

## CHAPTER III

### BIO-PHYSICAL AND SOCIO-ECONOMIC CONDITIONS FOR RICE PRODUCTION IN THE STUDY AREA

This chapter will lay out biophysical and socio-economic factors as well as rice production systems in the study area.

#### 3.1 Bio-physical conditions of Phayao province

##### 3.1.1 Location and topography

Phayao is one of the northern provinces of Thailand between latitudes 18° - 19° North and 99° - 101° longitude east. Neighboring provinces are (from east clockwise) Nan, Phrae, Lampang and Chiang Rai. The north-east borders Laos. It is 300-1,500 meters above sea level. The province area is 6,335.1 km<sup>2</sup> or 3,954,412 *rai*.

The province is subdivided in 7 districts and 2 minor districts, Mueang Phayao District, Chun District, Chiang Kham District, Chiang Muan District, Dok Kham Tai District, Pong District, Mae Chai District, Phu Shang Minor District, and Phu Kamyao Minor District. These are further subdivided into 68 subdistricts and 632 villages (Figure 3.2).

##### 3.1.2 Climate

In Phayao province, the climate is characterized by three distinct seasons: winter, summer, and rainy season. The winter season is from late November to end of February with an average temperature of 22.00 °C, the coolest month is December with an average temperature of 6.80 °C. The summer season is from early March to the end of May with an average temperature of 28.17 °C. The hottest month is April with an average temperature of 39.7 °C and the rainy season is from early May to the end of October with an average temperature of 27.63 °C. The wettest month is August or September. Figure 3.1 shows the temperature in a year with average,

maximum and minimum in each month for 2006. The total annual rainfall was 1,172.5 mm in 2006. Average monthly rainfall is shown in Figure 3.3. The highest precipitation is in the month of September, the lowest in December – February.

