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AGRICULTURAL & LIVESTOCK DATA

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MORNING PSALM

THE words of my psalm
ascend in the smoke of the kitchen
billowing to heaven
and on the stove
my wife boils milk-
Your first blessing to man.
The words of my psalm
run from valley to valley
and at the edge of the horizon
marry the silence
which has long awaited them.
Buffalo enter the river
stir up the pure water
challenging day
and the final judgment.
And
in the fresh air
perfume scatters
from the robe of an angel.
You lay Your beautiful body
down in the high mountains
from below it seems
like a cloud bathed in light.
Ducks lay
at the touch of Your hand.
Fish leap in the water
and the rice waves
greeting You.
The pine trees in the mountains
tickle Your feet
mischievously.
So You arise
to go to another sky
laughing and scattering beauty
walking, rising up, with the sun.
And the sun climbs
and climbs and climbs,
drying the shirt and trousers
my wife washed.

Rendra

1. Introduction

This volume describes the agricultural and animal husbandry activities in the survey villages. The agricultural data includes information on the levels of production and inputs, and the processing, storage and sale of crops. This data was collected to identify the potential for using agricultural residues as sources of fuel in the different renewable energy technologies and to determine the current requirements for agricultural inputs including energy. The animal husbandry data includes information on the ownership and trading of animals, the types of feed and shelter and the uses of animal dung. This data was collected to determine the sources of animal dung which are available for use in biogas technology as well as the number of animals used as a source of power for agricultural work.

2. Land Ownership and Use

The pattern of land ownership in the survey villages is shown in Table 1 for each province. One-sixth of the households own no land. The percentage of landless is highest in Chiang Mai, Lampang, and Korat, and lowest in Petchaburi, Roi-Et and Songkla. The largest land holdings are in Kampanghet, Udorn Thani, and Petchaburi. The median amount of land owned by all households including the landless is 18 rai in Petchaburi, 11 rai in Korat, 14 rai in Srisaket, 24 rai in Kampanghet, 4 rai in Lampang, 3 rai in Chiang Mai, 14 rai in Songkla, 10 rai in Chantaburi, 20 rai in Roi-Et, and 21 rai in Udorn Thani.

Several other forms of land tenure are used in Thailand to increase the amount of land cultivated. These arrangements include cash rental, share-cropping, encroachment on free land and farming of public land. The extent of their use is shown in Table 2. The provinces in which alternative arrangements are most important are: Petchaburi, Kampanghet, Lampang, Chantaburi and Songkla. The distribution of land ownership and the use of alternative land tenure arrangements are discussed in greater detail in the volume "Socio-Economic Data".

The total agricultural area controlled by each household was determined by adding together the land owned and the land controlled under other systems of tenure. The results are shown in Table 3. The median area controlled is 23 rai in Petchaburi, 17 rai in Korat, 22 rai in Srisaket, 32 rai in Kampanghet, 7 rai in Lampang, 17 rai in Songkla, 15 rai in Chantaburi, 21 rai in Roi-Et, 27 rai in Udorn Thani, and 6 rai in Chiang Mai. The percentage of households controlling small land areas is less than ten percent except in Lampang and Chiang Mia, Chantaburi and Korat, where 47 percent and 47 percent, 22 percent and 13 percent, respectively, control six or less rai. The percentage of households controlling large land areas is highest in Kampanghet, Udorn Thani, Petchaburi, Roi-Et and Srisaket where 72 percent, 66 percent, 56 percent, 52 percent, and 55 percent, respectively, control over 20 rai. The minimum area controlled by any survey households is one rai.

Table 1
Amount of Land Owned Per Household by Changwat
 (Percentage of Households)

Changwat	Amount of Land (RAI)											Ave
	None	1-3	4-6	7-9	10-12	13-15	16-20	21-30	31-50	51-100	101 and More	
Petchaburi	3.1	3.1	9.4	7.3	7.3	9.4	16.1	19.3	18.2	9.6	0.5	24
Korat	25.0	3.6	7.7	5.6	14.3	5.6	12.2	13.8	6.6	4.1	1.5	24
Sisaket	19.6	1.5	4.5	9.5	11.6	4.5	7.0	16.1	20.6	5.0	-	25
Kampangphet	19.3	1.2	5.3	2.9	5.8	1.8	8.8	11.1	18.7	19.9	5.3	44
Lampang	25.4	22.4	26.9	9.5	6.5	4.0	1.5	2.0	1.5	0.5	-	7
Chiangmai	31.1	22.0	23.7	9.6	5.6	7.3	0.6	-	-	-	-	6
Songkla	7.8	5.6	12.3	9.5	7.8	10.1	12.8	21.8	8.9	3.4	-	18
Chantaburi	14.9	10.5	12.7	10.5	8.3	6.6	9.4	9.4	11.0	6.6	-	19
Roi-Et	4.3	1.2	2.5	4.9	13.6	10.5	13.6	22.2	24.1	1.9	1.2	24
Udonrthani	15.5	1.7	5.7	2.9	6.3	5.2	13.2	19.0	17.2	10.3	2.9	32

