# CHAPTER IV

# BIOPHYSICAL AND SOCIO-ECONOMIC CHARACTERISTICS OF MAIZE CROPPING SYSTEM IN THE STUDY AREA

Before studying factors affecting the adoption of chemical fertilizers in maize cropping system; it is necessary to know the environmental conditions upon which maize based cropping system is practiced. Therefore, this chapter describes biophysical, socio-economic factors and cropping system in the study area. Independent t- test was performed to determine the level of statistical significance between two groups of farmers, namely adopters and non adopters of chemical fertilizers in two Townships.

## 4.1 Biophysical environment

Most of the Shan State is a hilly plateau; there are higher mountains in the north and south. The area of Shan State is 155,801 square kilometer. The population is about 5,306,000 people in which upland population is about 4,486,000 people (MOAI, 2007). Taunggyi district is one of the three districts of Southern Shan State and it is located in the western part of this State. Yatsauk township covers 2,847 square kilometers and has a population of 96,353 but Pindaya township covers 660 square kilometers and has a population of 44,335. Farmers who live in study area rely on only rain-fed conditions in maize production.

### 4.1.1 Climate

The study area has tropical to sub tropical climate and average annual maximum temperature is about 35˚C and average annual minimum temperature is about 12˚C. April is the hottest month with the average temperature of 38˚C and January is the coolest month with an average temperature of 3˚C. Total rainfall is about 1,202.92 mm in 2008 (Figure 4.1). According to this figure; we can see the amount of rainfall in the month of July as about 49 mm. This month is very important for the farmers who grow maize because of maize physiology. It is an essential time of enough moisture to get potential yield of maize for stem elongation and as it is the tasseling time, farmers need to apply chemical fertilizers as side dressing.

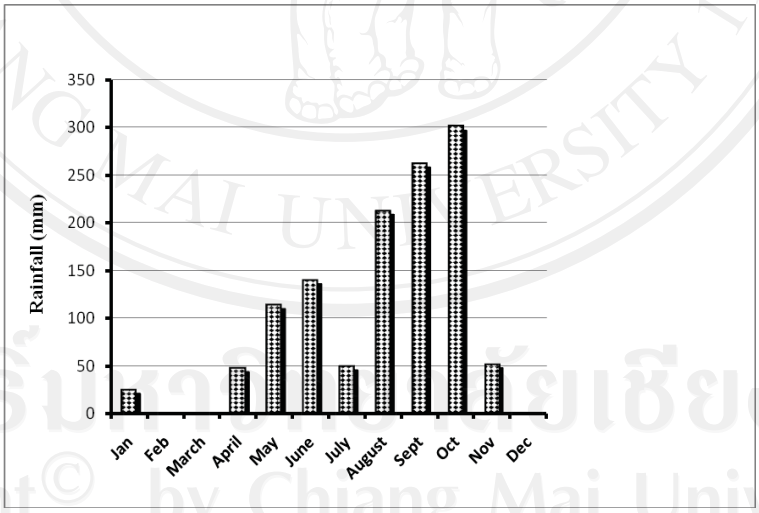
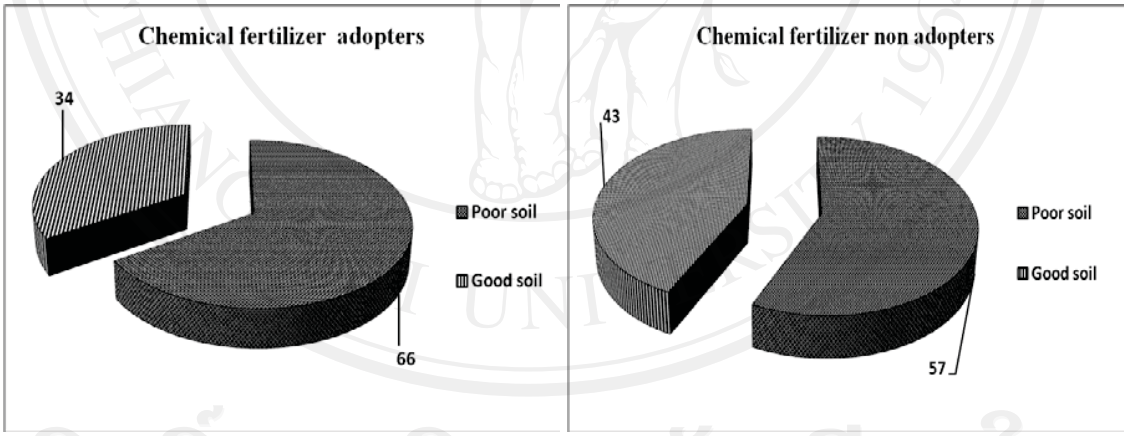



Figure 4.1: Distribution of rainfall (mm) in the study area.

Source: Southern Shan State Agricultural Office, 2009.

### 4.1.2 Soil

According to the classifications by the Land Use Division; soil in this study area is mountainous red soil and sandy loam on the surface layer and light brown and loamy as subsoil. Soil pH is ranged from 4.5 to 5.5 and acid soil conditions are occurred in the study area. So, it is very difficult to manage higher crop yield especially in maize cultivation because maize is a heavy feeder crop. According to field survey, 66 percent of farmers who adopt chemical fertilizers had poor soil while 57 percent of farmers who did not adopt chemical fertilizers had poor soil. There is not significantly difference between chemical fertilizers adopters and non adopters who had poor soil (Figure 4.2).




Source: Survey data (2009)

Figure 4.2: Soil fertility in study area.



## 4.2 General characteristics of study area

In Table 4.1, there are 9 crops grown in the study area. Among them, maize is the largest sown area; rice and niger are the second and third largest area in Yatsauk. In

Pindaya, maize area is relatively small compared to Yatsauk. The production of maize was very large amount (46 tons) in Yatsauk while it was about 8 tons of maize production in Pindaya. Compare to Pindaya, sown area and production of niger is higher in Yatsauk; but wheat sown area in Pindaya is about 10 times larger than in Yatsauk. Farmers in Yatsauk prefer to grow maize and rice in monsoon and niger in post monsoon while farmers in Pindaya also favor to grow maize and rice in monsoon but they want to grow wheat crop in post monsoon.

Table 4.1 Sown area and production of various crops in two Townships in 2008

| Crops | Yatsauk | | Pindaya | |
|---|---|---|---|---|
| | Sown area (ha) | Production (ton) | Sown area (ha) | Production (ton) |
| Rice | 12,151.8 | 42,768.5 | 11,137.2 | 35,105.2 |
| **Maize** | **14,481.8** | **46,429.5** | **2,574.1** | **7,987.2** |
| Soybean | 937.2 | 1,304.2 | 1,270.8 | 1,642.3 |
| Wheat | 263.9 | 511.6 | 2,119.4 | 4,621.9 |
| Niger | 6,863.1 | 3,365.8 | 4,134.4 | 2,027.6 |
| Groundnut | 728.7 | 2,910.1 | 300.4 | 2,613.9 |
| Sesame | 51.8 | 36.6 | 3.6 | 3.1 |
| Sunflower | 1,635.6 | 4,887.4 | 2,648.5 | 7,901.7 |
| Pigeon pea | 4,375.3 | 6,325.6 | 624.3 | 847.1 |

Source: Annual report, MAS, Southern Shan State (2008-09)