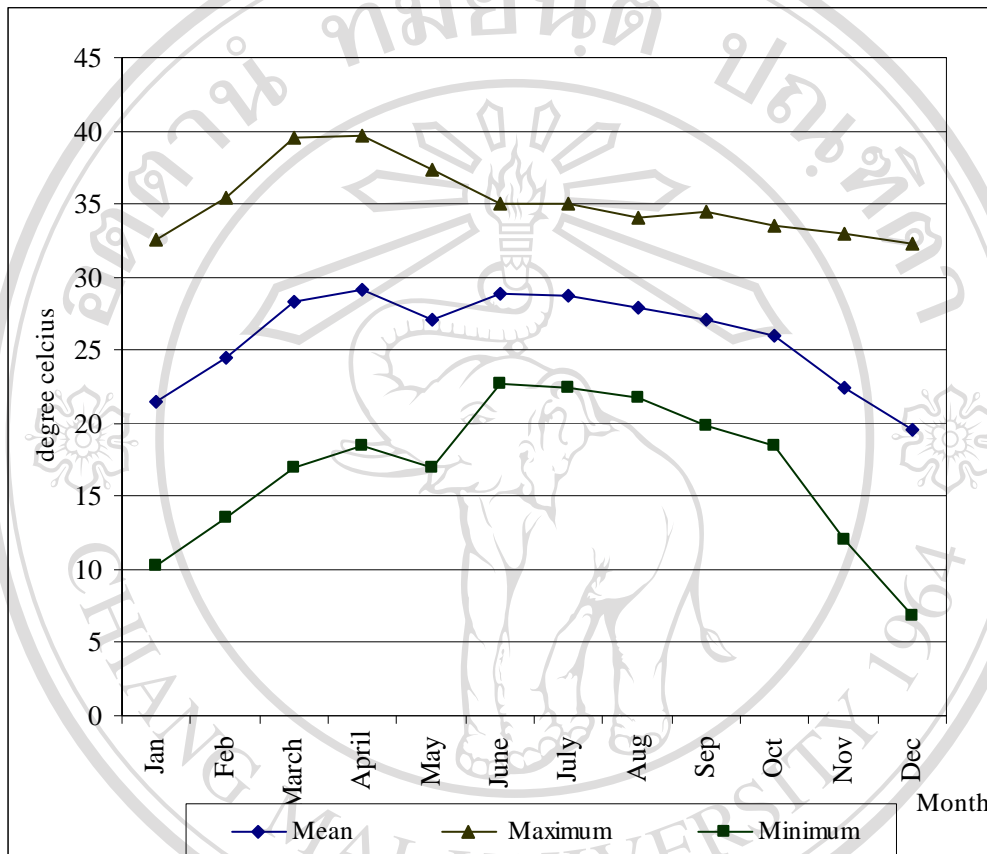


Figure 3.1 Distribution of monthly average temperature in Phayao province, 2006

Source: Phayao Meteorological Station, 2007

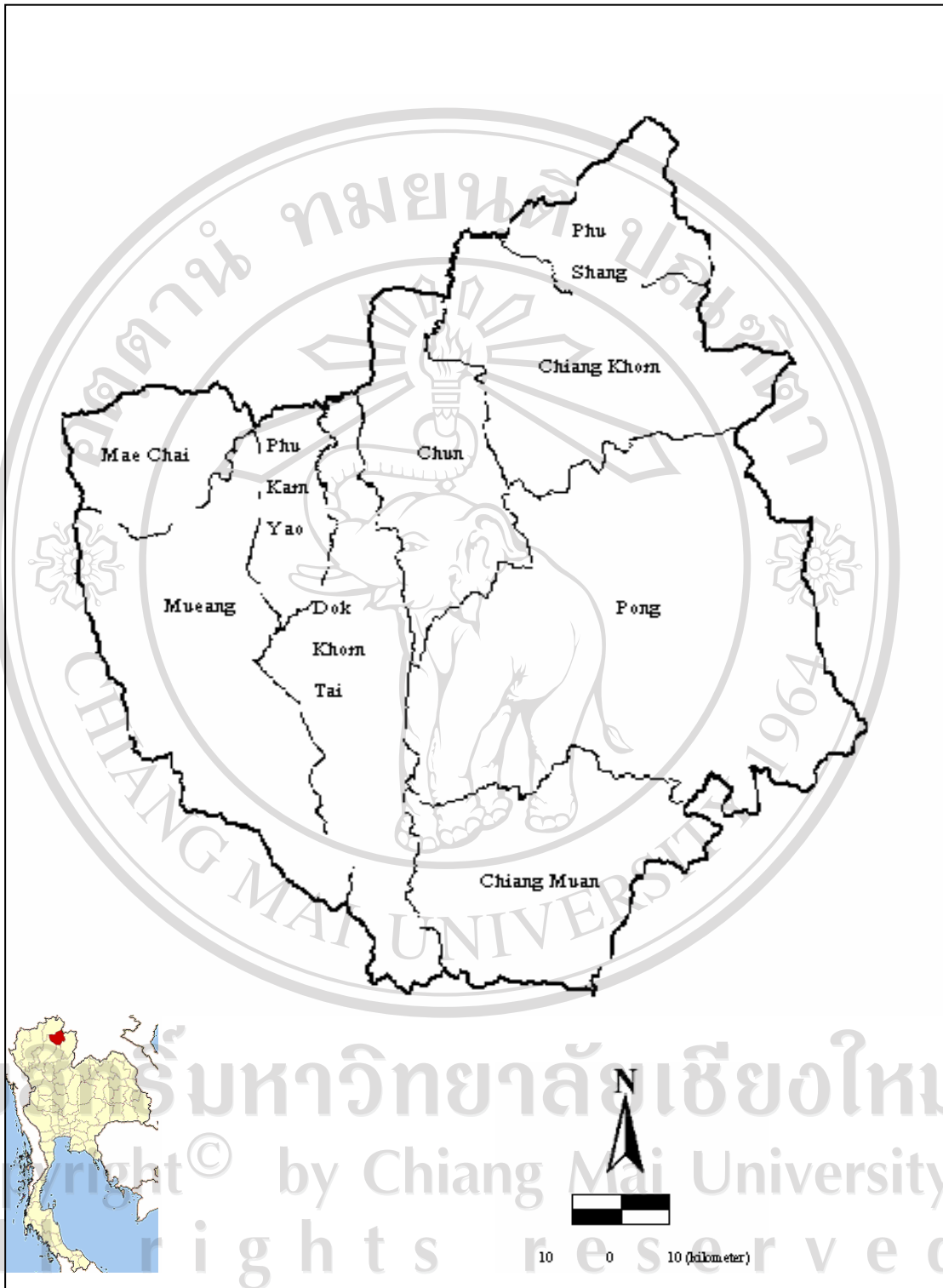


Figure 3.2 Map of Phayao Province

Source: Office of Agricultural Economics, 2006

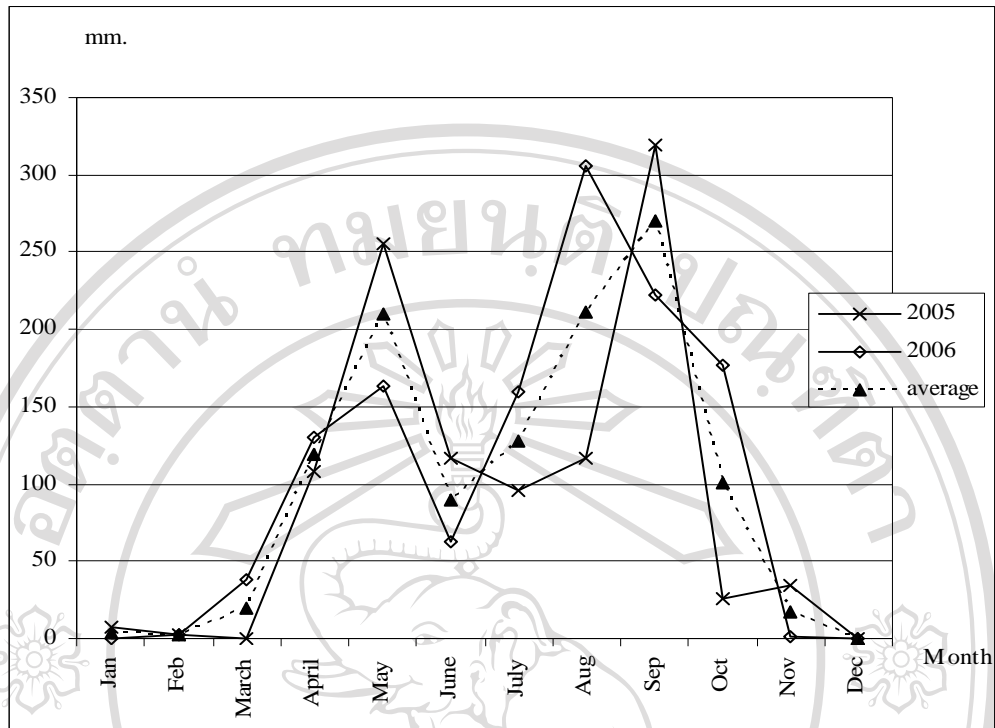


Figure 3.3 Distribution of monthly average rainfall in Phayao province: 2005-2006

Source: Phayao Meteorological Station, 2007

### 3.1.3 Soil

There are 5 main soil types that consist of soil from mountain, clay, loose soil, sedimental soil, and soil from limestone. Soil in Mueang district, Mae Chai district, Dok Khom Tai district and Chun district is fertile and suitable for rice cultivation comprising around 23 percent of Phayao province. Another 23 percent of the soil in the province is suitable for fruit, and upland crops i.e in Mueang, Chun and Pong. Part of Chiang Muan, Chiang Khom, Pong and Mueang are not suitable for cultivation because these areas are forests (52 percent of Phayao province) (Phayao Province Agriculture and Cooperative Office, 2004).

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### 3.1.4 Water supply

The city of Phayao is located at the Phayao Lake (Kwan Phayao) in the valley of the Ing River. There are three big mountains surround the valley, the Doi Luang (1,697 meters above sea level), Doi Khun Mae Fat (1,550 msl) and Doi Khun Mae Tam (1 330 msl). A large part of Phayao's land resource (53%) is upland. The central upland consists of many mountain ranges that give birth to several stream and tributaries (Yom river).

There are many irrigation projects which were constructed to support the agricultural production. However, most projects are small and used mainly for agriculture. Total irrigated area of the province was 280,349 *rai*. Large irrigation projects cover 26,429 *rai*. Medium projects cover 87,650 *rai*. There are 105 small irrigation projects cover area of about 166,270 *rai*

### 3.2 Socio-economic conditions

This section lays out socio-economic conditions about land use, land holding, population, labor, gross provincial product, farm income, and expenses including debt situation.

#### 3.2.1 Land use and land holding

Total Phayao area totals 3,959,412 *rai*, non agricultural area 3,027,831 *rai*, agricultural area 931,581 *rai*. Average irrigated rice area per household is 5.65 *rai* and for rainfed area 12.43 *rai*/household. Total area for field crops is 33,707 *rai*, and for other land uses 152,070 *rai* (Table 3.1).

**Table 3.1 Land use in Phayao province, 2001**

Land use in Phayao	Area ( <i>rai</i> )
Total Phayao area	3,959,412
Non agricultural area	3,027,831
Agricultural area	931,581
Paddy area	779,511
Irrigated area ( <i>rai</i> /household)	5.65
Rainfed area ( <i>rai</i> /household)	12.43
Crop filed	33,707
Other	152,070

Source: Office of Agricultural Economics, 2002

The total number of households with agricultural land holdings was 72,786 covering an area of 938,826 *rai*. Table 3.2 presents the utilization of agricultural area. Rice is the major crop. In 2006, there were 57,667 households in rice production. Rice area was 573,769 *rai*. Field crop area was 190,766 *rai* operated by 20,782 households. 120,101 *rai* was in perennial plant operated by 21,341 households. 4,907 households planted vegetable crop, herb, flower and ornamental plant in 19,164 *rai*.