Table 2
Percentage of Households Possessing Land Under Various
Tenure Arrangements

Changwat	Control of Land (Percentage of Households)				
	Own	Cash Rental	Share Crop	Available for Free	Other
Petchaburi	96.9	4.2	16.7	8.9	17.7
Korat	75.0	8.2	9.2	15.8	3.6
Srisaket	80.4	4.0	5.5	14.6	6.0
Kampangphet	80.7	24.0	8.8	11.1	2.9
Lampang	74.6	1.5	10.0	5.5	22.9
Chiangmai	68.9	10.7	10.2	4.5	*
Songkla	92.2	16.8	5.1	20.7	*
Chantaburi	85.1	6.1	12.7	27.1	*
Roi-et	95.7	0.6	1.9	6.8	*
Udorn Thani	84.5	3.4	10.9	16.7	*

* Not available

The area planted by the household was computed for all crops and all seasons. The distribution of the total area planted is shown in Table 4. Although all households indicated that they control at least one rai, some of the households did not cultivate any land during the previous year. The percentage of households that did not plant averaged just less than 10 percent. The only two provinces which exceeded this figure were Udorn Thani and Chiang Mai with 36 percent and 15 percent, respectively. The highest percentages of households with planted areas in excess of 20 rai occurred in Kampongphet with 64 percent and in Korat and Roi-Et with 54 percent. The median area planted was 14 rai in Petchaburi, 15 rai in Korat, 23 rai in Srisaket, 30 rai in Kampongphet, 6 rai in Lampang, 8 rai in Songkla, 9 rai in Chantaburi, 22 rai in Roi-Et and 7 rai in Chiang Mai.*

Not all land is planted in rice. Significant areas of land in Korat, Kampongphet, and Petchaburi were planted in other crops. The median area planted in other crops was 3 rai in Petchaburi, 5 rai in Korat, 1 rai in Srisaket, 15 rai in Kampongphet, 1 rai in Lampang and Songkla, 2 rai in Chantaburi, 4 rai in Roi-Et and 2 rai in Chiang Mai. About 30 percent of the households did not have areas planted with non-rice crops. The distribution of areas planted in crops other than rice is shown in Table 5 for each province.

A comparison of the total area planted to the total area controlled was made for each household. The computed ratios indicate the extent to which the land is cultivated. The ratios are as shown in Table 6. The most intensive use of the available land was in Roi-Et and Srisaket where two-thirds and three-fifths, respectively, of the households planted an area greater than or equal to the amount they controlled. In Lampang, Chiang Mai and Korat the villagers also used their land extensively; about two-thirds of the household planted an area equal to 90 percent or more of the land controlled. In Chiang Mai, 8 percent of the households listed areas planted that were more than double the areas controlled.

The higher ratios of area-planted-to-area-controlled are due to multiple cropping. Double cropping of rice was not common as shown in the data in Table 7, however, most of the households planted a mixture of rice and upland crops. It is in the upland areas that double cropping is most common although rice and beans may be intercropped in the lowland areas.

3. Rice Cultivation

The head of households were asked about the period of time for rice cultivation from the start of land preparation to the end of harvesting. The answers varied due to differences in type of rice, growing periods,

*The data for Udorn Thani was not available at the time of publication.

Table 3
AGRICULTURAL AREA CONTROLLED
 (% OF HOUSEHOLDS)

AREA (RAI) CHANGWAT	0	1-2	3-4	5-6	7-8	9-10	11-15	16-20	21-30	31-50	>50
PETCHABURI	-	-	1.1	5.3	2.1	4.3	13.9	17.1	21.4	21.9	12.8
KORAT	-	2.4	4.2	6.5	4.2	11.3	17.3	13.1	20.8	12.5	7.7
SRISAKET	-	1.1	0.5	4.8	9.6	9.0	10.6	9.0	22.3	25.5	7.4
KAMPHAENGPHE	-	1.2	2.5	3.1	1.9	5.0	3.7	10.6	16.9	20.0	35.0
LAMPANG	-	12.7	15.6	18.5	12.7	13.3	12.7	4.6	6.4	2.9	0.6
SONGKHLA	-	-	2.3	6.9	6.3	9.1	18.9	14.3	24.0	14.9	3.4
CHANTHABURI	-	7.0	7.0	8.2	5.8	5.3	19.3	12.9	13.5	14.0	7.0
ROI-ET	-	1.3	1.3	1.9	1.9	9.4	16.4	16.4	22.0	25.8	3.8
UDORNTHANI	-	1.8	1.8	3.0	1.8	5.4	7.8	12.7	24.1	22.3	19.3
CHIANGMAI	-	14.8	17.4	24.8	12.8	8.1	16.8	4.7	0.7	-	-

Table 4
Total Area Planted
 (Percentage of Households)

