneous.

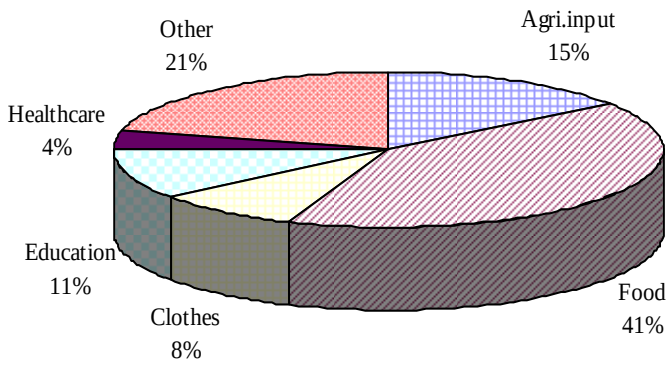

Figure 4.5 Utilization of the in come study areas

(Source: AEA, 2005)

4.7 Other constraints faced by farmers

Farmer in the survey areas reported that poor soil fertility is the first rank problem. Diseases and insect also the major problem causing crop failure. Drought was also a problem in the study areas. The farmers estimate that drought was common in the rainfed lowland areas (33.3% farmer reported). However farmer in the study areas did not identity flooded as significant problem. Other problems are lack high

yielding varieties (HYV), and lack of irrigation facility to improve the agriculture production the area (table 4.10). Poor access to market and technology are other constraints focused by farmers in the area.

Table 4.10.Contrain face by farmer in study area

Problem	Ranking
Poor soil fertility	1
Problem with insect and disease	2
Drought damage to rice crop	2
Lack of high yield variety	3
Lack of irrigation	4
Lack of technology	5
Access to market	6
n=15	

(Source: Survey, 2005)