**Table 3.2 Number of household with agricultural land holdings and area coverage, 2006**

Land use	Number of Household	Area ( <i>rai</i> )
Total	127,024	938,826
Rice	57,667	573,769
Para rubber	595	4,378
Perennial plant	21,341	120,101
Field crop	20,782	190,766
Vegetable crop, herb, flower and ornamental plant	4,907	19,164
Forest (planted)	712	5,569
Pasture	229	1,123
Pen	15,160	6,624
Fresh water culture	2,871	5,049
Others	2,760	12,283

Source: National Statistical Office: Ministry of Information and Communication

Technology, 2003.

Note: One holding may report more than one land type of land use

### 3.2.2 Population and labor

Table 3.3 shows the number of population from registration record in Phayao province which indicated that total population was 488,343 people in 2004 then decreased to 486,219 people in 2006. The number of population decreased most of the districts except Mueang Phayao district and Phu Sang minor district.

**Table 3.3 Number of population from registration record by district, 2004 - 2006**

District/Minor district	2004	2005	2006
Phayao Province	488,343	486,889	486,219
Mueang Phayao District	121,619	121,083	122,026
Chun District	52,542	52,066	51,696
Chiang Kham District	77,709	77,744	77,692
Chiang Muan District	19,596	19,542	19,480
Dok Kham Tai District	73,535	73,205	72,752
Pong District	53,263	53,212	53,078
Mae Chai District	36,268	36,089	35,839
Phu Sang Minor District	31,031	31,289	31,258
Phu Kamyao Minor District	22,780	22,659	22,398

Source: Department of Local Administration, Ministry of Interior, 2007

Table 3.4 indicated that total labor force in Phayao province consist of 281,786 persons. The number of people with employment were 278,034. The number of people with unemployment were 2,249. The number of people who waited for employment were 1,503. Total number of people not in the labor force were 115,247 persons. There were 33,510 housekeepers, 33,752 students and 48,166 persons in other categories.

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**Table 3.4 Status of labor in Phayao province, 2006**

Status of Labor Force	Average No. of persons
Total labor force	281,786
Employment	278,034
Unemployment	2,249
Waiting for the season	1,503
Total not in labor force	115,427
Housekeepers	33,510
Students	33,752
Others	48,166

Source: National Statistical Office; Ministry of Information and Communication Technology, 2006

In 2001, the numbers of agricultural workers with the ages between 15-64 years in Phayao province were 169,272. The numbers of farm family members were 285,382. Total agricultural workers from other provinces were 937 persons. Average farm family size was 4.39 persons per household. The average number of agricultural workers was 2.59 persons per household (Table 3.5). The wage rate for crop year (2005/06) was 150 baht/day.

**Table 3.5 Labor supply in agriculture in Phayao province, 2001**

Labor supply in Phayao	Number of persons
Number of farm family members (person)	285,382
Total agricultural workers 15-64 years old (person)	169,272
Total agricultural workers from other province (person)	937
Farm family size (person/household)	4.39
Size of agricultural workers, 15-64 years old, per household (person/household)	2.59

Source: Office of Agricultural Economics, 2002

### 3.2.3 Gross provincial product, expense, income and indebtedness

Table 3.6 shows gross provincial product of Phayao province from 1999 to 2007. Gross provincial product (GPP) has been increasing from 13,459 million baht in 1999 to 23,279 million baht in 2007 (a growth rate of 8.1% per year). GPP for agriculture sector in 1999 was 2,865 million baht then rose to 7,449 million baht in 2007—a growth rate of 17.8 % per year. In 1999, then gross provincial product in the non-agriculture sector was 10,594 million baht then increased to 15,831 million baht (a growth rate of 5.5 % per year).

**Table 3.6 Gross provincial product at current prices by industrial origin, Phayao province, 1999-2006**

Year	Agriculture (million baht)	Non-agriculture (million baht)	Gross provincial Product (GPP) (million baht)	Per capita GPP (baht)
1999	2,865	10,594	13,459	26,208
2000	2,969	10,237	13,206	25,642
2001	3,046	10,482	13,528	26,477
2002	4,193	10,941	15,134	29,703
2003	4,016	11,230	15,246	29,997
2004	4,817	12,367	17,184	33,884
2005	5,354	14,365	19,719	37,470
2006p	6,335	14,608	20,943	39,677
2007p	7,449	15,831	23,279	43,960

Source: Office of the National Economic and Social Development Board, 2008

Note: p = Preliminary

Table 3.7 shows age of household head, expense and income of households by socio-economic class, Phayao province in 2004. From statistical data in the study area, average age of all household's heads was 51.5 years. For farm households, the average age of household's heads was 51.8 years while for households with own business, it was about 50.8 years. Average age of household's head salary workers was around 46-50 years.

In 2004, the household expenses for consumption averaged 6,950 baht/month. Farm expenses averaged 5,103 baht/month. Business owner expenses for consumption averaged 8,750 baht/month. Average consumption expense of salary workers was 8,087 baht/month.

In term of income of salary workers, the average was 11,128 baht/month. Farm operators' average income was the lowest amount of 6,590 baht/month. Business owners' average income was 11,994 baht/month. All household average income was 9,587 baht/month.

**Table 3.7 Age of household head, expense and income of households by socio-economic class, Phayao province, 2004**

Socio - economic class	Average age of household head	Average consumption expense (baht/ month/household)	Average current gross (baht/ month/ household)
All households	51.5	6,950	9,587
Farm operators	51.8	5,103	6,590
Business owners	50.8	8,750	11,994
Salary workers	48.0	8,087	11,128

Source: National Statistical Office, Ministry of Information and Communication Technology, 2004

Table 3.8 shows revenue and expense of farmers in year 2001. Cash revenue was 113,593 baht/household while cash expense was 99,440 baht/household. The net cash income was 14,152 baht/household. The average of interest rate paid by farmers in Phayao was approximately 8% at the Bank for Agriculture and Agricultural Cooperatives (BAAC). In Phayao, non farm revenue contributed 56 % of all cash revenue while 44 % came from farm. In terms of expenses, 63 % was non farm expense and 37 % was farm expenses.

**Tale 3.8 Cash revenue, expenses and net cash income of farmers in Phayao province, 2001**

Item	Amount (baht/household/year)	%
1. Cash income	113,593	100
Farm cash revenue	49,807	44
Crops	36,212	32
Livestock	3,072	3
Other	10,522	9
Non farm cash revenue	63,786	56
2. Cash expense	99,440	100
Farm cash expense	37,196	37
Crops	17,625	16
Livestock	2,547	2
Other	17,023	15
Non farm cash expense	62,244.67	63
3. Net cash income	14,152	-

Source: Office of Agricultural Economics, 2002

Table 3.9 shows the number of indebted households and total debt in Phayao province in 2006. Average amount of debt for salary workers was the highest debt (1.1 million baht/household) and for farmers 184,299 baht per household. Sources of borrowing were from two sectors; formal loan sector<sup>1/</sup> totaling 179,461 baht per household (97%), and informal sector 4,839 baht per household (3%). Total number of indebted household was 114,500, 55,300 being farm households, 23,400 being business owners, 21,600 salary workers and 14,200 economically inactive households.