Area (Rai)	0	1-2	3-4	5-6	7-8	9-10	11-15	16-20	21-30	31-50	Greater than 50
Changwat											
Petchaburi	6.4	3.2	5.9	7.5	9.6	6.4	15.5	16.6	16.6	9.1	3.2
Korat	4.8	1.8	4.2	6.5	6.5	11.3	17.3	15.5	17.9	10.7	3.6
Srisaket	2.7	-	2.1	2.7	3.7	11.7	16.0	6.9	19.7	26.1	8.5
Kamphangphet	3.7	1.9	1.2	2.5	5.0	5.0	10.6	8.1	13.1	26.2	22.5
Lampang	8.1	11.6	14.5	17.3	12.7	8.7	13.9	6.9	4.0	1.7	0.6
Songkla	4.6	4.0	12.0	18.3	20.6	15.4	20.0	4.0	1.1	-	-
Chantaburi	10.5	5.8	9.4	11.7	9.9	9.4	19.9	9.4	7.6	2.9	3.5
Roi-et	2.5	1.3	-	1.3	1.9	3.8	16.4	18.9	26.4	23.3	4.4
Chiang Mai	14.8	7.4	10.7	9.4	16.8	13.4	16.8	4.0	3.4	-	3.4

Table 5
AREA PLANTED - NON RICE
 (% OF HOUSEHOLDS)

AREA (RAI) CHANGWAT	0	1-2	3-4	5-6	7-8	9-10	11-15	16-20	21-30	31-50	50
PETCHABURI	38.0	9.1	9.1	5.3	9.1	7.0	9.6	5.3	5.3	2.1	-
KORAT	39.3	1.2	4.8	7.7	5.4	14.3	10.7	5.4	5.4	4.8	1.2
SRISAKET	30.9	55.3	9.6	1.1	-	1.6	0.5	0.5	-	0.5	-
KAMPHAENGPHE	16.9	3.1	6.3	5.0	4.4	5.6	8.7	12.5	13.1	16.2	8.1
LAMPANG	41.0	27.7	14.5	7.5	2.3	2.3	1.2	2.3	0.6	0.6	-
SONGKHLA	42.9	24.6	21.1	6.3	1.7	0.6	2.3	0.6	-	-	-
CHANTABURI	41.5	11.1	17.0	12.3	4.1	6.4	3.5	3.5	0.6	-	-
ROI-ET	3.1	28.9	29.6	13.2	13.2	5.0	3.1	1.9	1.3	-	0.6
CHIANGMAI	23.5	24.8	22.1	15.4	6.0	2.0	4.7	1.3	-	-	-

Table 6

Ratio of Total Area Planted to Area Controlled
(Percentage of Households)

Ratio	.01-.30	.30-.60	.60-.90	.90-1.0	1.00-1.50	1.50-2.00	2.00
Changwat							
Petchaburi	20.9	26.2	26.7	19.8	4.3	1.6	0.5
Korat	6.5	8.9	17.9	53.0	8.9	2.4	2.4
Srisaket	4.3	3.2	3.7	30.3	55.3	3.2	-
Kampangphet	13.7	11.9	17.5	29.4	16.2	9.4	1.9
Lampang	15.0	12.7	8.7	33.5	16.8	8.1	5.2
Chiang Mai	16.1	3.4	10.1	24.2	16.1	22.1	8.1
Songkla	32.0	32.0	21.0	8.0	4.6	1.1	1.1
Chantaburi	22.8	22.8	23.4	23.4	2.9	1.8	2.9
Roi-et	2.5	2.5	10.7	17.0	64.8	1.9	0.6

Table 7 .
MULTIPLE CROPINGS OF RICE
 (PERCENTAGE OF HOUSEHOLDS)

CHANGWAT	PLAIN RICE			STICKY RICE		
	NO	ONCE	TWICE	NO	ONCE	TWICE
PETCHABURI	19.8	79.2	1.0	68.8	31.3	-
KORAT	23.0	73.0	4.1	53.6	46.4	-
SRISAKET	11.6	88.4	-	61.8	38.2	-
KAMPANGPHET	45.6	53.2	1.2	91.8	8.2	-
LAMPANG	96.5	3.5	-	24.4	73.1	2.5
CHIANGMAI	99.4	0.6	-	35.6	61.6	2.8
SONGKHLA	8.4	88.8	2.8	31.8	67.6	0.6
CHANTABURI	28.7	69.6	.7	51.9	48.1	-
ROI-ET	48.1	51.9	-	6.2	93.2	0.6
UDORNTHANI	40.2	59.8	-	12.1	84.5	3.4

and the timing of land preparation vis-a-vis the start of the rainy season. The median period is between 5 and 6 months although the answers range from four to seven months (see Table 8). Some of the answers in excess of 7 months are from households that double crop the rice. However, the relatively high percentage of responses for periods over 7 months are difficult to explain. This occurs for sticky rice in Roi-Et, Srisaket, Udorn Thani and Songkla and for plain rice in Petchaburi, Korat, Srisaket, Songkla and Roi-Et. Agricultural conditions and farming techniques may explain the longer periods of cultivation in Udorn Thani, Srisaket, Roi-et and Korat.

