

CHAPTER IV

GENERAL INFORMATION AND CHARACTERISTICS OF THE GROUNDNUT PRODUCTION SYSTEMS IN CENTRAL REGION OF MYANMAR

Differences in agricultural productivity are observed among nations and regions. Significant productivity difference also show among firms from within region and from different region of same country. A part of these differences can be explained by the differences in the conventional inputs such as area, fertilizer, and natural endowments such as soil condition, climate, etc. Other institutional organizations, and so on are very important for the smooth and viable existence of groundnut production systems. However, these factors can't capture all. It is relied to the farmer's capacity ability to produce more output from given resources use in firms (Neuyen, 1997).

In this chapter, general information of the central region of Myanmar was presented to provide an understanding of the study areas. As well, inputs used for groundnut production such as varieties, seed rate, labor used, fertilizer, pesticides and insecticides application in groundnut production as well as socio-economic characteristics of sample groundnut farmers such as age and education of household head as decision-maker, ownership of farmland and natural endowment such as soil quality and climate condition were presented. The information would help in understanding the farmers' socio-economic condition in relation to their performance of the cultivation of groundnut in the central region of Myanmar. Institutional factors, access to credit and access to extension services, hypothesized to have effected on technical efficiency were also presented in this chapter.

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4.1. General information of the central region of Myanmar

4.1.1 General Physical description and land use

Myanmar can be divided into three agricultural zone; (1) the delta zone, where rice cultivation predominates, (2) the dry zone, where a combination of rice and a wide variety of other crops are grown, (3) the hill and plateau regions, where forestry and shifting agriculture are the most important. The central region of Myanmar is classified in the dry zone where there are three divisions, namely Magway, Mandalay and Sagaing divisions. Groundnut is produced mainly in the Mandalay and Magway divisions.

Mandalay division is situated between latitudes 19°20' north and 23°45' north and longitudes 94°45' east and 97°00' east. It is in the central region of Myanmar with the total area of 37935 km². Mandalay, the second most populous division in Myanmar, has 6,313,938 inhabitants. The average population density is 164 persons per km². In Mandalay, paddy fields and annual crop fields are the majority of farms. There are over 2.024 million hectares of irrigated farm lands. Mandalay division annually put over 0.407 million hectares under edible oil seed crops including groundnut, nearly 0.364 million hectares under beans and pulses, over 0.122 million hectares under cotton and over 2.024 million hectares under paddy (http://www.yadanabon.com/around_mandalay.htm).

Magway division has a common boundary with Mandalay and Bago divisions as well as Rakhine and Chin States. Magway division is situated between North Latitude 18° 50' and 22° 47' and East Longitude between 93° 47' and 95° 55' and has an area of 44820 km². The population of Magway division is 4,218,699. It occupies an area of 459218.67 km². Farmland occupies 0.65 million hectares of about 1.01 million hectares of total arable land in the division and the rest are paddy land, silt land (Kaing-kyunmyar), hill-side cultivated land (taungya-myay) and vegetable land. Multiple cropping is practiced at paddy land and farmland. In Magway division, 0.203 million hectares is put under paddy. The major oilseed crop is sesame and over 0.405 million hectares is put under this crop. As Magway division produces a large quantity

of groundnut and sesame edible oil, it is also known as the oil pot of Myanmar. (<http://www.yadanabon.com/magway.htm>).

4.1.2. Climate

There are three seasons in the central region of Myanmar; namely summer, rainy and winter seasons. Average temperatures of the central region are between 37°C and 40°C in summer, especially April which is the hottest month. In the winter, the average temperature is 21°C and lowest temperature is 18°C. Range of the total annual rainfall of the central region is from 812.8 mm to 863.6 mm. The average relative humidity is about 67.5 percent in Mandalay and 72.2 percent in Magway.

For Mandalay, the highest temperature is 34.3°C and lowest temperature is 22.1°C. The total annual rainfall is about 1164.4 mm in 2006. Figure 4.1 presents the rainfall pattern for 12 months in Mandalay in 2006. It shows that rainfall starts from March to ends in November with the highest level of rainfall in September.

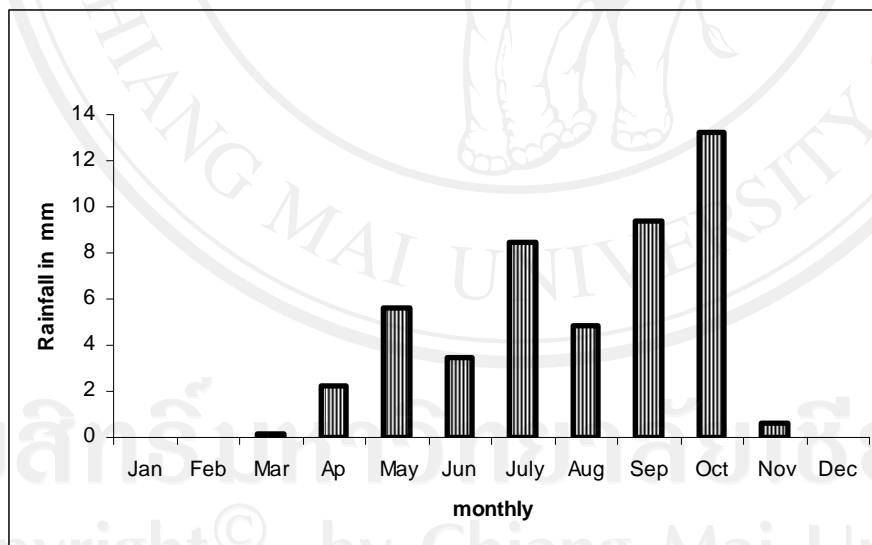


Figure: 4.1 Monthly Rainfall distributions in Mandalay Division in 2006.

Source: Department of Meteorology and Hydrology, Mandalay division, 2006.

As the majority part of Magway division falls within the Dry Zone, it is very hot during the hot season and is relatively cold during the cold season. The highest temperature is 33.9°C and the lowest temperature is 20.1°C. The total annual rainfall of Magway division is about 1219.96 mm in 2006. Figure 4.2 presents the rainfall

pattern for 12 months in Magway in 2006. It shows that rainfall starts from March to ends in November with the highest level of rainfall in the month of October (<http://www.yadanabon.com>).