**Table 3.9 Average amount of debt per household with debt by source of borrowing and socio-economic class, 2006**

Items	Farm operators	Business owners	Salary workers
Total amount of indebted households (number) <sup>1/</sup>	55,300	23,400	21,600
Total debt (baht/household)	184,299	150,562	1,103,295
Loan from formal sector (baht/household)	179,461	126,550	1,082,312
Percent	97	84	98
Loan from informal sector (baht/household)	4,839	24,012	20,983
Percent	3	16	2

Source: Statistical National Office; Ministry of Information and Communication Technology, 2006

Note: 1/ one household could report more than one purpose of borrowing

### 3.3 Rice production system

In 2006, Phayao has more than 609,000 *rai* of paddy rice. There are 608,058 *rai* wet-season rice area and 1,654 *rai* of dry-season rice area (Phayao Provincial Agricultural Extension office, 2006). Figure 3.4 shows the area that was suitable for rice cultivation. Popular rice varieties in Phayao province are RD 6 for glutinous rice, RD 15, and Kao Hom Mali 105 or Kaow Dawk Mali 105 (KDML105) for non-glutinous rice. In 1995/96 total glutinous rice area was 432,597 *rai*. In 2005/06, total glutinous rice planted area of province became lower i.e. 337,438 *rai*, and while non-glutinous rice area increased 225,551 to 410,825 *rai* (Table 3.10). Many farmers changed from glutinous rice to non-glutinous rice. As non-glutinous rice price tended to increase, glutinous area declined while non glutinous rice area increased. Total glutinous rice production was 259,991 tons with an average yield 601 kg/*rai* in 1995/96, then in 2005/06 total production were 250,603 tons with an average yield 610 kg/*rai*. For non-glutinous rice, total production rose from 128,564 tons to 239,511 tons because of land expansion, but the range of average yield was 547-590 kg/*rai*. Average yields of glutinous rice and non glutinous rice did not vary very much.

#### 3.3.1 Cropping pattern

Cropping patterns in the lowlands consisted of rice and non-rice production. Rice is the dominant crop in the cropping systems in the study area and mung bean or garlic becomes the second important crop. For wet-season rice, farmers will cultivate rice in the beginning of July and finish harvesting in middle of November until end of December. After that farmers will plant mung bean or garlic. Normally in irrigated areas, farmers plant mung bean or garlic in the dry season (Figure 3.5).

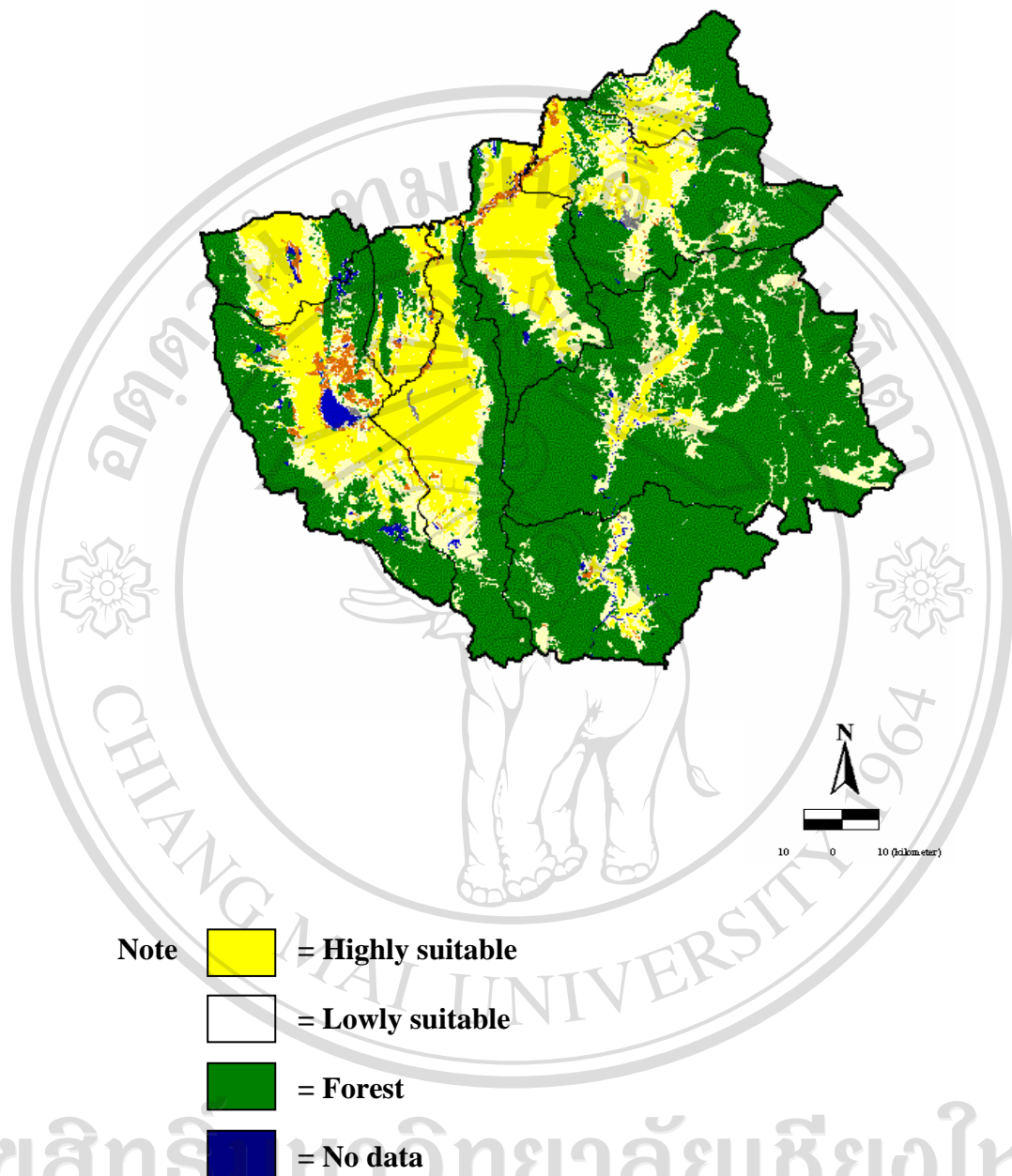


Figure 3.4 Suitable rice area in Phayao

Source: Office of Agricultural Economics, 2006

**Table 3.10 Wet season rice area and rice yield in Phayao province: 1995 - 2006**

Year	Non-glutinous rice			Glutinous rice		
	Area (rai)	Total production (ton)	Average yield (kg/rai)	Area (rai)	Total production (ton)	Average yield (kg/rai)
1995/96	225,551	128,564	570	432,597	259,991	601
1996/97	217,654	127,981	588	420,123	257,956	614
1997/98	231,987	126,897	547	356,441	203,528	571
1998/99	182,507	103,299	566	493,588	289,736	587
1999/00	192,674	102,695	533	487,540	275,948	566
2000/01	243,535	143,686	590	452,364	266,442	589
2001/02	259,942	145,568	560	458,961	271,705	592
2002/03	281,974	162,135	575	468,031	289,243	618
2003/04	353,755	192,443	544	413,776	241,645	584
2004/05	364,950	213,496	585	387,323	231,619	598
2005/06	410,825	239,511	583	410,825	250,603	610
2006/07	410,825	na	na	337,438	na	na