The total production of rice varies with the type of rice, the area planted and the yields. The distribution of level of production for the survey households in the previous year is shown in Table 9. Sticky rice is the primary crop in Lampang, Chiang Mai, Roi-Et and Udorn Thani where it is grown by 76 percent, 63 percent, 95 percent and 89 percent, respectively, of the households. The median level of sticky rice production per household for these four provinces is 1900 kilograms, 2400 kilograms, 2300 kilograms and 3800 kilograms, respectively. In the other provinces plain rice is the primary crop. It is grown by 81 percent of the households in Petchaburi, 77 percent in Korat, 91 percent in Srisaket, 65 percent in Kamphangphet, 92 percent in Songkla and 71 percent in Chantaburi. The median amounts of plain rice grown in these six provinces are 3200, 3100, 3100, 8000 kilograms, 1400, and 2400 kilograms, respectively, per household. The median level of production for the total sample is 1100 kilograms of sticky rice and 2200 kilograms of plain rice, per household.

The rice yields for each household were calculated by dividing the gross production by the area planted. Since both numbers were obtained from the head of the household and are factored together, the reliability of the results is thought to be lower than for previous statistics. The actual yields are determined by a combination of factors including the type seed, fertility of soil, weather and availability of water. The variation of these factors among provinces and between villages explains much of the differences in yield. For plain rice the median yield in the previous year was over 400 kilograms per rai in Kamphangphet, Songkla, Lampang, and Chiang Mai, about 300 kilograms per rai in Petchaburi, Korat and Chantaburi, close to 250 kilograms per rai in Songkla and Udorn Thani, 190 kilograms per rai in Srisaket and only 170 kilograms per rai in Roi-Et. Yields of under 150 kilograms per rai were computed for 44 percent of the respondents in Roi-Et, 31 percent in Srisaket, 32 percent in Udorn Thani and 22 percent in Songkla. Yields of over 400 kilograms per rai were computed for 100 percent of the respondents in Chiang Mai, 58 percent in Kamphangphet, 57 percent in Lampang, 38 percent in Chantaburi, 36 percent in Korat and 34 percent in Petchaburi. The distribution of the yields is shown in Table 10.

The yields for sticky rice were generally lower than for plain rice. The median yield was over 400 kilograms per rai in Lampang and Chiang Mai, close to 250 kilograms per rai in Petchaburi and Chantaburi, near 225

Table 8
Period of Cultivation (Days)
 (Percentage of Households)

Changwat	Crop	No Response	120 or Less	121-150	151-180	181-210	Over 210
Petchaburi	sticky rice	69.3	2.6	6.8	8.9	8.9	3.6
Korat	"	51.4	4.1	8.2	8.7	17.3	7.7
Srisaket	"	62.3	2.0	5.5	4.0	13.1	13.1
Kampangphet	"	91.2	3.6	1.8	0.6	2.3	0.6
Lampang	"	24.9	15.5	9.5	24.4	3.5	2.0
Chiang Mai	"	35.6	9.6	21.5	25.4	3.4	4.5
Songkla	"	34.1	7.2	3.9	15.6	21.8	17.3
Chantaburi	"	53.6	5.0	12.7	17.1	9.9	1.7
Roi-et	"	6.8	-	3.7	30.9	11.1	47.5
Udon Thani	"	10.9	8.6	17.8	38.5	8.6	15.5
Petchaburi	Plain rice	22.4	2.1	7.3	32.8	7.3	28.1
Korat	"	24.0	1.5	8.7	13.8	35.2	16.8
Srisaket	"	13.1	4.0	11.1	31.7	23.6	16.6
Kampangphet	"	52.6	7.6	8.2	14.0	7.6	9.9
Lampang	"	96.5	-	1.0	1.5	0.5	0.5
Chiang Mai	"	99.4	-	-	0.6	-	-
Songkla	"	10.6	10.1	4.5	21.8	26.8	26.2
Chantaburi	"	30.9	7.2	14.9	22.1	19.3	5.7
Roi-et	"	48.8	0.6	2.5	15.4	5.6	27.1
Udon Thani	"	39.7	8.0	13.2	27.6	3.4	8.0

Table 9

DISTRIBUTION OF PRODUCTION QUANTITY BY CROP
(NUMBER OF HOUSEHOLDS - KG OF PRODUCT)