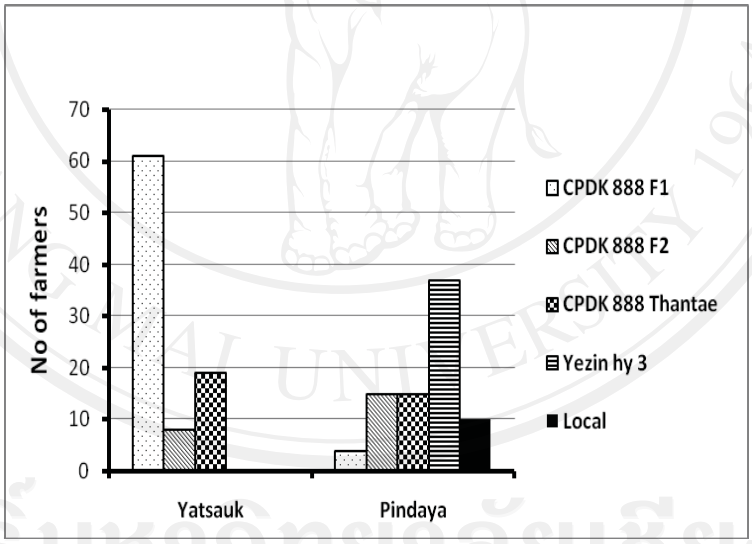
### 4.2.1 Cropping systems

Rice-based cropping system predominated in the rain-fed upland indeed but maize-based cropping system becomes the second most important crop. With this ecosystem in the surveyed area, most of the cropping activities are concentrated during rainy season and almost all of the farmers rely on only rain-fed conditions. Farmers start growing maize in May to September and rotation mainly with niger, wheat and some farmers grow maize and pigeon pea as intercropping in rainy season. However, few farmers grow only maize crop all year round and they fallow their land after maize (Figure 4.3). Land preparation is practiced at least 2 times plowing and 2 times harrowing before sowing. The animal draft wage from 24,700 to 37,000 kyats $ha^{-1}$ (1 US$ = 1000 kyats). A labor requirement is at peak during weeding, ridging, harvesting and husking time, and usually farmers share or hired labor from outside area and almost all of the farmers also use their family labor.

### 4.2.2 Variety

In the study area, farmers use three kinds of maize variety namely, CPDK 888, Yezin hybrid 3 and local (Akari) variety. However, there are three different type of CPDK 888 variety such as $F_1$, $F_2$ and Thantae seed. Farmers use the various kinds of seed because of seed price. CP Company produces true maize seed ($F_1$) to distribute farmers but seed price is expensive. On the other hand, poor farmers can purchase $F_2$ seed or Thantae seed that are cheaper than $F_1$ seed but not good quality and not high yield. $F_2$ seed means that some farmers stored maize grain from last year and they use this grain like seed for the next growing season. Thantae seed comes from Thantae

village, Shwe Nyaung Township where CP Company established the factory to release CPDK 888 $F_1$ seed. Farmers who live in Thantae village released this CPDK 888 Thantae maize variety themselves. Yezin hybrid 3 is released by the Department of Agricultural Research at Yezin in Mandalay Division since 1992 and local variety called Akari is open pollinated variety (OPV) that used only in upland area. According to Figure 4.3, none of the farmers use local and Yezin hybrid 3 varieties except CPDK 888 variety in Yatsauk. In Pindaya, nearly the same no of farmers use Yezin hybrid 3 and CPDK 888 but small farmers apply local maize variety in this area and the number of farmers used different type of CPDK 888 maize variety in the study area.




Source: Survey data (2009)

Figure 4.3 Different maize varieties sown by farmers in two Townships.



Table 4.2 shows the production packages of technology for different maize varieties in Southern Shan State. The technologies that grow Yezin hybrid 3 and local

Table 4.2 Packages of Technology for Hybrid Maize Cultivation

| | **Yezin hybrid -3** | **CPDK 888** | **Akari (local)** |
|---|---|---|---|
| Soil Type | - Silk loam, Clay, Sandy loam | - Silk loam, Clay, Sandy loam | - Silk loam, Clay, Sandy loam |
| Land Type | -Hilly land, Low land, Upland | - Hilly land, Low land, Upland | - Hilly land |
| Land Preparation | - Plowing 2 times (20 to 25 cm depth)<br>- Harrowing 2 to 3 times | - Plowing 2 times (20 to 25 cm depth)<br>- Harrowing 2 to 3 times | - Plowing 2 times (20 to 25 cm depth)<br>- Harrowing 2 times |
| Spacing | - 75 cm x 22.5 cm (1 seed/hole) | - 75 cm x 25 cm (1seed/hole)<br>- 75 cm x 50 cm (2 seeds/hole) | - 75 cm x 22.5 cm (3 seeds/hole) |
| Seed Rate/hectare | - 14.82 kilogram | - 12.35 kilogram | - 14.82 kilogram |
| Thinning | -10 to 14 DAE | - 15 DAE | - 10 to 14 DAE |
| Time of seeding | -2nd week of May to June (for SSS) | -2nd week of May to June (for SSS) | - 2nd week of May to 2nd week of June (for SSS) |
| Fertilizer doses 1st time at Basal (kg/ ha) | - Urea -126<br>- TSP -126<br>- Potach -63 | - Urea -123.5<br>- TSP -123.5 | - TSP - 62<br>- Potach -185 |
| Fertilizer doses 2nd time (kg/ha) | - Urea-138 | - 123.5 | - Urea - 31 |
| Fertilizer doses 3rd time (kg/ha) | - Urea-138 | - | - |
| Time of application | - 1st time (basal)<br>- 2nd time (20-21 DAE)<br>- 3rd time (35-40 DAE) | - 1st time (basal)<br>- 2nd time (30-40 DAE) | - 1st time (basal application)<br>- 2nd time (14 DAE)<br>- 3rd time (30 DAE) |
| Weeding and inter-cultivation | - 1st time (20-21 DAE)<br>- 2nd time (35-40 DAE) | - 1st time(seeding) herbicide application<br>- 2nd time (30-40 DAE) | - 1st time (14 DAE)<br>- 2nd time (30 DAE) |
| Days of maturing | - for hilly region (115-120) days<br>- for middle region (100-105) days | - 120 days | - 120 days |
| Harvesting | - black color appear at top of the grain head | - black color appear at top of the grain head | - black layer formation on top of the grain head<br>- husk cover is completely dry |
| Storage | - storage at 10 to 14% moisture content | - storage at 14% moisture content | - storage at 12 to 14% moisture content |

Source: DAR, CP Co. Ltd. Note: DAE=Days after emergence SSS=Southern Shan State

maize variety are recommended by Department of Agricultural Research and the technologies for CPDK 888 are recommended by CP company Ltd. These all varieties are suitable in acid soil condition especially in sandy loam. In CPDK 888 variety, no recommended fertilizer rate for Potash but it is needed to apply in Yezin hybrid 3 maize variety. There were different chemical fertilizer rate in maize production by different varieties acording to the recommendation.