Source: Phayao Provincial Agricultural Extension office, 2006

Note: na = no amount

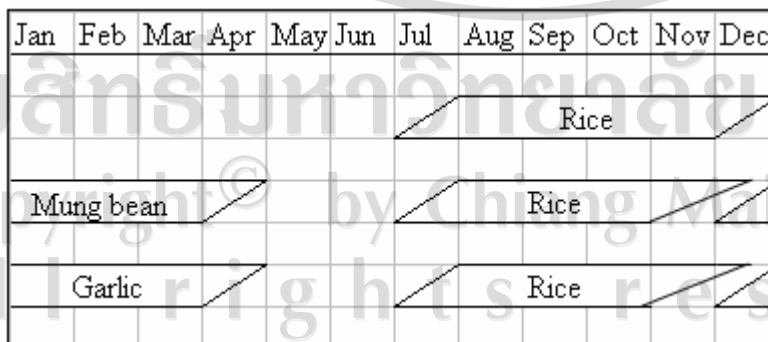


Figure 3.5 Pattern of wet season rice

Source: Survey, 2007



### 3.3.2 Rice marketing and market price

Glutinous rice is popular for consumption. So, farmers choose to plant glutinous rice before they plant non-glutinous rice or rice that they think has high price. Generally, rice is grown for household consumption. The surplus is partly sold to the local merchant and partly to the rice mills. Some of rice farmers keep the rice until they get better price but most of the farmers need cash for debt repayment. So they sell immediately after harvesting. Both of the merchant and rice mills sell to the exporters. The rice mills also supply directly to the local consumers or to the local retail (Figure 3.6).

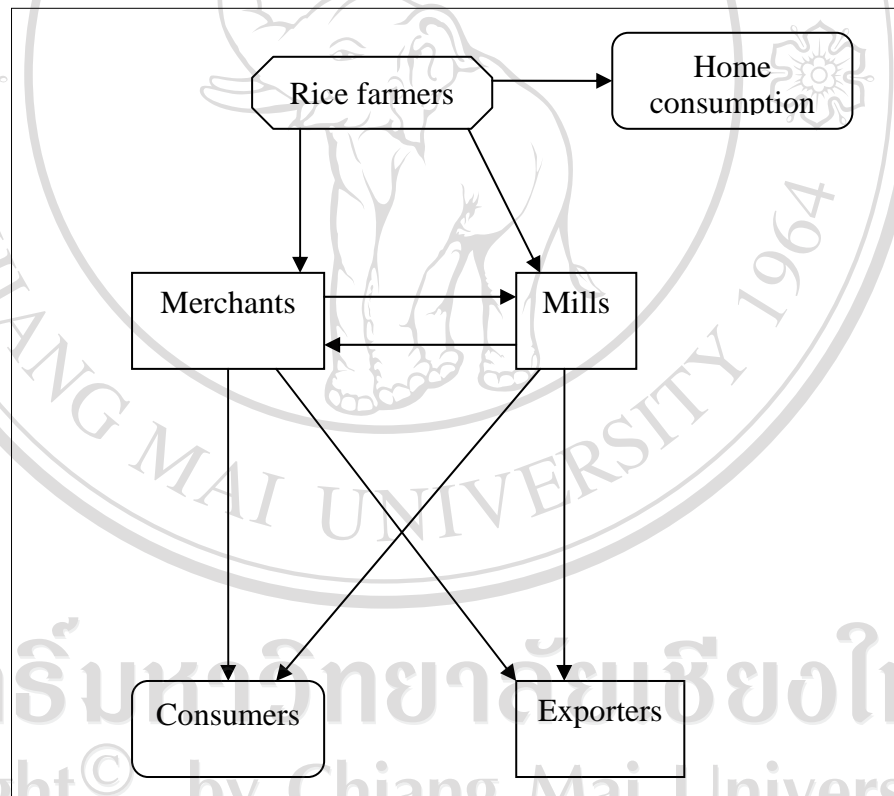


Figure 3.6 Rice marketing channel

In Phayao province, RD15 market price was similar to KDML105 market price. Non-glutinous rice (RD15 and KDML105) market price was higher than glutinous rice (RD6). RD15 and KDML105 market price increased from 5.067 baht/kg in 1994/95 to 8.371 baht/kg in 2007/08. RD6 market price increased from 3.708 baht/kg in 1994/95 to 8.278 baht/kg in 2007/08 (Table 3.11).

**Table 3.11 Market price of rice, 1994-2007**

Year	RD15	KDML105	RD6
	----baht/kg----		
1994/95	5.067	5.067	3.708
1995/96	4.519	4.519	4.417
1996/97	5.787	5.787	5.280
1997/98	8.443	8.443	7.382
1998/99	9.036	9.036	7.845
1999/20	7.673	7.673	5.202
2000/01	8.460	8.460	5.202
2001/02	5.685	5.685	5.254
2002/03	5.727	5.728	5.927
2003/04	8.137	8.096	5.492
2004/05	8.692	8.765	5.898
2005/06	8.653	8.714	6.759
2006/07	8.405	8.400	6.419
2007/08	8.371	8.371	8.278