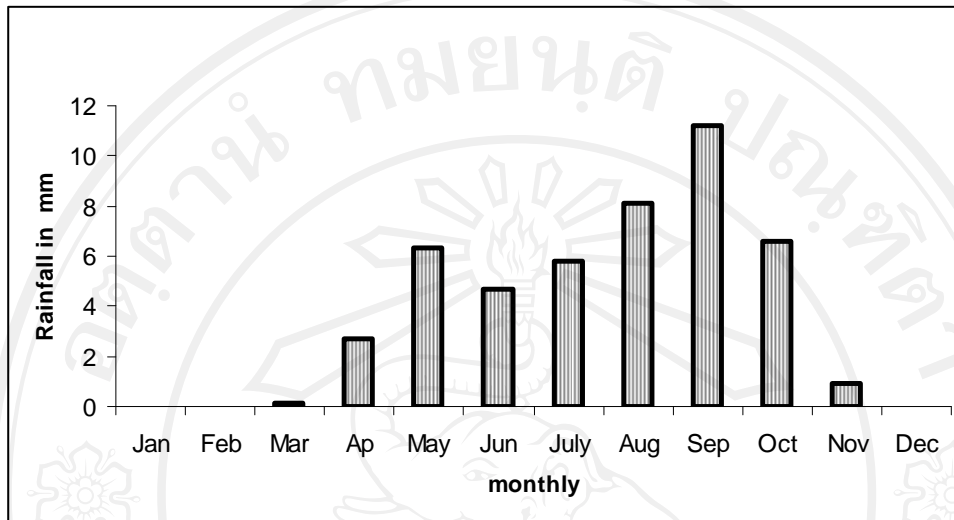


Figure 4.2 Monthly rainfall distributions in Magway Division in 2006.
Source: Department of Meteorology and Hydrology, Magway Division, 2006.

4.1.3. Groundnut production in the central region of Myanmar

The groundnut is widely distributed in the most cropping regions within Myanmar. Temperatures in central region are warm enough for the growth of groundnut. Well drained soil is easy to till and has a suitable texture for groundnut production. In addition, the soil in this region is favored for the cultivation of groundnut. Moreover, where conditions are suitable for growing groundnut, it has greater profitability due to groundnut seed quality must be good for oil contents, high yielding for productivity and lack of seed dormancy than other oil seeds (Aye Aye Mon, 1996).

Mandalay and Magway divisions have favorable natural and socio-economic condition for agricultural development, especially for groundnut production. Crop production is performed mostly under the rain-fed condition with 17% of irrigation rate of arable-land in 1999/2000 (Aye Aye Than, 2006). That is why; adverse or favorable weather situation can affect the production levels of groundnut.

In 2007, among of total oilseed crop sown area in the country, which is 865,000 hectares, total groundnut production area in the central region was 467,643

hectares, more than a half of total oilseed production area in Myanmar. Magway division, the largest groundnut production, is grown 149,000 hectares of oilseed crops and 120,650 hectares is grown in Mandalay division (CSO, 2006). Only sample farmers produced groundnut with a range 0.40 to 28.33 hectares per farm household in which they owned the land for the groundnut production.

4.2. Groundnut Production System of Sample Farms

In this study, groundnut production systems was characterized through groundnut-based cropping patterns, production area, land use and ownership, soil quality, other input uses, farm practice as well as socio-economic characteristics of sample groundnut production farms.

4.2.1. Groundnut –based cropping patterns

Groundnut is a dominant crop in the cropping systems of the central region of Myanmar. Locally groundnut in which under the rainfed area is called “Yar” that means dry land.

In the study area, farmers usually grow two sequential crops per year, namely, the monsoon and winter crops. Crops grown in the central region (part of dry zone), in addition to rice, include millet, maize, groundnuts, sesame, legumes, and other crops. To cultivate much of this land successfully, however, irrigation is required. The portions of this area that are not irrigated and utilized for the production of crops that are less sensitive to the seasonality or irregularity of rainfall than rice such as pulses, beans, maize, sesame , chilies, and others. The major groundnut-based cropping patterns in the study area were as follow:

1. Groundnut/Mungbean – Chili /pulses
2. Groundnut – Chilies / Groundnut/ Rice / Sorghum/ Sugarcane
3. Groundnut /Mung bean – Sesame/ Pulses
4. Groundnut– Groundnut
5. Groundnut/Sesame- Groundnut/ Maize

6. Groundnut/Sesame/Mungbean-Sesame/Pulses

7. Groundnut / Sesame – Sesame / Pulses / Maize

According to these patterns, the pattern 1, 2 and 4 can be found in Mandalay and the most popular pattern in Mandalay was groundnut/Mungbean-Chilies/Pulses (see Table 4.1) which means groundnut was grown in the same time with Mungbean but in different plots and they were the first two crops and chilies and pulses were grown after harvesting groundnut and Mungbean and they were considered as the second crop. The patterns of Groundnut-Sesame were mainly found in Magway and the most popular pattern found from the survey was groundnut/Mungbean/Sesame-Sesame/Pulses.

Table.4.1 Number of sample farmers for each cropping pattern in the central region of Myanmar, 2007.

Cropping Pattern	Mandalay		Magway	
	No.	%	No.	%
Groundnut/Mungbean-Chilies/Pulses	93	78.81	-	-
Groundnut/Chilies-Groundnut/Rice/Maize/Sugarcane	15	12.71	-	-
Groundnut- Groundnut	10	8.48	7	4.65
Groundnut/Sesame-Groundnut/Maize	-	-	51	33.75
Groundnut/Mungbean/Sesame-Sesame/Pulses	-	-	83	54.98
Groundnut/Sesame-Sesame/Pulses/Maize	-	-	10	6.62
Total	118	100.00	151	100.00

Source; Field survey, 2007.