### 4.2.3 Characteristics of production systems

In the study area, the surveyed households in Yatsauk possessed greater total land area and maize area than households in Pindaya. All households grew the variety of CPDK 888 in Yatsauk township while just 41 percent of the households grew this variety in Pindaya. 47 percent of households in Pindaya used Yezin hybrid 3 and only 12 percent used local maize variety. Almost all of the household farmers had their own land to cultivate maize in the study area. The surveyed households grew maize-fallow (20 percent), maize-niger (38 percent) and maize-wheat (21 percent) cropping systems. Households in Yatsauk adopted maize-niger cropping system and households in Pindaya adopted maize-wheat cropping system (Figure 4.4).

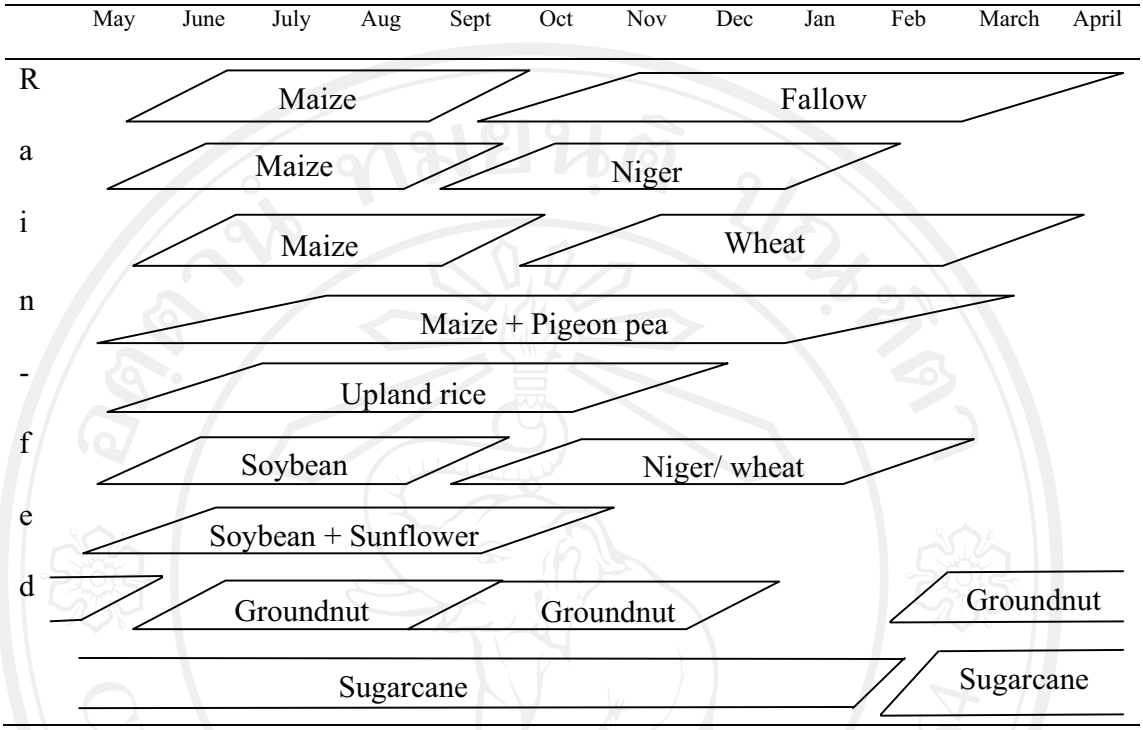



Figure 4.4 Cropping pattern in the study area.

Figure 4.5 and 4.6 showed that households in Yatsauk township have cultivated comparatively larger farm size compared to Pindaya township.

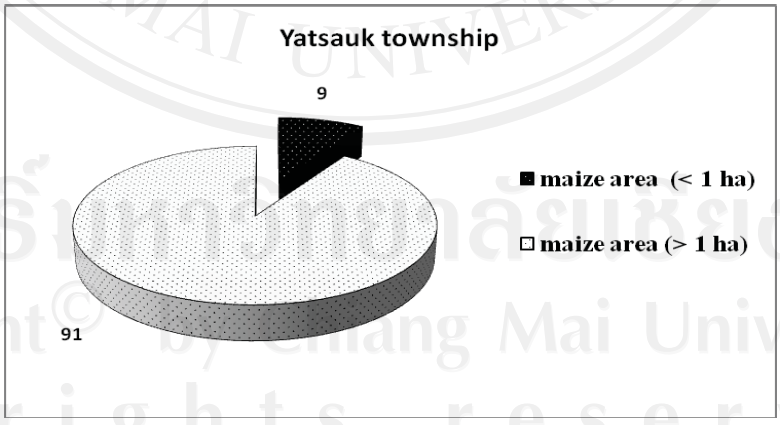



Figure 4.5 Percentage of households by size of maize cultivated area in Yatsauk township.

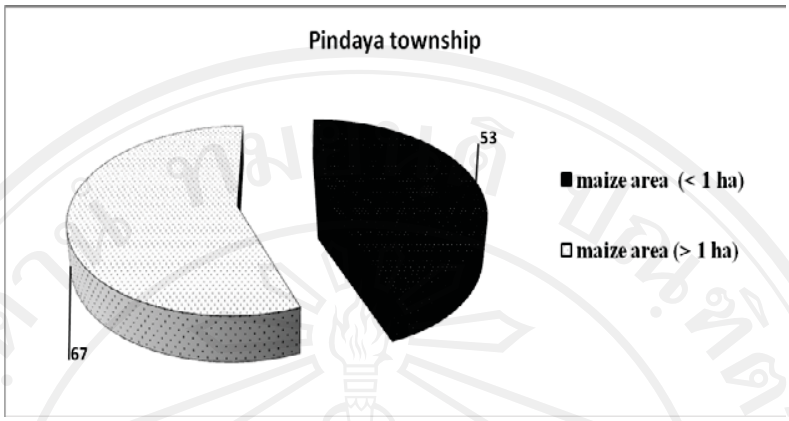



Figure 4.6 Percentage of households by size of maize cultivated area in Pindaya township.

These above figures demonstrate percentage distributions of the cultivated maize area in two Townships. According to that, higher percentage of households (91 percent) cultivated one hectare or more than that in Yatsauk; while higher percentage of households (67 percent) cultivated more than one hectare of maize area in Pindaya.

Significant differences could also be found in terms of threshing methods in both regions as shown in Table 4.3. Results showed that significantly higher number of households (76 percent) in Yatsauk was doing mechanical threshing compared to the surveyed households (0 percent) at Pindaya. This suggests that maize cultivating households in Pindaya were smaller scale than the sampled households in Yatsauk. Average land labor ratio in Yatsauk (3.36 ha labor $^{-1}$) is higher than that in Pindaya (1.93 ha labor $^{-1}$). Crop rotation was also carried out by farmers in both townships especially 93 percent in Yatsauk and 97 percent in Pindaya. Amount of compost applied by households

in Yatsauk (1,408 kg $ha^{-1}$) was less than the amount of compost applied by households in Pindaya (1,813 kg $ha^{-1}$).

Although yield in unit area was quite low in the study area compared to the average yield in Southern Shan State (2.9 ton $ha^{-1}$); average yield gained by households in Yatsauk (2.2 ton $ha^{-1}$) was higher than in Pindaya (1.7 ton $ha^{-1}$). It was because of weather condition in the year of this survey, households' wealth and households' adoption of chemical fertilizers in maize cropping systems.

In the year 2008, weather condition was abnormal especially in rainfall condition. In July 2008, average rainfall was 72.14 mm in Yatsauk while it was 26.67 mm in Pindaya township comparing to the ten year average rainfall of 138.43 mm and 119.63 mm in Yatsauk and Pindaya respectively (Figure 4.7).