Source: Department of Internal Trade, 2007 and 2008

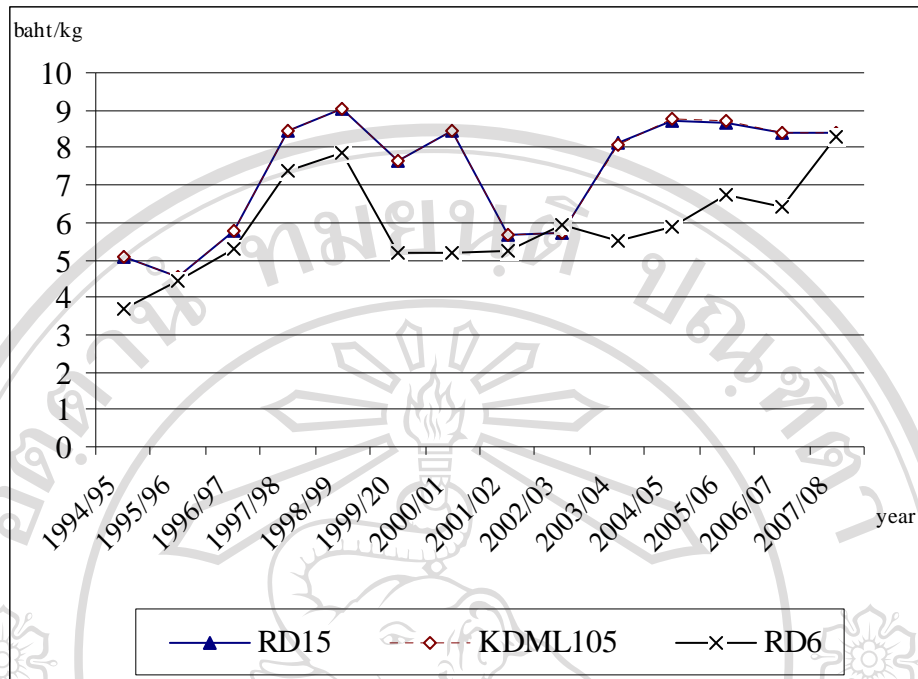


Figure 3.7 Market price of rice in Phayao, 1994/95-2007/08

Source: Department of Internal Trade, 2007 and 2008

### 3.3.3 Rice mortgage and government support price

The Rice Policy Committee in the Department of Internal Trade determines the rice policy to maintain the stability of paddy rice prices. The rice mortgage organization structure emphasizes the private sector. The Bank for Agriculture and Agricultural Cooperatives will accept paddy mortgages from small-scale farmers and members of the Farmers Institute. The mortgage contracts will be permitted and kept by the Public Warehouse Organization. Farmers who have the issued certificates or who are client of the Bank for Agriculture and Agricultural Cooperatives can do the contract. The certificates are issued by Ministry of Agriculture and Cooperatives. Mortgage contracts must be not over 350,000 baht per farmer and maintenance fee or warehouse fee is 20 baht per ton of rice per month.

In Phayao province, KDML105 government support price was high especially during 2004/05 – 2007/08. It increased from 6.495 baht/kg in 1994/95 to 8.850 baht/kg in 2007/08. RD15 government support price increased from 5.014 in 1994/95 to 7.375 baht/kg in 2007/08. RD6 government support price increased from 5.784

baht/kg in 1994/95 to 7.700 baht/kg in 2007/08. RD15 had the lowest government support price.

**Table 3.12 Government support price, 2000-2007**

Year	RD15	KDML105	RD6
	----baht/kg----		
2000/01	5.014	6.495	5.748
2001/02	4.766	6.900	5.775
2002/03	5.064	6.667	5.775
2003/04	5.064	6.900	5.775
2004/05	6.400	8.900	7.100
2005/06	6.700	9.900	7.400
2006/07	7.375	8.850	7.700
2007/08	7.375	8.850	7.700

Source: Office of Commercial affair in Phayao, 2000-2008

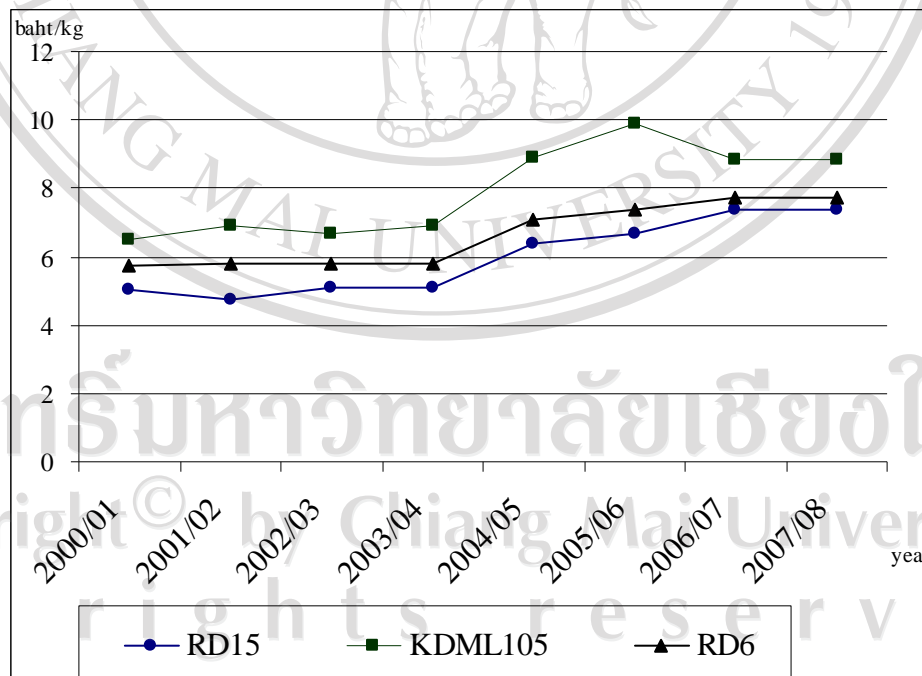


Figure 3.8 Government support prices of rice in Phayao, 2000/01-2007/08

Source: Office of Commercial Affairs in Phayao, 2000-2008

### 3.3.4 Rice Varieties

Rice (*Oryza Sativa L.*) is a short-lived plant related to the grass family, with a life cycle of 3-7 months. The span of one cycle varies, depending on its type and the growing environment. Rice growing usually requires an irrigation system and properly leveled fields. In general, the rice family could be broken down into three main categories:

1. Indica (long grain) - grown in the warm climate region, such as Thailand, India, Pakistan, Brazil, and Southern USA.
2. Japonica (round grain) - grown in the cold weather area, such as Japan, Korea, Northern China and California.
3. Javanica (medium grain) - only grown in Indonesia

Thai Jasmine rice belongs to the Indica (long-grain) category and could be divided into 4 sub-categories: Kao Dok Mali, RD15, Klongluang, and Suphan. The next section will present rice varieties in Phayao province. There are RD6 for glutinous rice, RD15, and Kao Hom Mali 105 or Kao Dok Mali 105 (KDML105) for non-glutinous rice in Phayao province. This province has an environment that is appropriate for these rice production.

#### RD 15

RD15 belongs to Thai jasmine rice family. It is non glutinous rice and the characteristic is similar KDML105 because RD15 was modified from KDML105. It can withstand drought. Therefore this rice can be planted in high area that with less rain. Harvesting period is short. When cooked, it has good smell and good taste like KDML105. In Phayao province, RD15 price is nearly as high as KDML105 price. In some districts KDML105 and RD15 have the same price. Its rice grain is good and easy to grind in mill. The quality of rice grain is similar to KDML105. However, the stems of this rice is easy to lodge and not able to be planted in bad water management area.