CHANGWAT	CROP	0	1-100	101-500	501-1000	1001-2000	2001-3000	3001-4000	4001-6000	6001-8000	OVER 8000
PETCHABURI	STICKY RICE	134	4	44	8	-	1	-	-	-	-
	PLAIN RICE	37	-	3	19	28	25	15	37	15	13
KORAT	STICKY RICE	109	17	60	8	2	-	-	-	-	-
	PLAIN RICE	46	1	3	10	36	22	33	25	10	10
SRISAKET	STICKY RICE	122	2	18	29	23	1	2	-	-	1
	PLAIN RICE	18	-	1	14	33	36	38	29	17	13
KAMPANGPHET	STICKY RICE	158	-	12	-	-	-	-	-	-	1
	PLAIN RICE	59	-	1	2	8	11	2	16	12	60
LAMPANG	STICKY RICE	48	1	8	26	47	31	11	16	7	5
	PLAIN RICE	194	-	2	3	1	1	-	-	-	-
CHIANGMAI	STICKY RICE	65	-	7	13	25	25	6	20	8	7
	PLAIN RICE	176	-	-	-	1	-	-	-	-	-
SONGKHLA	STICKY RICE	57	21	91	8	-	-	1	-	-	-
	PLAIN RICE	15	3	24	29	70	23	10	4	-	-
CHANTABURI	STICKY RICE	92	7	69	10	2	-	-	1	-	-
	PLAIN RICE	52	-	5	19	31	25	10	19	14	5
ROI-ET	STICKY RICE	8	-	7	15	40	44	22	18	6	1
	PLAIN RICE	78	20	42	13	6	1	-	-	-	1
UDORNTHANI	STICKY RICE	20	-	2	3	24	25	28	33	16	23
	PLAIN RICE	69	7	47	24	12	8	4	2	1	-

Table 10
Plain Rice Yield
(Percentage of Households)

YIELD (Kg/rai)	Percent Responding								
		≤ 90	91-150	151-210	211-250	251-300	301-400	Over 400	
Changwat									
Petchaburi	80	-	3	9	12	16	27	34	
Korat	76	3	10	10	12	8	22	36	
Srisaket	90	8	23	32	19	14	5	1	
Kampangphet	59	1	4	6	6	6	19	58	
Lampang	4	-	-	14	-	-	29	57	
Songkla	92	7	15	12	12	15	20	20	
Chantaburi	71	5	2	4	15	14	21	38	
Roi-et	51	20	24	21	12	9	7	7	
Udorn Thani	60	13	19	14	14	14	11	16	
Chiang Mai	1	-	-	-	-	-	-	100	

kilograms per rai in Srisaket and Udorn Thani, about 200 kilograms in Korat, Kamphangphet, and Songkla, and only 140 kilograms per rai in Roi-Et. Yields of less than 150 kilogram per rai were reported by 63 percent of the respondents in Roi-Et, 41 percent in Songkla and 30 percent in Korat. Yields in excess of 400 kilograms per rai were reported by 75 percent of the respondents in Chiang Mai, 51 percent in Lampang, and 30 percent in Kamphangphet. The distribution of yields for each province are shown in Table 11.

4. Non Rice Crops

A variety of cash crops are grown in the survey villages as shown in table 12. Cassava is a major crop in Korat, Udorn Thani and Chantaburi. Rubber is the predominant crop in Songkla and is an important secondary crop in Chantaburi. Tobacco is an important source of income in Srisaket, Roi-et, and especially in Chiang Mai. Sugar cane and corn are secondary crops in Petchaburi and Udorn Thani, while sugar cane by itself is an important crop in Lampang.

The cultivation of cash crops is most important in Kamphangphet, Korat, Songkla, Petchaburi, and Udorn Thani. The average area planted in cash crops is about 24 rai in Kampanphet, 14 rai in Korat, and 8 rai in Petchaburi. The data for Songkla does not include the area planted in rubber which is estimated to average over 15 rai. The data on Udorn Thani was not available, but is thought to be comparable to Petchaburi.

5. Inputs to Agriculture

The head of households were asked about their use of natural and chemical fertilizers, pesticides and insecticides. The application rates were recorded but no attempt was made to determine the type of manure or chemicals used. Therefore, the data presented in Table 13 is useful only to indicate the degree of use of agrochemicals for different crops in the survey villages. Manure is widely used for all major crops except cassava, rubber and sugar cane. It is used to fertilize rice in all provinces but at relatively low rates of application with the exception of Lampang, Chantaburi, and Udorn Thani. The highest application rates are for vegetables, tobacco and watermelon in Srisaket and Roi-Et. Kamphangphet and Songkla have the lowest rate of use of manure as a fertilizer. The use of manure is determined by its availability as well as the type of crops. Availability is determined not only by the number of animals but also by where they are kept and what they are fed. These factors are examined in the second half of this volume.