Moreover, the average yield by different varieties was 2.6 ton $ha^{-1}$ in CPDK 888 $F_1$, 1.4 ton $ha^{-1}$ in CPDK 888 $F_2$, 1.9 ton $ha^{-1}$ in CPDK 888 Thantae, 1.5 ton $ha^{-1}$ in both Yezin hybrid 3 and local maize variety in the study area. In the study area, yield gained by the households were different according to the Table 4.4. 12.5 percent of households in Yatsauk got less than 1 ton $ha^{-1}$ of maize yield but 32.9 percent of households got this quantity of yield in Pindaya and 31.8 percent and 36.7 percent of households achieved their yield between 1.1 and 2.0 ton $ha^{-1}$ in Yatsauk and Pindaya respectively. Within the range of 2.1 to 3.0 ton $ha^{-1}$ of yield, there were 28.4 percent and 15.2 percent of households possessed their yield and finally, the percentage of households in Yatsauk (27.3 percent) gained more than 3.1 ton $ha^{-1}$ of yield but only 15.2 percent of households achieved their yield in Pindaya. Therefore, the percentage of households in Yatsauk was

more than in Pindaya in both group of the yield between 2.1 to 3.0 and more than 3.1 ton $ha^{-1}$. Thus, the average yield in Yatsauk was higher than in Pindaya (Table 4.3).

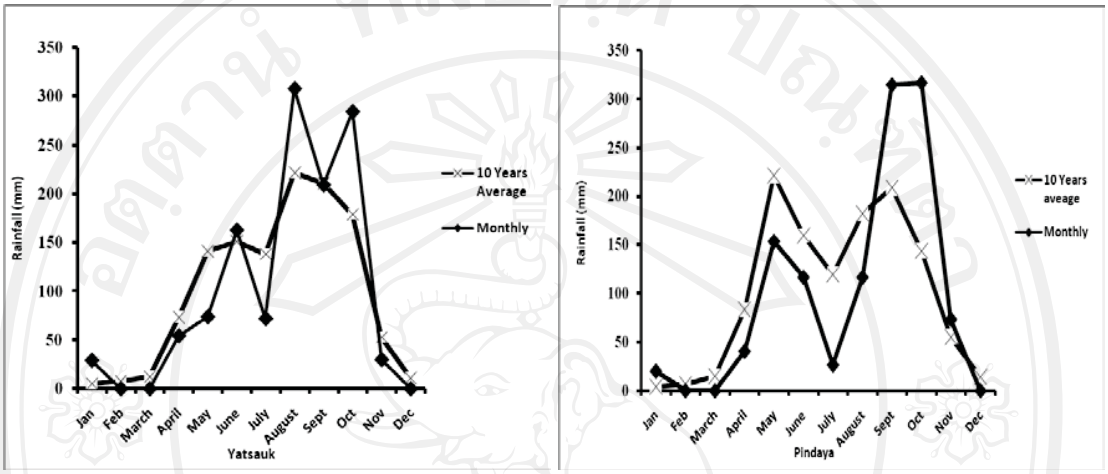



Figure 4.7 Average monthly rainfalls (mm) in the study area.

None of the households applied local maize variety in Yatsauk while a few households (13 percent) grew local variety in Pindaya but all households used hybrid maize variety in Yatsauk and in Pindaya, there were 87 percent of households used hybrid maize variety (Table 4.3). Generally, households in Yatsauk had more land-labor ratio to their maize field and they preferred mechanical threshing and also used only hybrid maize variety especially CPDK 888 $F_1$ variety.

Table 4.3 Characteristics of production systems in two Townships

| Characteristic | Yatsauk (N=88) | Pindaya (N=79) | Total (N=167) | Level of Significance |
|---|---|---|---|---|
| Method of threshing | | | | |
| - Mechanical | | | | |
| (% of households ) | 76 | 0 | 38 | 0.000*** |
| - Manual (% of households ) | 24 | 100 | 62 | |
| Crop rotation –Yes (% of households ) | 93 | 97 | 95 | |
| No (% of households) | 7 | 3 | 5 | 0.009** |
| Land labor ratio (ha/labor) | 3.36 | 1.93 | 2.65 | 0.008** |
| Local variety (% of households ) | 0 | 13 | 6.5 | 0.000*** |
| Hybrid variety (% of households) | 100 | 87 | 93.5 | 0.000*** |
| Compost application (Kg/ha) | 1,408 | 1,813 | 1,611 | 0.655 |
| Yield (Kg/ha) | 2,194 | 1,731 | 1,963 | 0.005*** |

Note: **, *** shows significant at 5% and 1% level of significance respectively.

Table 4.4 Average yield group of maize in the study area in 2009

| Yield (ton $ha^{-1}$) | Yatsauk (88) | | Pindaya (79) | |
|---|---|---|---|---|
| | No of households | % of households | No of households | % of households |
| < 1.0 | 11 | 12.5 | 26 | 32.9 |
| 1.1- 2.0 | 28 | 31.8 | 29 | 36.7 |
| 2.1- 3.0 | 25 | 28.4 | 12 | 15.2 |
| > 3.1 | 24 | 27.3 | 12 | 15.2 |

Source: Survey data (2009)

### 4.2.4 Marketing

Maize from Monywa, Pachoku, Taunggyi and Aungban townships is delivered to Mandalay market and from Mandalay market to the city of Yangon for exporting. Maize also flows from Mandalay market to China through the Muse border trade. The foreign importer will use Myanmar's maize as animal feed and as inputs in dying industry after

Table 4.5 Average annual prices of maize (kyat viss$^{-1}$) in different wholesale markets

| Year | Yangon | Mandalay | Monywa | Pachoku | Taunggyi | Aungban | Lashio |
|---|---|---|---|---|---|---|---|
| 2001 | 183 | 197 | 104 | 95 | 77 | 91 | - |
| 2002 | 251 | 255 | 118 | 106 | 100 | 94 | - |
| 2003 | 300 | 311 | 135 | 139 | 119 | 118 | - |
| 2004 | 244 | 250 | 115 | 101 | 95 | 95 | - |
| 2005 | 146 | 160 | 162 | 159 | 140 | 127 | - |
| 2006 | 242 | 181 | 189 | 185 | 162 | 159 | - |
| 2007 | 368 | 334 | 342 | 323 | 313 | 304 | 295 |
| 2008 | - | - | - | - | 290 | 280 | 330 |
| 2009 | - | - | - | - | 375 | 350 | 262 |

Source: MIS (2009), MAPT (Taunggyi)

Note: ' – ' is not recorded,

1 viss = 3.6 lb = 1.63 kg.

1 US$ = 1000 kyats (March 2009)

grinding. Maize production in the study area is mostly dependent on Aungban and Taunggyi market by Pindaya and Yatsauk township respectively. Maize is sold as dry grain in both study areas. The average annual prices of maize in different whole sale markets can be seen in Table 4.5.

Generally, maize prices were higher in year by year from 2001 to 2009 except the year 2004. Although maize had exported to other countries in every year; the quantity of export in 2005 was lower than in other years. Therefore, the price of maize fluctuated in the year 2004 and 2005. In Taunggyi and Aungban market that the households sold their products in the study area, the price was fluctuated during the year 2007 to 2009. Households got the higher price in Taunggyi market than in Aungban market in every year.