Based on the data in Phayao province, in 2000/01 the average RD15 yield was about 644 kg/rai. It became lower in 2005/06 at 539 kg/rai. Its returns using market

price was 3,134 baht/rai in 2000/01 then increased to 4,668 baht/rai. The profit increased from 1,190 baht/rai in 2000/01 to 1,858 baht/rai in 2005/06. However, profit under government support price also decreased from 1,730 baht/rai in 2000/01 to 1,127 baht/rai in 2005/06. Besides, farmers earned low profit in some years. For example, profit was only 583 and 304 baht/rai in 2001/02 and 2003/04 respectively. This was because of high cost of production. During 2000/01- 2005/06, the costs of RD15 production rose from 1,907 baht/rai to 2,810 baht/rai because of increasing labor cost and input cost. For example wage increased from 100 baht/rai to 150 baht/rai (Table 3.13).

**Table 3.13 Yield, cost, price, income and profit of RD15 rice in Phayao province**

Items	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Yield <sup>1</sup> (kg/rai)	644.33	541.58	489.63	470.08	521.00	539.48
Cost <sup>1</sup> (baht/rai)	1,907	1,997	1,370	2,076	2,301	2,810
Returns by using market price <sup>2</sup> (baht/rai)	3,134	3,079	2,804	3,825	4,529	4,668
Return by using government support price <sup>2</sup> (baht/rai)	3,231	2,581	2,479	2,380	3,334	3,615
Profit under market price <sup>2</sup> (baht/rai)	1,190	1,082	1,434	1,749	2,228	1,858
Profit under government support price <sup>2</sup> (baht/rai)	1,730	584	1,109	304	1,033	1,127

Source: <sup>1</sup> Office of Agricultural Economics, 2003; Office of Agricultural Economics, 2007; Bank of Agriculture and Agricultural Cooperatives, 2003, 2004

<sup>2</sup> From calculations

**KDML 105**

KDML105 rice is also called jasmine rice. Being Thai aromatic rice, Jasmine rice is originally from Thailand. It was discovered as the Kao Hom Mali 105 or Kaow Dawk Mali 105 variety (KDML105) by Sunthorn Seehanern, an official of the Ministry of Agriculture in the Chachoengsao province of Thailand in 1954. Good characteristics of KDML105 include resistance to drought and acid soil. It has good smell and good taste. Harvesting and threshing is easy. Rice grain is good and easy to mill. Price of this rice is high. However, the stems of this rice variety are not strong and grain weight is light. KDML105 is suitable for wet season only.

From data in Phayao province, in 2000/01 to 2005/06, the average KDML105 yield varied from 445 to 545 kg/rai. Yield tended to be low and the costs of KDML105 production increased during 2000/01 to 2005/06. It was 1,501 baht/rai in 2000/01, afterward 2,527 baht/rai in 2005/06. Returns using market price was 3,097 baht/rai in 2000/01 and then in 2005/06, it increased to be 4,441 baht/rai. Profit was 1,596 baht/rai in 2000/01, after that profit was 1,914 baht/rai in 2005/06. Moreover profit by using government support price also increased from 1,634 baht/rai in 2000/01 to 2,208 baht/rai in 2005/06 (Table 3.14).

**Table 3.14 Yield, cost, price, income and profit of KDML105 rice in Phayao province**

Items	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Yield <sup>1</sup> (kg/rai)	545.22	554.70	495.14	502.35	445.00	509.61
Cost <sup>1</sup> (baht/rai)	1,501	1,937	1,642	2,324	2,410	2,527
Returns by using market price <sup>2</sup> (baht/rai)	3,097	3,153	2,836	4,067	3,900	4,441
Return by using government support price <sup>2</sup> (baht/rai)	3,541	3,827	3,301	3,466	3,961	5,045
Profit under market price <sup>2</sup> (baht/rai)	1,596	1,216	1,194	1,743	1,490	1,914
Profit under government support price <sup>2</sup> (baht/rai)	1,634	1,891	1,659	1,143	1,551	2,208

Source: <sup>1</sup> Office of Agricultural Economics, 2003; Office of Agricultural Economics, 2007; Bank of Agriculture and Agricultural Cooperatives, 2003, 2004

<sup>2</sup> From calculations



**RD 6**

RD6 rice is glutinous variety usually called that Gor Kor 6. This rice has tough stems. It is resistance to drought. Stems of this rice are strong and not easy to fall and tussock spread well. It can adjust itself to new environment. It is suitable for planting in lowlands and easy to be harvested. Ears of paddy and rice grain are long. Yield is high. When cooked, it has good smell and taste. However it can be planted only in wet season. RD6 is a traditional rice variety that is popular rice for consumption in northern Thailand. Most of farmers are willing to produce this rice variety even at low prices.

Based on the data in Phayao province, RD6 production costs were around 2,082-2,480 baht/rai from 2000/01 to 2005/06. RD6 yield quite fluctuated. The average RD6 yield was approximately 542 kg/rai in 2000/01, and it was 522 kg/rai in 2005/06. However highest average RD6 yield was 616 kg/rai. The lowest was 490 kg/rai in 2003/04. Returns using market price was 2,819 baht/rai in 2000/01 then in 2005/06, it increased to 3,535 baht/rai so farmers' profit was 1,055 baht/rai in 2005/06. Profit under government support price also increased from 1,033 baht/rai in 2000/01 to 1,254 baht/rai in 2005/06 (Table 3.15).

**Table 3.15 Yield, cost, price, income and profit of RD6 rice in Phayao province**

Items	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Yield <sup>1</sup> (kg/rai)	542.00	616.87	533.60	499.94	530.00	522.98
Cost <sup>1</sup> (baht/rai)	2,082	1,755	1,636	2,061	2,185	2,480
Returns by using market price <sup>2</sup> (baht/rai)	2,819	3,241	3,163	2,746	3,126	3,535
Return by using government support price <sup>2</sup> (baht/rai)	3,115	3,562	3,081	2,887	3,763	3,870
Profit under market price <sup>2</sup> (baht/rai)	737	1,486	1,527	685	941	1,055
Profit under government support price <sup>2</sup> (baht/rai)	1,034	1,807	1,446	826	1,578	1,255

Source: <sup>1</sup> Office of Agricultural Economics, 2003; Office of Agricultural Economics, 2007; Bank of Agriculture and Agricultural Cooperatives, 2003, 2004

<sup>2</sup> From calculations

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Each rice variety has different characteristics that are shown in Table 3.16. This table shows comparison among RD15, KDML105, and RD6 in term of disease endurance, insect pest endurance, drought and flooding tolerance.

RD15 can resist brown spot and root-knot nematode, but it cannot resist tungro, blast, sheath blight, bacterial leaf blight and ragged stunt. For insect pest disease, it cannot resist thrips, brown planthopper, green leafhopper, stem borers, common armyworm, gall midge and leaf folder. RD6 is tolerant to droughts but it is not tolerant to floods.