The use of chemical fertilizers is more prevalent than the use of manure in all provinces except Srisaket and Lampang. The percentage of respondents using chemical fertilizers is especially high in Songkla, Roi-Et and Udorn Thani. In fertile areas such as Petchaburi, Lampang,

Table 11
Sticky Rice Yield
 (Percentage of Households)

YIELD (Kg/rai)	Percent Responding	YIELD						
		≤ 90	91-150	151-210	211-250	251-300	301-400	>400
Changwat								
Petchaburi	30	5	19	15	12	10	16	21
Korat	43	16	14	24	10	10	19	8
Srisaket	39	6	11	30	13	21	16	5
Kampangphet	8	-	24	30	8	-	8	30
Lampang	76	3	5	6	7	7	21	51
Songkla	68	14	27	16	7	19	7	10
Chantaburi	49	6	11	15	15	16	11	26
Roi-Et	95	17	39	17	14	7	3	2
Udorn Thani	89	5	20	19	15	16	13	12
Chiang Mai	63	2	5	2	5	3	9	75

Table 12
Non-Rice Crops

Changwat	Principal Crops	Percent Planting Non-Rice Crops	Median Area Planted* (rai)	Average Area Planted* (rai)
Petchaburi	Cotton, Sugar Cane, Corn	62%	8	7.8
Korat	Cassava	61%	10	14.4
Srisaket	Tobacco	69%	2	2.5
Kampangphet	Corn, Cassava	85%	15	23.4
Lampang	Sugar Cane	59%	3	4.6
Songkla	Rubber	57%	3	3.6
Chantaburi	Cassava, Rubber	58%	4	6.1
Roi-et	Tobacco, Kenaf, Watermelon	97%	4	5.3
Udorn Thani	Cassava, Sugar Cane, Corn	N/A	N/A	N/A
Chiang Mai	Tobacco	76%	4	4.5

* For those planting non-rice crops.

AVERAGE QUANTITIES OF AGRO-CHEMICALS USED BY CROP AND VILLAGE

CHANGWAT	CROP	VILLAGE	NATURAL FERTILIZER		CHEMICAL FERTILIZER		PESTICIDE		INSECTICIDE	
			kg/RAI	% USING	kg/RAI	% USING	CC/RAI	% USING	CC/RAI	% USING
Petchaburi	rice	1	-	-	23	37	-	-	164	37
		2	100	14	14	43	825	14	235	38
		3	NI	6	20	44	NI	3	101	22
		4	57.1	23	13	17	NI	7	201	23
		5	273.3	31	NI	10	NI	7	270	41
	banana	1	-	-	NI	13	NI	9	NI	9
		2	NI	5	31	24	1974	24	-	-
		3	NI	4	85	48	1467	43	NI	14
		4	NI	12	59	28	2200	40	-	-
	sugar cane	1	-	-	NI	17	-	-	-	-
		2	-	-	60	58	2247	37	-	-
		5	-	-	-	-	875	NI	-	-
	lemon	3	-	-	95	14	1474	39	883	62
		4	-	5	174	68	1900	50	1455	27
		5	-	-	74	30	NI	15	NI	15
	potato	1	-	-	680	63	-	-	-	-
	Korat	rice	1	137	47	16	53	-	-	54
2			NI	9	-	-	NI	9	NI	32
3			25	16	-	-	-	-	NI	3
4			NI	10	25	17	-	-	NI	10
5			17	18	17	36	2	21	NI	18

Table 13 (continued)

(2)

AVERAGE QUANTITIES OF AGRO-CHEMICALS USED BY CROP AND VILLAGE

CHANGWAT	CROP	VILLAGE	NATURAL FERTILIZER		CHEMICAL FERTILIZER		PESTICIDE		INSECTICIDE	
			kg/RAI	% USING	kg/RAI	% USING	CC/RAI	% USING	CC/RAI	% USING
Sisaket	rice	1	38	48	16	80	-	-	-	-
		2	71	43	13	88	-	-	-	-
		3	21	19	10	78	-	-	-	-
		4	15	17	11	72	-	-	NI	3
		5	40	23	12	88	-	-	NI	3
	tobacco	1	-	-	13	71	-	-	550	57
		2	NI	60	NI	20	-	-	NI	20
		3	115	91	-	-	-	-	NI	9
		4	392	96	NI	14	-	-	225	55
		5	473	95	48	71	-	-	410	58
	vegetable	1	7	39	33	78	-	-	447	65
		2	186	80	NI	40	-	-	NI	60
		3	94	94	-	-	-	-	457	59
		4	371	82	NI	8	-	-	NI	25
		5	166	83	30	67	-	-	345	44
watermelon	5	331	90	54	95	-	-	333	60	
Kampangphet	rice	4	NI	10	13	45	8	35	75	60
	cassava	4	-	-	13	35	NI	6	NI	6
	sugar cane	4	-	-	NI	67	-	-	NI	33
	bean	4	-	-	NI	43	-	-	95	71

Table L3 (continued)

(3)