However, the average price of maize in the study area as shown in Table 4.6. Households gained the various price as grouping in this table. There were 22.7 percent and 13.9 percent of households got less than 135 kyats per kilogram of maize grain, but 44.3 percent and 33.0 percent of households got the price within the range of 135.1 to 170 kyats per kilogram and 25 percent and 39.2 percent of households gained the price between 170.1 to 205 kyats per kilogram in Yatsauk and Pindaya township respectively. Then, only 8.0 percent of households in Yatsauk and 13.9 percent of households in Pindaya gained the maize price of more than 205.1 kyats per kilogram in the study area.

Table 4.6 Average price group of maize in the study area in 2009

| Market price (kyats kg $^{-1}$) | Yatsauk (88) | | Pindaya (79) | |
|---|---|---|---|---|
| | No of households | % of households | No of households | % of households |
| < 135 | 20 | 22.7 | 11 | 13.9 |
| 135.1- 170 | 39 | 44.3 | 26 | 33.0 |
| 170.1-205 | 22 | 25.0 | 31 | 39.2 |
| > 205.1 | 7 | 8.0 | 11 | 13.9 |

Source: Survey data (2009)

**4.3 Characteristics of the farm households**

According to the results from field survey, the majority of maize farmers had good experience in maize cultivation. On average, the experience of households in maize cultivation is 12 years. Surveyed household heads in Yatsauk were significantly more experienced in maize cultivation than the surveyed household heads in Pindaya. Among them, about 14 percent of household head was illiterate, 56 percent of respondents were able to achieve primary education (year 1-5), another 17 percent obtained secondary education (year 6- 9), 12 percent of the respondents had high education with 10-11 years of schooling and the rest 1 percent of household heads had a high education with 12-15 years of schooling. This indicated that they have enough knowledge to understand chemical fertilizers application techniques to promote maize production. There were 11 percent of households being aware of lime application. 65 percent of farmers faced more soil acidity problems in their maize fields. Moreover, households in Yatsauk were able to

have significantly higher extension officers visits compared to households in Pindaya. This indicated that the relatively weak and unapproachable institutional support in the form of extension service in Pindaya (Table 4.7).

Table 4.7 Comparison of the characteristics of surveyed households

| Socio economic characteristics | Yatsauk (N=88) | Pindaya (N=79) | Mean (N=167) | Level of Significance |
|---|---|---|---|---|
| Average education (Years) | 5.8 | 5.2 | 5.5 | 0.000*** |
| Average experience in maize cultivation (Years) | 14.1 | 9.3 | 11.7 | 0.000*** |
| Total land (ha) | 5.6 | 3.3 | 4.5 | 0.022** |
| Total maize area (ha) | 3.2 | 0.8 | 2.0 | 0.000*** |
| Awareness of lime application | | | | $0.337^{ns}$ |
| Yes (% of households) | 13 | 10 | 11 | |
| No (% of households) | 87 | 90 | 89 | |
| Soil problem | | | | 0.027** |
| Yes (% of households) | 70 | 59 | 65 | |
| No (% of households) | 30 | 41 | 35 | |
| Off farm income (Ks/yr) | 143,384 | 80,387 | 111,886 | 0.001*** |
| Average number of oxen | 4.4 | 6.2 | 5.3 | 0.099* |
| Average no of extension contacts [No/season] | 3.4 | 1.2 | 2.3 | 0.000*** |

Source: Survey data, 2008/2009, *, **, ***, $^{ns}$ shows significant at 5%, 1% level of significance and non significance respectively at t-test, 1 US$ = 1000 kyats

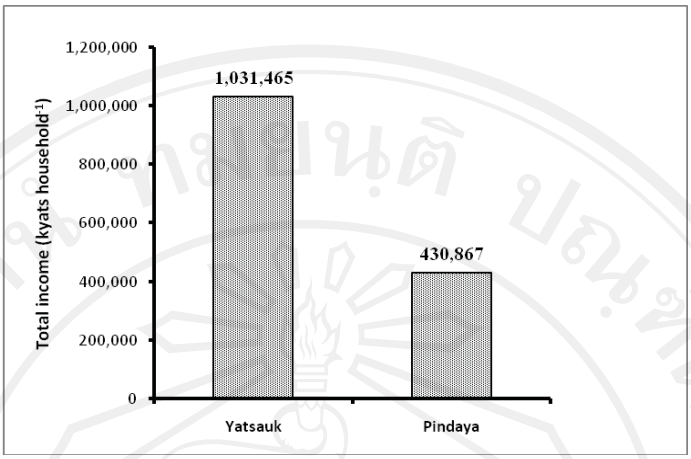



Figure 4.8 Comparison of average total income (kyats household-1) in Yatsauk and Pindaya Townships.

Households' income was different in two townships according to the survey data. Although income from other crops was not much different between Yatsauk and Pindaya township (Table 4.8); average total income per household varied in the study area (Figure 4.8). It was because of difference maize cultivation area and yield in two townships. Therefore, farmers in Pindaya were poorer than farmers in Yatsauk according to the survey data.

Table 4.8 Average income from different activities in the study area

| Total income (kyats household $^{-1}$) | Yatsauk | Pindaya |
|---|---|---|
| Various crops | 349,747.7 | 315,387.3 |
| Maize | 681,717.6 | 115,479.7 |

Source: Survey data (2009)

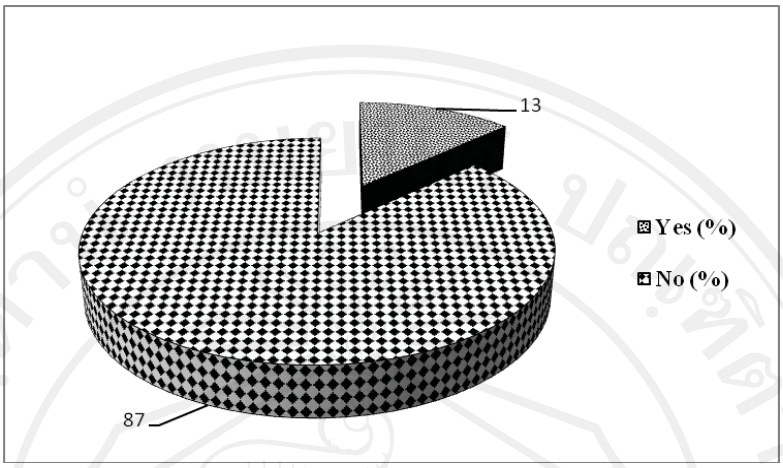



Figure 4.9 Awareness of lime application by households in Yatsauk township.

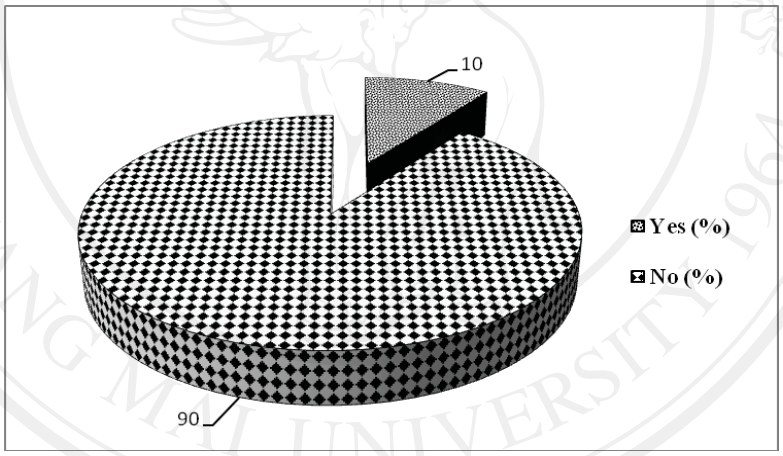



Figure 4.10 Awareness of lime application by households in Pindaya township.