In Mandalay, groundnut was grown two times a year as monsoon and winter crops. Groundnut is grown as a first crop in the calendar cropping seasons. It is planted before the end of May and harvesting is finished in August. After harvesting groundnut, farmers usually grow chilies and pulses as second crop from end of September to January and beginning of February. Also, some farmers grow groundnut and mungbean together as integrated crop in the beginning of rainy season. (see Figure 4.3).

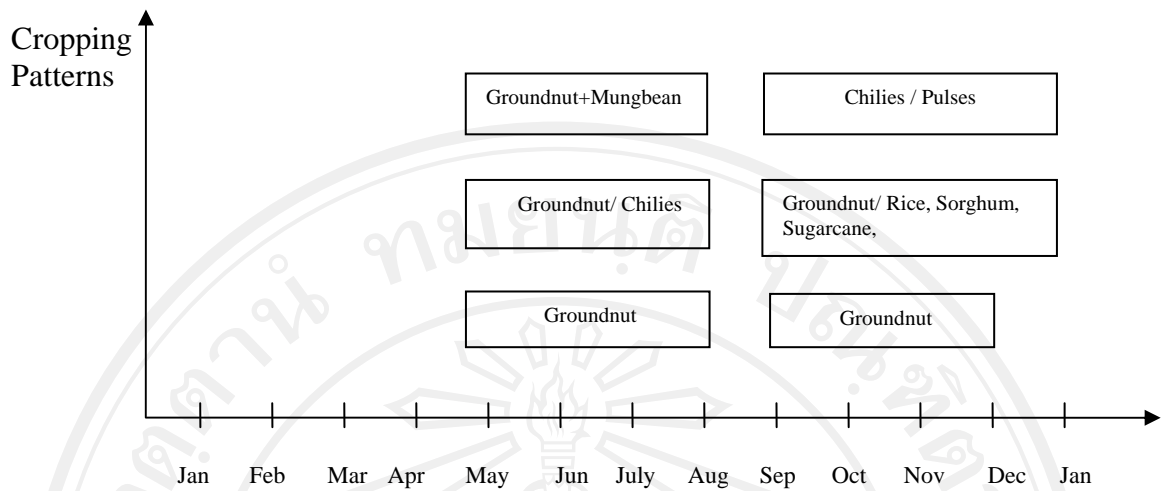


Figure 4.3 Groundnut-based cropping patterns in Mandalay division
(Source: Field survey, 2007)

In Magway, groundnut is also grown as the first crop but a little bit earlier compare to Mandalay. Farmers prepared their land and grow the groundnut in the end of April and groundnut is harvested in the end of July. Most of farmers also grew sesame as a first crop. After the groundnut harvesting is finished, some farmers grown beans, mainly mung bean, during July to the end of August as a second crop before growing sesame and pluses as the third crops. Integrated crop between groundnut and other crops were not found in Magway during the field survey in 2007. Most farmers have only two crops a year. After the first crop, groundnut, sesame, pulses, maize were grown as the second crop during September to December-January (see Figure 4.4).

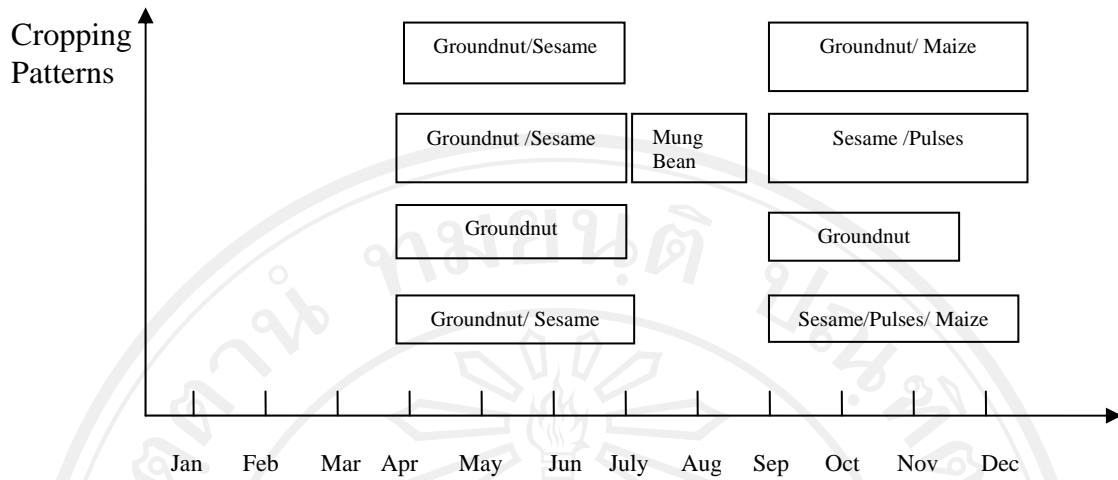


Figure 4.4 Groundnut-based cropping patterns in Magway division.
(Source: Field survey, 2007)

4.2.2 Farm size and land characteristic for groundnut production

4.2.2.1 Farm size and ownership

Farmers in the study area generally had different cultivated groundnut areas according to farm size with a range from 0.4 hectare to 8.09 hectare per household in Mandalay division and ranging from 0.81 hectare to 28.33 hectare per household in Magway division. The range is quite wide in Magway division. The average size of farm in Mandalay division was 2.32 hectare per household which was only a half of the average farm size, 5.45 hectare per household, in Magway division. Even though all land in the country owned by Union of Myanmar, farmers are allowed by government to grow the crops. There is no official land renting system in the study area but some sample farmers shared land with their relatives. Two third of farmers in Magway have land more than 3 hectares, whereas two third of farmers in Mandalay have land between 1.0-3.0 hectares (see Table 4.2).