AVERAGE QUANTITIES OF AGRO-CHEMICALS USED BY CROP AND VILLAGE

CHANGWAT	CROP	VILLAGE	NATURAL FERTILIZER		CHEMICAL FERTILIZER		PESTICIDE		INSECTICIDE	
			kg/RAI	% USING	kg/RAI	% USING	CC/RAI	% USING	CC/RAI	% USING
Lampang	rice	1	211	37	-	-	-	-	NI	3
		2	237	47	50	9	-	-	92	34
		3	152	28	20	67	-	-	110	22
		4	172	89	NI	4	-	-	-	-
		5	30	39	NI	10	-	-	NI	3
	sugar cane	1	-	-	-	20	-	-	-	-
		2	-	-	50	88	NI	8	-	-
Songkhla	bean	3	43	67	14	42	-	-	NI	25
	garlic	3	35	80	NI	40	-	-	NI	20
	rice	1	24	14	24	100	-	-	NI	3
		2	30	21	21	94	NI	18	NI	3
		3	NI	6	82	100	-	-	NI	6
		4	NI	6	29	97	-	-	109	29
		5	-	-	26	89	-	-	-	-
	rubber	1	-	-	42	80	NI	8	-	-
		2	-	-	54	100	NI	7	-	-
		3	-	-	127	67	NI	11	-	-
		4	-	-	39	78	NI	4	-	-
		5	-	-	40	90	265	30	-	-
	vegetable	1	71	57	15	91	-	-	NI	48
		2	50	75	12	55	NI	10	NI	35
		3	106	100	30	-	-	-	NI	38
4		83	73	NI	27	-	-	-	-	

Table 13 (continued)
AVERAGE QUANTITIES OF AGRO-CHEMICALS USED BY CROP AND VILLAGE

(4)

CHANGWAT	CROP	VILLAGE	NATURAL FERTILIZER		CHEMICAL FERTILIZER		PESTICIDE		INSECTICIDE	
			kg/RAI	% USING	kg/RAI	% USING	CC/RAI	% USING	CC/RAI	% USING
Chantaburi	rice	1	195	67	11	12	300	16	139	41
		2	NI	3	26	65	NI	3	NI	6
		3	331	21	30	73	1226	18	NI	33
		4	233	61	73	29	NI	3	NI	6
		5	44	14	33	82	NI	4	13	54
	cassava	1	-	-	27	47	850	50	-	-
		2	-	-	NI	29	-	-	-	-
		3	-	-	23	50	NI	11	-	-
		4	-	-	17	67	NI	7	-	-
		5	-	-	-	25	NI	25	-	-
	rubber	1	-	-	21	38	NI	25	-	-
		3	NI	6	35	70	NI	13	NI	9
	bean	2	-	-	16	80	-	-	-	-
		3	-	-	19	67	NI	10	NI	62
	fruit	4	NI	33	90	92	NI	8	NI	42
5		147	21	101	21	NI	7	115	21	
1		78	83	11	75	NI	3	117	8	
Roi-et	rice	2	68	78	8	94	-	-	-	6
		3	11	64	11	94	-	-	-	6
		4	51	63	10	91	-	-	-	9
		5	109	82	14	94	-	-	-	3
		1	412	9	46	88	-	-	29	53
	tobacco	2	287	28	48	100	-	-	16	72
		3	66	50	33	97	NI	3	59	83

Table 13 (continued)

AVERAGE QUANTITIES OF AGRO-CHEMICALS USED BY CROP AND VILLAGE

(5)

CHANGWAT	CROP	VILLAGE	NATURAL FERTILIZER		CHEMICAL FERTILIZER		PESTICIDE		INSECTICIDE	
			kg/RAI	% USING	kg/RAI	% USING	CC/RAI	% USING	CC/RAI	% USING
Roi-et	tobacco	4	146	80	42	100	-	-	127	69
		5	246	85	34	94	-	-	14	91
	corn	1	270	40	87	60	-	-	-	10
	jute	1	234	17	16	43	-	-	-	-
	watermelon	2	655	86	55	100	-	-	5	57
3		64	86	28	100	-	-	138	86	
5		373	100	32	100	-	-	91	50	
Udorn Thani	rice	1	209	36	12	91	NI	9	NI	9
		2	171	37	12	86	-	-	93	26
		3	57	62	9	77	-	-	34	44
		4	144	17	24	84	-	-	NI	3
		5	71	70	39	18	-	-	267	14
	sugar cane	1	-	-	31	75	-	-	NI	8
		2	41	100	-	-	-	-	-	-
		3	NI	29	9	71	-	-	600	74
		4	NI	12	20	94	-	-	397	94
		5	20	67	18	67	-	-	256	56
Chiang Mai	rice	1	180	18	50	4	-	-	NI	7
		2	125	9	35	82	NI	5	2	23
		3	NI	10	-	-	-	-	NI	14
		4	78	30	32	40	-	-	37	30
		5	112	57	40	43	NI	10	-	-

Table 13 (continued)

AVERAGE QUANTITIES OF AGRO-CHEMICALS USED BY CROP AND VILLAGE

(6)