In Figure 4.9 and 4.10, only 13 percent and 10 percent of households had awareness in lime application in Yatsauk and Pindaya township respectively. According to this, households in these study areas were not yet aware of lime application in order to improve soil fertility. So, soil problem in their fields was common as comparatively high percent of households who faced this kind of problem (Table 4.7).

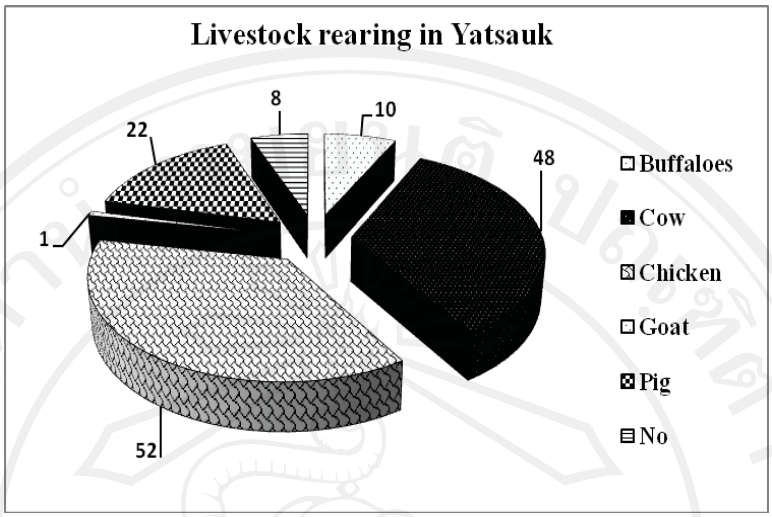



Figure 4.11 Number of households engaged in livestock rearing at Yatsauk Township.

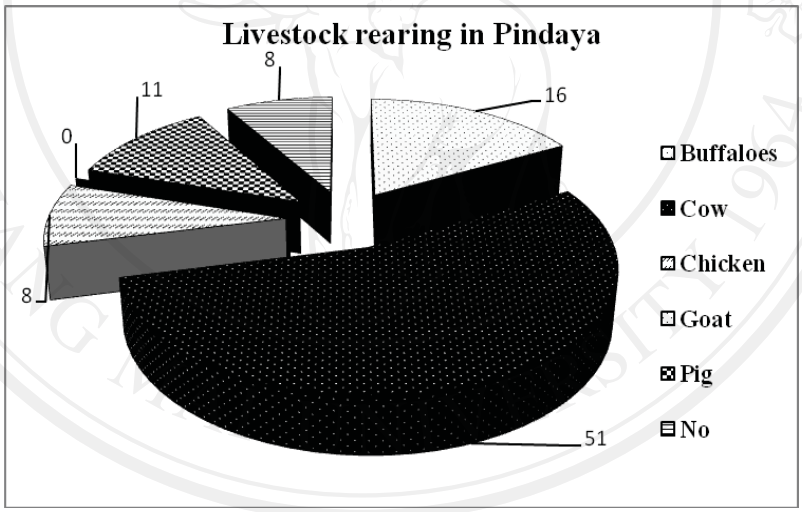



Figure 4.12 Number of households engaged in livestock rearing at Pindaya Township.



Figure 4.11 and 4.12 shows the number of households who engaged in livestock rearing in study area. In Yatsauk, the households rear the largest number of chicken compared to Pindaya. Households in Yatsauk were more likely to rear livestock than households in Pindaya because households produced a large amount of maize grain and then very easy access to market to purchase maize grain for chicken feed. But in both

townships, households rear a larger number of cows and a small number of buffaloes. Generally, there was a greater extent of livestock rearing by households in Yatsauk compared to Pindaya.

**4.4 Characteristics of the household adopting chemical fertilizers in the study area**

It is important to know the current chemical fertilizer practices adopted by households in study area to illustrate those practices.

Table 4.9 shows the distribution of households by their usage of chemical fertilizers in maize cropping system. Descriptive analysis showed that 96.6 percent of the households in Yatsauk township adopted chemical fertilizers while 60 percent of those in Pindaya township adopted them. Among all households (167), 21 percent did not use chemical fertilizers while 79 percent of households used it in the study area (Figure 4.13). Moreover, few households did not use chemical fertilizers in Yatsauk comparing to those in Pindaya (Figure 4.14). Farmers' use of chemical fertilizers was highly significantly different in the study area. Significantly higher experience in maize cultivation, off farm income and extension officers' visit may be the driving force for this situation in Yatsauk township.

Table 4.9 Household adoption of chemical fertilizer application in two Townships

| Variable | Yatsauk | | Pindaya | | Total | | Level of significance |
|---|---|---|---|---|---|---|---|
| | No of farmers | % | No of farmers | % | No of farmers | % | |
| Households did not use chemical fertilizers | 3 | 3.4 | 32 | 40.5 | 35 | 21.0 | 0.000*** |
| Households used chemical fertilizers | 85 | 96.6 | 47 | 59.5 | 132 | 79.0 | 0.000*** |

Note: *** Shows 1 % level of significance

Source: Survey data (2009)

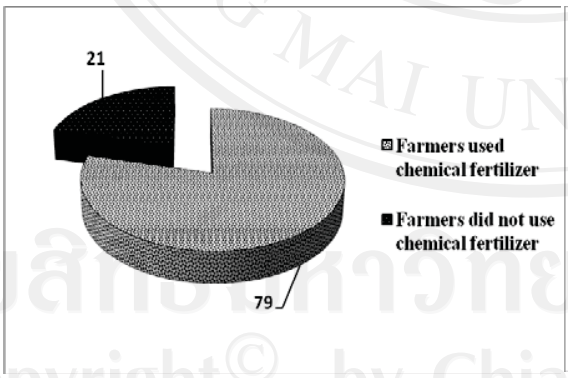



Figure 4.13 Percentage of farmers adopted chemical fertilizers in maize cultivation in study area.

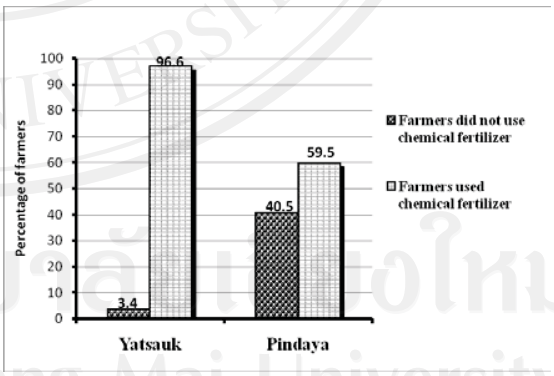



Figure 4.14 Comparison of chemical fertilizer use in two townships.

Maize cultivating households who were interviewed in both townships, believed that the advantage of the adoption of chemical fertilizers was the increase of maize yield; but this adoption was comparatively higher among the households in Yatsauk township with compared to households in Pindaya township. But according to the interview, they had some problems in credit, labor difficulties, low price, high fertilizer cost and finally bad weather conditions in that particular year.