Table 4.2 Classification of farm size in Mandalay and Magway

Farm size	Mandalay (n=118)		Magway (n=151)	
	Count	%	Count	%
Less than 1.0 ha	18	15.3	1	0.7
1.0 - 2.0 ha	42	35.6	21	13.9
2.0 - 3.0 ha	38	32.2	29	19.2
More than 3.0 ha	20	16.9	100	66.2
mean	2.32		5.45	
std	1.66		4.35	
max	8.09		28.33	
min	0.4		0.81	

Source: Field survey, 2007

4.2.2.2. Groundnut production areas

In Mandalay, groundnut production area ranged from 0.20 hectare to 7.30 hectare with an average of 0.95 hectare per household. Compared to Mandalay, the average groundnut production area in Magway was larger (1.64 hectare per household) and it ranged from 0.4 hectare to 12.14 hectare (see Table 4.3). Considering the proportion of groundnut planted areas to total farm areas, it was found that in average about 41 percent of total farm area was used for groundnut production for Mandalay and about 30 percent of that for Magway during cropping year 2007.

Table 4.3 Groundnut production areas in Mandalay and Magway

Production area	Mandalay (n=118)		Magway (n=151)	
	Count	%	Count	%
Less than 1.0 ha	78	66.10	67	44.37
1.0 - 2.0 ha	31	26.27	44	29.14
2.0 - 3.0 ha	6	5.08	26	17.22
More than 3.0 ha	3	2.54	14	9.27
mean	0.95		1.64	
std	0.82		1.70	
max	7.30		12.14	
min	0.20		0.40	

Source: Field survey, 2007

4.2.2.3. Soil

Generally quality of soil is an important factor that affected to the output of production. In the study area, it was found that soil were mainly sandy loam and sandy soil on the surface layer. According to farmers' view, only 55 percent of total 151 sample farm households in Magway considered that their soil quality was good for groundnut production, whereas only 26 percent of total 118 sample groundnut farmers in Mandalay thought that they have good quality of soil for groundnut production. Percent of farmers considered that their soil was fair and poor in Mandalay are higher than that in Magway. (see Figure 4.5 and 4.6).

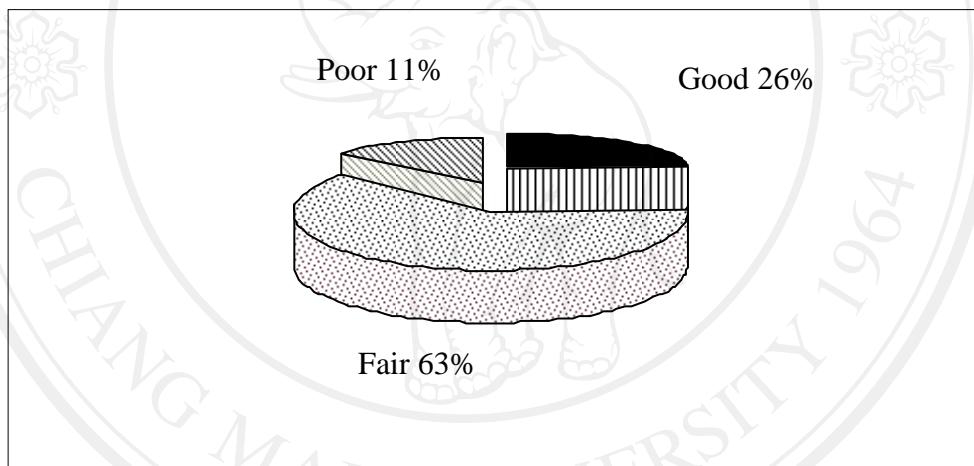


Figure.4.5 Soil quality based on farmers' view in Mandalay division.

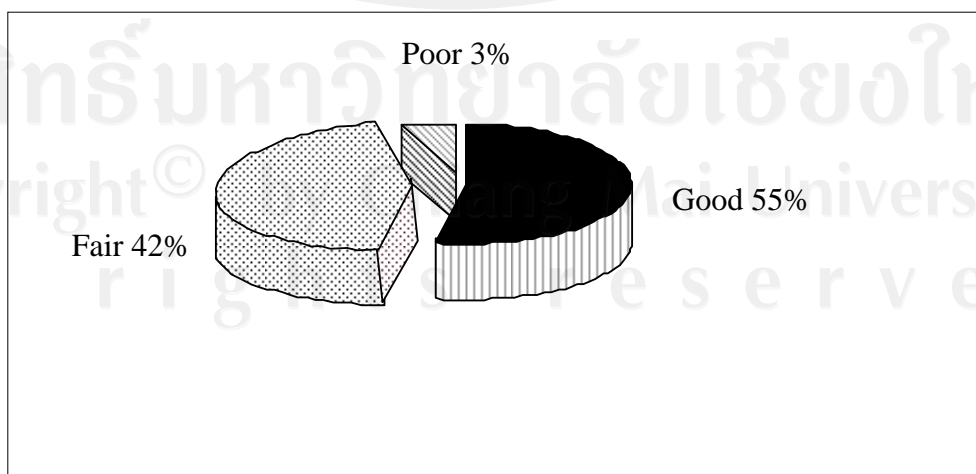


Figure. 4.6 Soil quality based on farmers' view in Magway division.

4.2.3 Land preparation

Land preparation generally starts from the end of April or early May for rainy season. Farmers prepared and ploughed their lands about a range 7 to 10 days before cultivating under rainfed condition. The time used for land preparation was very due to ploughing at a distance of 3 to 4 m from each other. From the survey, it was found that all sample farmers longer use only cattle for ploughing and harrowing in both study areas. There are no sample farmers using any machine for land preparation in the groundnut production under the rainfed area. It takes about 2 days per hectare to prepare land with a pair of cattle for groundnut production. The owned equipment and machine for groundnut production were still poor in the central region because groundnut production was firstly for household consumption; only small amount of surplus was exchanged in the market. As a result, farmers had no money from groundnut production to invest for machine.

4.2.4. Input use

Input use for groundnut production in this sub-section refers to labor, seed rate, chemical and manure fertilizer application as well as insecticide and pesticide application. The detail of each input use for groundnut production of sample farm households in the central region of Myanmar are presented as follows.

4.2.4.1. Labor use

There are two sources of labor used for groundnut production. The main source of labor is family labor. Hired labor is also used as additional labor for land preparation, planting, weeding and harvesting activities in selected study areas. However, hired labor is scarce during the harvesting period as all farmers are occupied in their own production. Especially, the households who produced large groundnut were not able to get adequate hired labors although they were willing to pay the wage at the market price.