KDML105 is only root-knot nematode tolerant but for tungro, blast, sheath blight, bacterial leaf blight, ragged stunt and brown spot, it is not tolerant. Besides, KDML105 is not resistant to thrips, brown planthopper, green leafhopper, stem borers, common armyworm, and leaf folder. However it has tolerance to rice gall midge, and it has good endurance to both floods and drought.

For RD6, it has disease endurance for blast and brown spot but not resistant to bacterial leaf blight. It is also not tolerant to thrips, brown planthopper and gall midge. However it has high endurance to drought and floods.

**Table 3.16 Comparison property among RD15, KDML105, and RD6**

Items	RD15	KDML105	RD6
<b>Rice diseases endurance</b>			
Tungro (Viral)	NO	NO	na
Blast	NO	NO	YES
Sheath blight	NO	NO	na
Bacterial leaf blight	NO	NO	NO
Ragged stunt (Viral)	NO	NO	na
Brown spot	YES	NO	YES
Root-knot nematode	YES	YES	na
<b>Rice insect pest endurance</b>			
Rice thrips	NO	NO	NO
Brown planthopper	NO	NO	NO
Green rice leafhopper	NO	NO	na
Rice stem borers	NO	NO	na
Common armyworm	NO	NO	na
Rice gall midge	NO	YES	NO
Rice leaf folder	NO	NO	na
Drought, lack of water	++	++	+++
Flooding	+	++	+++

Source: Rice Research Institute, Department of Agriculture, 1999; Department of Rice, 2008; Nakhonsawan Rice Seed Center, 2008.

Note: na = not available

+ = low tolerance

++ = medium tolerance

+++ = very good tolerance

### 3.3.5 Rice production

#### Rice yield

From the survey conducted in this study, it was found that an average RD15 yield in rainfed areas was 514.6 kg/rai, average KDML105 yield in rainfed areas was 470.4 kg/rai, and average RD6 yield in rainfed was 523.0 kg/rai. In irrigated area, average RD15 yield was 510.8 kg/rai, for average KDML105 yield was 493.1 kg/rai, and RD6 532.3 kg/rai (Table 3.17). Test of significance did not reveal any significance in yield between each rice variety in both rainfed and irrigated area.

**Table 3.17 Average rice yield for each rice variety**

Rice variety	Rainfed area	Irrigated area
	----- kg/rai -----	
RD15	514.6	510.8
KDML105	470.4	493.1
RD6	523.0	532.3

Source: Survey, 2007

#### Rice variable costs and gross margin

Variable costs of production for each activity were the aggregate costs of purchased inputs. These inputs include crop seed, fertilizer, chemical, hired machinery and labor. Variable costs of production of each rice variety are shown in Table 3.18. Total variable costs in rainfed area of RD15 were found to be 2,331 baht and in irrigated area, 2,359 baht. For KDML105, it has total variable costs in rainfed area and irrigated area about 2,344 and 2,341 baht respectively. RD6 total variable cost in rainfed area is 2,408 baht and in irrigated area, 2,337 baht. Considering all of total variable costs, it was found that they are similar. Labor costs were mainly variable costs. In rainfed areas, labor costs of RD15, KDML105, and RD6 were 1,406 1,458 and 1,357 baht/rai respectively. Labor costs in irrigated area of RD15, KDML105, and RD6 were 1,349 1,506 and 1,305 baht/rai respectively. RD15 material costs in rainfed area were 925 baht/rai, in irrigated area was 1,009 baht/rai. KDML105 material costs in rainfed area were 885 baht/rai, and in irrigated area, 835

baht/rai. RD6 material costs is the highest, in rainfed area was 1,051 baht/rai, and in irrigated area, 1,031 baht/rai.

Gross income of RD15, KDML105, and RD6 in rainfed areas were found to be 4,325 4,071 and 3,447 baht/rai respectively, and in irrigated areas 4,321 4,297 and 3,598 baht/rai respectively. Gross margin per rai of crops were obtained by multiplying yield with price, then minus variable costs. Data in 2005/2006 in the lowland were obtained from the survey. RD15 gross margin in rainfed area was 1,994 baht/rai, and in irrigated area 1,962 baht/rai. KDLM105 gross margin in rainfed area was 1,727 baht/rai, and in irrigated area 1,956 baht/rai. RD6 gross margin in rainfed area was the lowest, it 1,039 baht/rai, and in irrigated area it was 1,261 baht/rai.

### **Labor Use**

Labor use for rice production activities was classified in to 12 periods: early July until late December (Table 3.19). Units of labor use were man-days according to patterns of farmers' crop production in crop year 2005/2006. Man-days were estimated on the basis of 8 working hours per day. Table 3.18 presents the amount of labor use (man-days) per rai for growing each rice crop in the lowlands.

From late July until early August, around 1.22 – 4.04 man-days were needed for starting rice cultivation. After planting, farmers would take care and manage water system in their paddy fields. Harvesting and transporting start from early November until late December. Labor use was around 1.51 – 4.67 man-days.

**Table 3.18 Variable costs of production of RD15, KDML105, and RD6 in rainfed and irrigated area in crop year 2005/2006**

Items	RD15		KDML105		RD6	
	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated
	----baht/rai----					
Total income	4,325	4,321	4,071	4,297	3,447	3,598
Total variable costs	2,331	2,359	2,344	2,341	2,408	2,337
Material costs	925	1,009	885	835	1,051	1,032
seeds	120	66	102	76	115	79
chemicals	53	59	95	89	77	42
fertilizers	384	319	380	268	359	400
gasolines	110	161	111	98	117	146
others	258	406	197	283	382	365
Labor costs	1,406	1,349	1,458	1,506	1,357	1,305
ploughing	700	300	333	490	600	559
planting	350	350	423	416	336	350
harvesting	306	699	703	600	421	396
Gross margin	1,994	1,962	1,727	1,956	1,039	1,261

Source: Survey, 2007

**Table 3.19 Labor use in each rice variety in crop year 2005/2006**

Unit: man-days

Item	Month											
	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late
	July	July	Aug.	Aug.	Sept.	Sept.	Oct.	Oct.	Nov.	Nov.	Dec.	Dec.
RD15 labor in rainfed area	1.09	1.90	0.20	0.19	0.15	0.08	0.17	0.08	2.24	0.41	1.07	-
RD15 labor in irrigated area	1.11	3.41	0.28	0.64	0.68	0.52	0.69	0.52	2.07	0.36	3.22	-
KDML105 labor in rainfed area	1.10	3.99	0.10	0.52	0.27	0.38	0.16	0.14	0.78	4.67	0.98	2.15
KDML105 labor in irrigated area	0.92	3.59	0.44	0.39	0.32	0.21	0.19	0.22	0.11	3.97	0.80	2.26
RD6 labor in rainfed area	-	1.22	4.04	0.10	0.67	0.63	0.68	0.31	0.42	2.22	0.83	1.51
RD6 labor in irrigated area	-	1.75	2.31	0.21	0.52	0.55	0.48	0.26	0.39	2.76	0.63	2.51

Source: Ekasingh, *et al*, 2006