**4.5 Characteristics of households with relation to the chemical fertilizer adoption**

The main difference between chemical fertilizer adopters and non adopters was their average level of education of the household head. Even though not statistically significant, they were older and with comparatively higher experience in maize cultivation and with a higher number of oxen. There were 18.6 percent of households being aware of lime application. 61.5 percent of households faced more soil acidity problem in their maize fields (Figure 4.15).

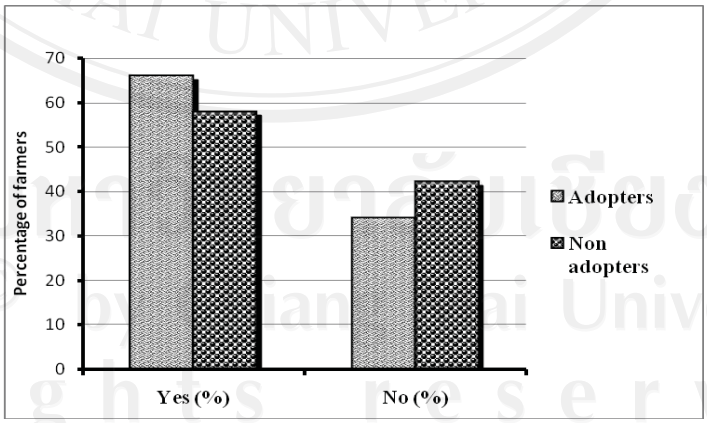



Figure 4.15 Percentage of households who face soil acidity by adopters and non adopters.

In terms of off farm income, chemical fertilizer adopters had a greater off farm income than non adopters (Figure 4.16). Average land labor ratio was larger in chemical fertilizers adopters than non adopters (Figure 4.17). In terms of contact with extension officers, adopters showed about twice as many contacts with extension officers within a season than non adopters. This indicated that the comparatively poor support of extension services for non adopters (Figure 4.18).

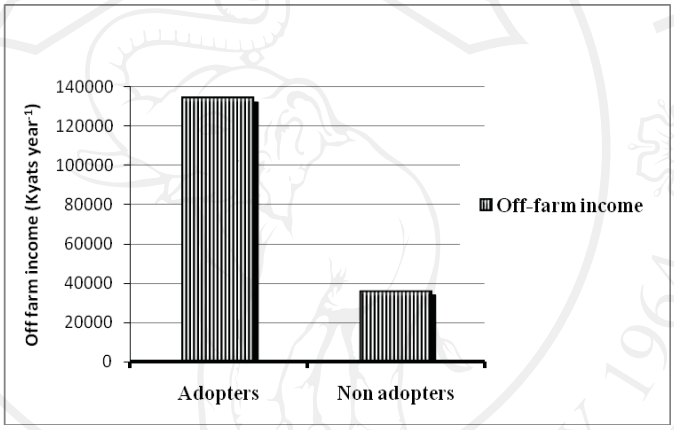



Figure 4.16 Average off-farm income (kyats year$^{-1}$) between adopters and non adopters.

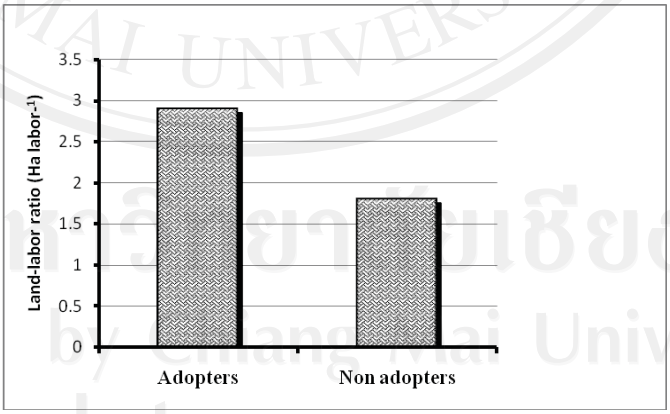



Figure 4.17 Average land-labor ratio (ha labor$^{-1}$) between adopters and non adopters.

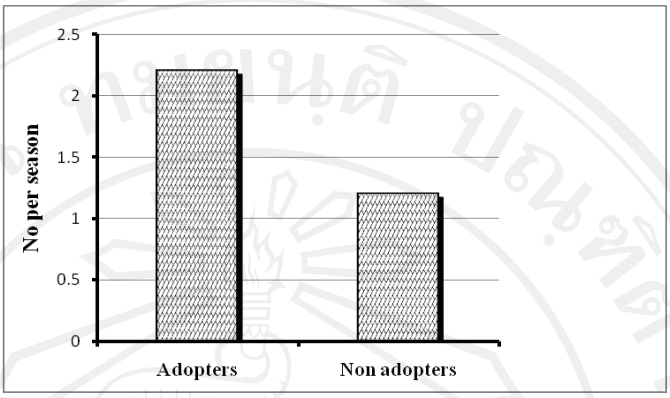



Figure 4.18 No of extension officers' visit to maize field by two groups

Table 4.10 Comparison of main characteristics between adopters and non adopters

| Socio economic characteristic | Adopters (N=132) | Non adopters (N=35) | Total (N=167) | Level of Signifi-cance |
|---|---|---|---|---|
| Average age (years) | 49.1 | 46.4 | 47.8 | 0.324 |
| Gender – Male (%) | 87.1 | 85.7 | 86.4 | 0.845 |
| Female (%) | 12.9 | 14.3 | 13.6 | |
| Average education (years) | 5.5 | 5.1 | 5.3 | 0.000*** |
| Experience in maize cultivation (years) | 12.0 | 11.1 | 11.6 | 0.491 |
| Total land (ha) | 4.9 | 2.9 | 3.9 | 0.028* |
| Total maize area (ha) | 2.3 | 0.9 | 1.6 | 0.005*** |
| Awareness of lime application | | | | |
| Yes (%) | 12.9 | 5.7 | 18.6 | |
| No (%) | 87.1 | 94.3 | 90.7 | 0.012** |
| Soil problem | | | | |
| Yes (%) | 65.9 | 57.9 | 61.5 | |
| No (%) | 34.1 | 42.1 | 38.1 | 0.127 |
| Off farm income (ks/year) | 134,192 | 35,860 | 85,026 | 0.000*** |
| Number of oxen | 4.7 | 4.2 | 4.5 | 0.362 |
| Number of extension officers' visit (Number /season) | 2.2 | 1.2 | 1.7 | 0.000*** |
| Average land-labor ratio (ha/labor) | 2.9 | 1.8 | 2.4 | 0.092 |

Note: *, **, *** shows significant at 10 %, 5 %, 1 % level of significant respectively
1US$ = 1000 kyats

Table 4.11 shows that the average yield obtained by adopters was relatively higher than that of non adopters. Average yield of maize for adopters of chemical fertilizers was 2,054 kg $ha^{-1}$ as compared to 1,676 kg $ha^{-1}$ for non adopters (Figure 4.19). Adopters of chemical fertilizers also used higher amount of compost (1,645 kg $ha^{-1}$ for adopters and 1,429 kg $ha^{-1}$) (Figure 4.20), and also had larger maize cultivated area (5.8 ha per household for adopters and 2.1 ha per household for non adopters) (Figure 4.21), and land labor ratio (average 3.36 ha per labor for adopters and 1.93 ha per labor for non adopters) (Figure 4.22) while using high adult family labor. Highly significant number of adopters was found engaging in crop rotation. Method of threshing was not significantly different among adopters and they used both mechanical and manual threshing. But it was significantly different among non adopters.