The average labor used for all activities in Mandalay was 60.1 man-day per hectare. The wage for hiring a labor was ranged from nearly 600 to 2000 kyats per day in groundnut production, depending on activity. In Magway, the average labor used was 61.9 man-day per hectare which was so much different from labor use in Mandalay. The wage of hiring a labor was also similar to Mandalay which ranged from 800 kyats per day to 2000 kyats per day.

When it time for harvesting, all farmers used simple tools like sickle for harvesting. Additional labor is hired for harvesting. The average labor used for harvesting is 13.75 man-day per hectare in Mandalay and 20.58 man-day per hectare in Magway.

Table 4.4. Labor used per hectare for groundnut production in central region of Myanmar

Activities	Mandalay(n=118)		Magway (n=151)	
	man-day/ha	percent	man-day/ha	percent
Land preparation	28.96	48.12	29.73	48.59
Planting	10.20	16.97	10.71	17.51
Chemical application	0.96	1.60	0.16	0.26
Harvesting	19.98	33.24	20.58	33.64
Total	60.10	100.00	61.18	100.00

Source; Field survey, 2007.

4.2.4.2. Seed variety and seed rate

From the survey, there are only two different seed varieties of groundnut in the study area which are SP-121 and MG-15. The SP-121 is grown in Mandalay division and MG-15 is grown in Magway division. These two varieties is the erect type which usually will mature in 90-105 days. The most important traits that farmers considered in selecting a variety were the crop vigor, short duration, high yield potentials. Seed, therefore, must be lack of dormancy as groundnut grows as soon as it is possible to prepare the land after first raining of premonsoon.

There, however, is no difference in seed rate per hectare used in groundnut production between sample farmers as well as between divisions. The average seed rate used in groundnut production was 53.47 kg /ha in Mandalay and 54.50 kg /ha in Magway.

One problem faced by the farmers is the high seed cost of groundnut production in the study areas. Average groundnut production cost of farmers in both areas was 69,863 kyats per hectare. Therefore, most farmers in both areas stored their seed for the next planting season, less farmers purchased seed from market (see table 4.5).

As groundnut planting depends, heavily on rainfall when pod become to sprout into land, if there is drought in that year, groundnut yield will be decreased and it is often found that the seed cost cannot be covered in such year.

Table 4.5 Percentage of purchasing groundnut seed of farmers in central region of Myanmar

Seed variety	Mandalay (N= 118)		Magway (N= 151)	
	no of sample	percent	no of sample	percent
No purchasing seed	109	92.37	139	92.05
Purchasing seed	9	7.63	12	7.95

Source; Field survey, 2007.

4.2.4.3. Chemical fertilizer and manure application

In both Mandalay and Magway, it is found that most farmers applied chemical or organic fertilizer in their groundnut production (see Table 4.6). About one third of farmers in both divisions used integrated fertilizer management. They usually put manure in their soil during land preparation and applied chemical fertilizer in two weeks after planting.

It seems like that the fertilizer application rate, both chemical and manure, of farmers in Mandalay is lower in Magway. The average rate of chemical fertilizer application in Mandalay was 32.5 kilogram per hectare which is a bit lower than that of Magway farmers which applied at the rate of 35.5 kilogram per hectare. For

manure, the average application rate was about 3.9 tons per hectare in Magway and 3.3 tons per hectare in Mandalay. The maximum rate of manure application was 37.1 tons per hectare in Mandalay and 39.1 tons per hectare in Magway (see Table 4.7)

Table 4.6 Application of chemical and manure fertilizer in groundnut production

Fertilizer	Mandalay (n=118)		Magway (n=151)	
	No of samples	percent	No of samples	percent
Not used both fertilizer	2	2	8	5
Applied chemical fertilizer	46	39	78	52
Applied manure	34	29	15	10
Applied both fertilizer	36	30	50	33
Total	118	100	151	100

Source: Field survey, 2007.

Table 4.7 Chemical and manure application in groundnut production areas

Amount of fertilizer application	Total amount of chemical fertilizer (kg/ha)		Total amount of manure fertilizer (tons/ha)	
	Mandalay (n=118)	Magway (n=151)	Mandalay (n=118)	Magway (n=151)
Mean	32.5	35.5	3.3	3.9
Std	35.5	38.8	4.7	7.2
Max	164.7	247.1	37.1	39.1
Min	0.0	0.0	0	0.0

Source; Field survey, 2007.

4.2.4.4. Insecticide and pesticide application

Farmers usually make decision on the pest and diseases management activities by themselves. After planning, farmers visited their field once a day or at least once every two days. When they find the appearance of pest or disease in the field, they will apply pesticides or insecticides suddenly. Mostly, yellow leaf spot, rust, mites, and beetles are the pest and insect attack the groundnut production in the study areas. More than a half of farmers (56 %) in Magway applied insecticide and pesticides for their groundnut production but only 25 % of farmers in Mandalay applied insecticide and pesticides in their groundnut production (see Figure 4.7 and Figure 4.8).

Farmers usually applied insecticides and pesticides for crop protection at least once in crop season by using sprayer. Most popular insecticides and pesticides applied for groundnut production in the study areas were Forwafuran, Dizinon, Malarthion, Kyan kyaung EC and Cypermethrin.

The average cost of insecticide and pesticide was approximately 767 kyats per hectare in Mandalay and 1933 kyats per hectare in Magway. However, there is no serious damage by pests and diseases in groundnut production in both Mandalay and Magway in the crop year 2007(see Table 4.8).

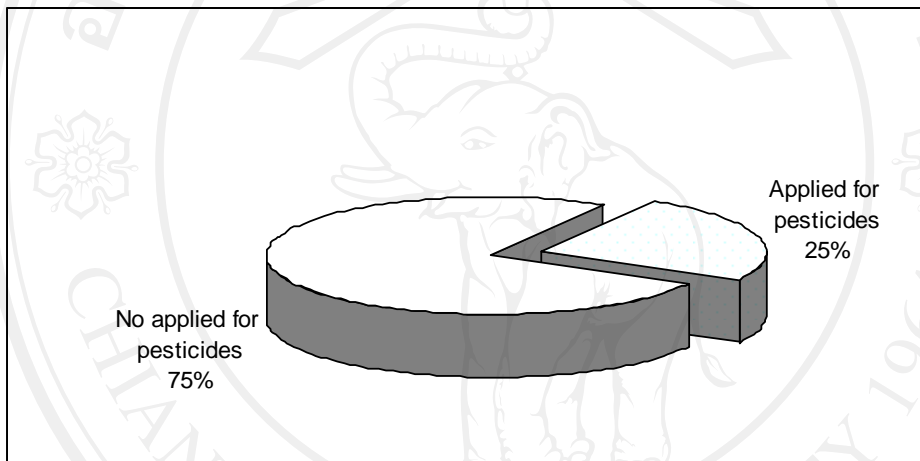


Figure 4.7 Percent of farmer applied pesticide for groundnut production in Mandalay
Source: Field survey, 2007.

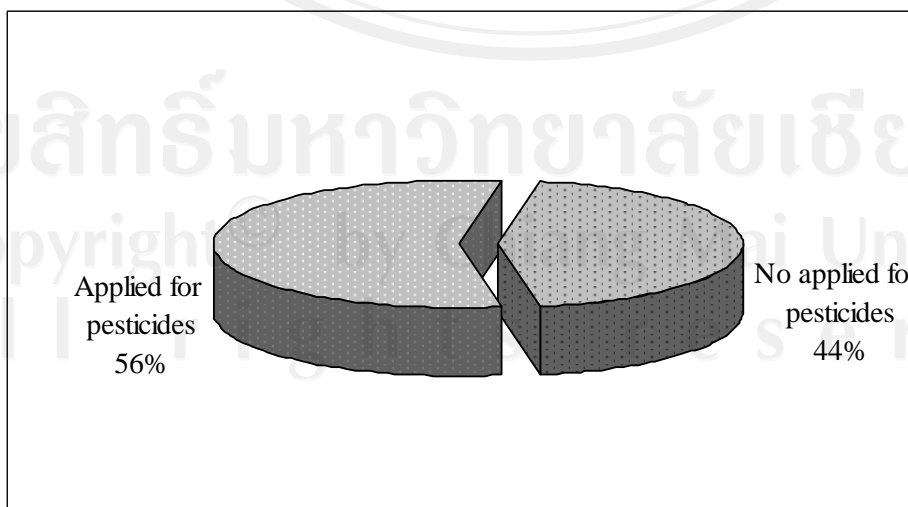


Figure 4.8 Percent of farmer applied pesticide for groundnut production in Magway
Source: Field survey, 2007.

Table 4.8 Insecticide and pesticides cost per hectare in groundnut production.

Insecticide and pesticides applied	Insecticide and pesticide cost (kyats/ha)	
	Mandalay (n=118)	Magway (n=151)
Mean	767.21	1933.27
Std	153.81	297.21
Max	2200.00	2300.00
Min	0	0

Source: Field survey, 2007.

Moreover, farmers usually do weeding by hand before using chemical. The frequency of hand weeding is at least two times per season. The first weeding is done about two weeks after planting and second weeding is done about two weeks after first weeding.

4.2.5. Productivity

4.2.5.1. Yield

The results show that the average yield of groundnut for Mandalay division was 649 kilogram per hectare with the wide range from 210 kilogram per hectare to 1681 kilogram per hectare. The average yield in Magway was higher, at the average of 993 kilogram per hectare with the wider range from 290 kilogram per hectare to 2428 kilogram per hectare (see Table.4.9).

The low productivity may be explained by two reasons. One is the seed quality as farmers used their own stored seeds for many seasons. Another reason might be low rainfall when groundnuts start to sprout into soil layer.

Table 4.9. Average yield per hectare in Mandalay and Magway

Yield(kg/ha)	Mandalay(n=118)		Magway(n=151)	
	No of sample	Percentage	No of sample	Percentage
Less than 500	29	25	16	11
500-1000	78	66	78	52
1001-1500	8	6.78	34	21
More than 1500	3	2.54	23	16
Total	118	100	151	100
Mean	649		993	
Max	1681		2428	
Min	210		290	

Source; Field survey, 2007.

4.2.5.2. Change of yield

Over 40% of the groundnut area as monsoon crop lies in the dry region where the rainfall during the growing season is very irregular and it affect the groundnut yield.

In general, yield level of groundnut in Mandalay division and Magway division is considered as moderate level. From the survey, farmers were asked about the change of yield in last three years from 2005-2007. About 23% of farmers in Mandalay responded that their yield had been increased during last three years while about 37% of farmers in Magway responded the same. In both areas, least farmers stated that their yields have been decreased in the last three years. However, some farmers did not have the records in which their groundnut yields were increase or decrease, especially in Manday where almost a half of farmers could not recognize.

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Table 4.10 Change of yields in last three years 2003-2005

Change of yields	Mandalay (n=118)		Magway (n=151)	
	Count	Percentage	Count	Percentage
Increase of yields	27	22.88	56	37.09
Decrease of yields	21	17.80	10	6.62
Same in yields	12	10.17	60	39.74
Farmers can not answer	58	49.15	25	16.55
Total	118	100	151	100

Source; Field survey, 2007.

4.2.6 Socio-economic characteristic of farm households

4.2.6.1. Age of household heads

All respondents were household heads. Most of household heads were male in both divisions. The average age of total household heads was 49 years old in both divisions with the range of 23 years and 83 years in Mandalay and 24 years and 75 years in Magway division. Most farmers have experiences in groundnut production longer than 20 years in both divisions.

The survey results show that the age structure of household head in Magway and Mandalay are similar. Almost a half of the sample household heads are between 30 and 49 years old and about 40-44% of household heads are between 50-69 years (see Table 4.11).

Table 4.11 Age of household heads in Mandalay and Magway areas.