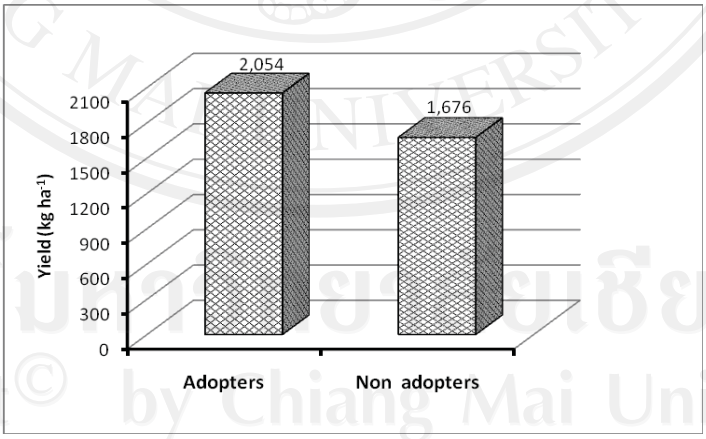



Figure 4.19 Average yield (kg $ha^{-1}$) of households between adopters and non adopters.

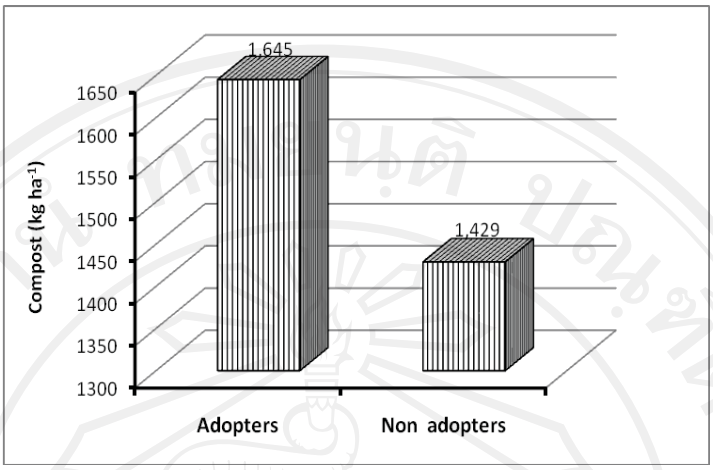



Figure 4.20 Average amount of compost (kg $ha^{-1}$) used by households between adopters and non adopters.

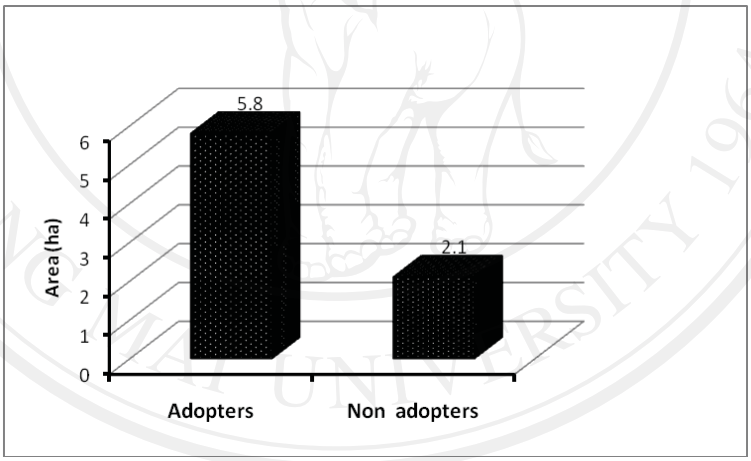



Figure 4.21 Total maize area (ha) of households between adopters and non adopters.

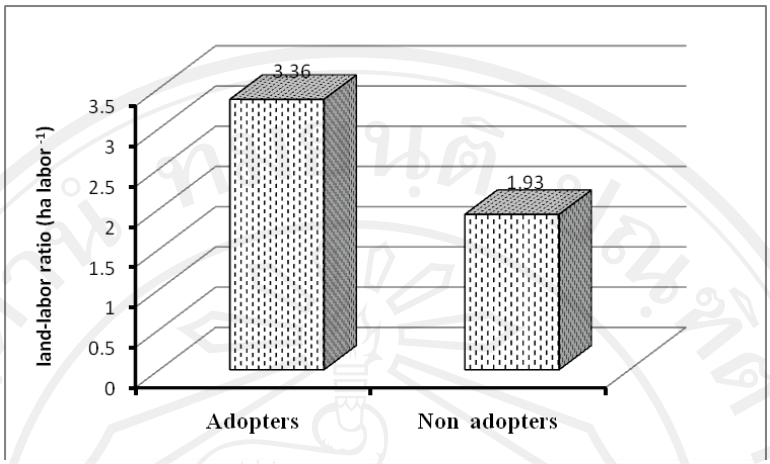



Figure 4.22 Average land-labor ratio (ha labor$^{-1}$) between household adopters and non adopters.

Table 4.11 Characteristics of production systems between chemical fertilizers adopters and non Adopters

| Characteristics | Adopters (N=132) | Non adopters (N=35) | Total (N=167) | Level of Significance |
|---|---|---|---|---|
| Yield (Kg/ha) | 2,054 | 1,676 | 1,865 | 0.067 |
| Method of threshing | | | | |
| - Mechanical (%) | 49.2 | 5.7 | 27.5 | |
| - Manual (%) | 50.8 | 94.3 | 72.6 | 0.000*** |
| Crop rotation – Yes (%) | 75.8 | 94.3 | 85.1 | |
| No (%) | 24.2 | 5.7 | 15.0 | 0.002*** |
| Land labor ratio (ha/labor) | 3.36 | 1.93 | 2.65 | 0.092 |
| Total maize area (ha) | 5.8 | 2.1 | 4.0 | 0.005*** |
| Use of local variety (%) | 3.8 | 14.3 | 6.5 | 0.000*** |
| Amount of compost application (kg/ha) | 1,645 | 1,429 | 1,537 | 0.502 |
| Family labor (no) | 5.1 | 4.4 | 4.8 | 0.653 |

Note: *** shows significant at 1% level of significance

**4.6 Summary**

This chapter has outlined biophysical and socio-economic characteristics of maize production system in the two townships, Yatsauk and Pindaya. With regard to chemical fertilizers adoption, significant differences could be noticed among the households' characteristics between two townships. Households in Yatsauk township were with significantly higher experience in maize cultivation. But they showed significantly higher extension officers' visits and also mechanical threshing in Yatsauk township. None of the households used local maize variety in Yatsauk township and crop rotations were performed by households in both Yatsauk township and Pindaya township. While households in Yatsauk were with significantly higher maize cultivating area, they used hybrid varieties to increase maize yield compared to the surveyed households in Pindaya. 96.6 percent of households were found to be adopting chemical fertilizers in Yatsauk. Although 59.5 percent of households had adopted chemical fertilizers application in Pindaya; inadequate trainings, demonstrations and less motivation has been noticed as major reasons with regard to non adoption of chemical fertilizers in that township.