Age of households (years)	Mandalay (n=118)		Magway (n=151)	
	Count	percent	Count	percent
Less than 29 years	4	3.39	6	4.00
30- 49 years	56	47.46	73	48.34
50- 69 years	48	40.68	67	44.37
More than 70 years	10	8.62	5	3.31
Mean	49.30		48.65	
Max	83.00		75.00	
Min	23.00		24.00	

Source; Field survey, 2007.

4.2.6.2. Education of household heads

In general, education is one of the important factors for adoption of new technologies. Usually farmers who have high education level are likely to adopt a new technology to increase their production efficiency.

The education system in Myanmar can be classified into 3 levels. First, the primary school, it takes 4 years to finish primary school. Second is the middle school. It takes 6 years after primary school to finish secondary school. The third level is the high school which takes another 5 years to finish it.

The survey results show that most farmers are in the middle school level. From the mean value, it is shown that they didn't finish the middle school as the average years in school are 5 years for Mandalay and 7 years for Magway. A few farmers educated at the high school. In average, Mandalay farmers have fewer years in school than Magway farmers (see Table.4.12).

Table 4.12. Education of households in two study areas of Myanmar.

Level of education	Mandalay (n=118)		Magway (n=151)	
	count	percent	count	percent
1-5 years (primary school)	34	29	27	18
6-8 years (middle school)	80	68	99	66
9-15 years (high school)	4	3	25	16
Mean (years in school)	5		7	
min	1		4	
max	11		15	

Source; Field survey, 2007.

4.2.6.3. Experience in groundnut production

Farmers were asked how many years they have grown groundnut in their farms. The results show that almost a half of farmers in Mandalay have experience with groundnut production in the range of 11-20 years whereas in Magway, farmers' experience of groundnut production is quite equally distributed from less than 10 years to not more than 40 years. A half of farmer in Magway have experience less than 20 years and another half is more than 20 years (see Table 4.13). However, considering the average years of experience, it is found that farmers have experience in groundnut production about 26 years for Mandalay and 28 years for Magway.

Table 4.13 Experience in groundnut production, in Mandalay and Magway.

Experiences years in GP	Mandalay		Magway	
	No of sample	percent	No of sample	percent
Less than 10	13	11	32	21
11-20	51	43	42	28
21-30	35	30	40	26
31-40	16	14	31	21
More than 40	3	2	6	4
Total	118	100	151	100
Mean	26		28	
Max	57		52	
Min	2		2	

Source; Field survey, 2007.

4.2.6.4. Labor force availability

Labor force availability in a household was calculated using adult-equivalent unit. A half of sample household in Mandalay has labor force in the range of 2-4 adult-equivalent units whereas a half of sample household in Magway has labor force more than 4 adult-equivalent units. However, the average labor forces per household of both areas were not so much different that was 4.12 in Mandalay and 4.40 in Magway (see Table 4.14)

Table 4.14. Labor force availability in groundnut production of study areas, Myanmar.

Labor force availability	Mandalay (n=118)		Magway (n=151)	
	No of sample	percent	No of sample	percent
Less than 2	7	5.93	21	13.91
2-4	60	50.85	53	35.10
4-6	42	35.59	62	41.06
More than 6	9	7.62	15	9.93
mean	4.12		4.40	
min	1.00		1.00	
max	9.00		9.50	

Source; Field survey, 2007.

4.2.7. Capital use

In these study areas, groundnut farmers grew the groundnut production cost by borrowing from the agricultural and co-operatives and private lenders. Cost of production for oilseeds is the cost paid for labor, cost of varieties, and input resources. Farmers usually use the capital to invest in the groundnut production including activities such as land preparation, cultural practices, harvesting, and to purchase the inputs like seed, cow dung, fertilizers and insecticides.

4.2.7.1 Own capital

Only 11 percent of farmers who produce the groundnut production in Mandalay can afford the production cost by their own capital whereas more than one third of farmers in Magway used their own capital for groundnut production. Most firms in this area needed to borrow money to operate groundnut production because they could not afford the high capital use in their firms. From the survey, it was found that the most firms borrowed money from the Myanmar agricultural development bank at an interest rate of 1.50 percent per month.

The Rural Credit Scheme was implemented by the Myanmar Agricultural Development Bank (MADB) under the Ministry of Agriculture and Irrigation. The Myanmar Agricultural Development Bank gives credit to farmers as seasonal credit for growing crops with a reasonable interest rate.

Table 4.15 Source of capital used for groundnut production in central region of Myanmar

Source of capital	Mandalay (n=118)		Magway (n=151)	
	No of sample	Percent	No of sample	Percent
Own capital	13	11.02	56	37.09
Taking credit	105	88.98	95	62.91
Total	118	100	151	100

Source; Field survey, 2007.

4.2.7.2 Credit access

In the study areas, there are two types of credit which are in cash and in kind. There are several credit sources available for farmers. In Mandalay, most farmers borrowed money from private lenders such as shoppers in the villages, broker-men and crop traders and about 38 percent borrow money from the Agricultural Development Bank of Myanmar (see Table 4.16). In Magway, the proportions of farmers borrowed money from private lender and the Agricultural Development Bank are not so much different, about 36-38 percent. Some farmers also borrowed money from the Myanmar pawnshop. Farmers usually borrow cash to purchase inputs for groundnut production such as seed, chemical fertilizer and pesticides in their village. The interest rate from private lender is much higher than from the government bank. They have to pay money back after harvesting with interest rate of 7 to 15 percent per month.

Table-4.16 Source of credit of groundnut farmers in central region of Myanmar

Source of credit	Mandalay (n= 118)		Magway (n= 151)	
	No of samples	percent	No of samples	percent
Agricultural Development Bank	40	38	34	36
Myanma pawnshops	4	4	25	26
Broker men , crops traders , and shopkeepers in village	61	58	36	38
Total	105	100	95	100

Source; Field survey, 2007.

The average amount of credit was 10171.2 kyats per hectare in Mandalay and 8763.3 kyats per hectare in Magway. There were 11 percent of groundnut farmers in Mandalay that took credit more than 20,000 kyats per hectare but 31 percent of farmers in Magway (see Table.4.17). Therefore, the rural credit is imperative role to groundnut farmers in the study areas

Table 4.17 Amount of Credit in groundnut production in study areas, Myanmar.

Amount of credit (kyats/ha)	Mandalay (n=118)		Magway (n=151)	
	No. of sample	Percentage	No. of sample	Percentage
Less than 10000	89	75	97	64
10000-20000	16	14	8	5
More than 20000	13	11	46	31
Average		10171.2		8763.3
Max		100000.00		80000.00
Min		0		0

Source: Field survey, 2007.

4.2.8 Extension services

The agricultural extension division is responsible for disseminating information on technical progress to farmers, providing training on crop management, conducting agricultural development programs for hybrid varieties and others.

Firms in the study area had opportunity to access to new technologies through participation in training courses held by the agricultural extension division. As the training courses were not organized regularly, the main source of agricultural information were still from newspapers, agricultural journals, television and radio.

Farmers were asked whether they have received extension services about groundnut production in the study area. The results showed that most of farmers in Mandalay (87.29%) and Magway (66.23%) have not received extension service about groundnut production (see Table 4.18). This showed that agricultural extension services are quite limited in the study area. This may be due to lack of extension staff.

For some farmers who had access to extension service, they might have chance to participate a training program such as training how to apply an available technology more efficiently in their farms (see Figure 4.9 and 4.10). The agricultural extension division also has a program to improve the capacity (ability) of farmers for developing the farmers' analytical skills, critical thinking, and creativity to make better decisions. However, this program is still weak in Myanmar.

Table-4.18 Access to extension services, in Central of Myanmar.

Extension contacts	Mandalay		Magway	
	No of samples	percentage	No of samples	percentage
No contact to	103	87.29	100	66.23
Access to extension	15	12.71	51	33.77
Total	118	100	151	100

Source; Field survey, 2007.

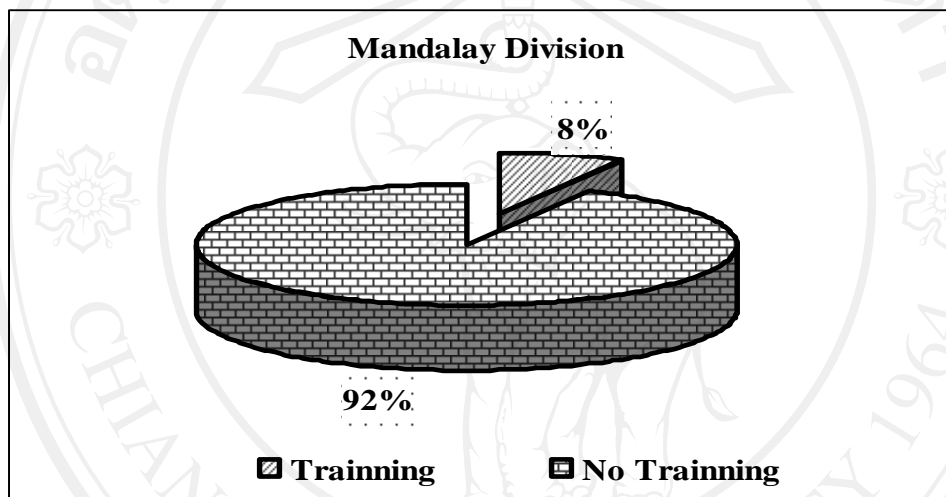


Figure 4.9 Training participation of household heads in Mandalay division, Myanmar.

Source; Field survey, 2007.

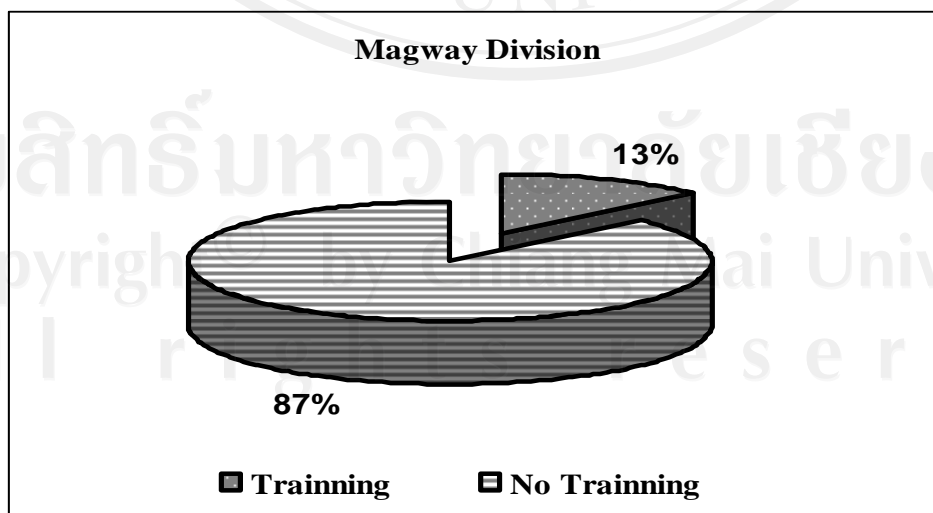


Figure 4.10 Training participation of household heads in Magway division, Myanmar.

Source; Field survey, 2007.

4.2.9. Farmers' view on problems of groundnut production

Farmers were asked about problems of groundnut production. The results showed that most groundnut farmers faced with drought in the crop year 2006-07. This information would help to explain why yield per unit area was not increased over the year. Other problems that farmers faced were pests and disease such as beetles, aphides and leaf spot. Only few farmers had no problem with groundnut production (see Table 4.19).

Table- 4.19 Problems of groundnut farmers in central region of Myanmar.

Sorts of Problems	Mandalay (n= 118)		Magway(n=151)	
	No of samples	Percent	No of samples	Percent
No problems	8	6.78	6	3.97
Drought	86	72.88	117	77.48
Pest and Disease	12	10.17	14	9.27
Both drought and pest, diseases	12	10.17	14	9.27

Source: Field survey, 2007.