CHANGWAT	CROP	VILLAGE	NATURAL FERTILIZER		CHEMICAL FERTILIZER		PESTICIDE		INSECTICIDE	
			kg/RAI	% USING	kg/RAI	% USING	CC/RAI	% USING	CC/RAI	% USING
Chiang Mai	tobacco	1	28	15	53	93	-	-	.08	96
		4	53	50	-	17	NI	17	.70	83
		5	NI	40	37	100	NI	40	-	100
	chili	1	NI	4	52	92	-	-	.06	75
		2	-	-	58	100	-	-	2.3	60
		5	160	44	13	44	NI	11	-	44
	onion	1	-	-	181	100	NI	7	1.8	93
		3	NI	10	-	-	-	-	53	80
	bean	4	65	29	20	33	-	-	64	71
		5	152	24	27	48	-	-	-	48

Chantaburi and Chiang Mai, the use of chemical and natural fertilizers is lower than in the other provinces. In areas with poorer soils such as Srisaket, Roi-Et and Udorn Thani the use of both chemical and non-natural fertilizers is relatively high. Also in Roi-Et the tobacco companies supply chemical fertilizers to the villagers. Pesticides are not widely used except in Petchaburi and Chantaburi and on the rubber plantings in Songkla. Insecticides, however, are used in all provinces to some extent. Especially heavy use is required in Srisaket, Roi-Et, Udorn Thani and Chiang Mai.

Most of the seeds used for growing crops are saved from previous harvests. The exceptions include seeds for melons, durian, and rambutan which are purchased and the seeds for beans, corn and other vegetables which are both saved and purchased. Also, partly purchased are the seeds for cash crops such as cassava, jute, and tobacco. Details on the purchase of seeds are shown in Table 14.

The heads of the households were asked about the method used for milling the different crops. These methods were categorized as manual or machine. The results are summarized in Table 15. Both machine and manual methods are used for the milling of plain and glutinous rice, but the former is the primary method throughout the survey provinces. Only machine milling is used for glutinous rice in Chiang Mai and Lampang. Machines are also used as the primary method for milling corn and peanuts. Manual processing is used for kapok, castor and tamarin. For beans a combination of machine and manual methods is used.

The heads of the households were also asked about where they store their crops and for how long. A summary of the answers is shown in Table 15. Most crops are either sold at the time of harvest or placed in a store room after harvesting. Rice is usually threshed and then stored unmilled. Milling is done at the time rice is to be consumed or sold. The average length of time rice is stored in each province ranges from 4 to 15 months. This length of time probably refers to the period from when a crop is stored until the last of it is consumed. Assuming one crop per year, the average storage time would be twelve months if there were no surplus. The shorter storage periods in Kamphangphet are due to the large production of rice for sale. The length of time mentioned is probably the delay between harvesting and selling. The longer storage period in Songkla may be associated with the practice of storing rice unthreshed for long periods of time.

Tobacco is stored after drying but before processing for periods up to one year. The average storage period in Roi-Et and Chiang Mai is close to half a year. Again, this is probably the period between harvesting and sale and probably relates to drying and curing the tobacco. Corn is stored for relatively short periods of time. The average period in Kamphangphet is only one month between the time of harvest and the time of sale. In Petchaburi and Udorn Thani the period of storage averages close to half a year. For other cash crops such as cassava, rubber and cotton

Table 14

SOURCE OF SEED BY CROP

GLUTINOUS RICE

CHANGWAT	RESPONDING		SAVE %	BUY %	BOTH %	SELL SEED
	No.	%				
SONGKLA (6)	38	21	100	-	-	-
CHANTABURI (7)	5	3	100	-	-	-
ROI-ET (8)	53	32	100	-	-	-
UDORN THANI (9)	111	61	100	-	-	-
CHIANG MAI (10)	43	24	88	12	-	-
PLAIN RICE						
6	159	88	99	-	1	-
7	129	71	98	2	-	1
8	115	71	100	-	-	-
9	130	72	99	1	-	1
10	76	42	99	1	-	-
MELON						
6	5	3	-	100	-	-
8	31	17	3	68	29	-
9	1	1	100	-	-	-
TOBACCO						
6	13	7	100	-	-	-
8	156	87	98	2	-	1
10	38	21	79	18	3	3
CORN (MAIZE)						
6	14	15	21	79	-	-
7	1	1	100	-	-	-
8	18	11	67	33	-	-
9	31	17	55	39	6	-

Table 14 (continued)

SOURCE OF SEED BY CROP

CASSAVA

CHANGWAT	RESPONDING		SAVE %	BUY %	BOTH %	SELL SEED
	No.	%				
6	3	2	100	-	-	-
7	65	36	100	-	-	-
8	1	1	-	100	-	-
9	49	27	90	10	-	-
SUGAR CANE						
9	44	24	80	18	2	9
JUTE						
8	48	30	23	77	-	-
9	10	6	60	40	-	-
BETEL LEAVES						
7	1	1	100	-	-	-
COCONUT						
6	6	3	83	17	-	-
7	24	13	92	8	-	8
BEANS						
6	38	21	29	60	11	-
7	41	23	83	17	-	2
8	13	8	85	15	-	7
9	17	9	65	29	6	-
10	69	38	35	62	3	6

Table 14 (continued)

SOURCE OF SEED BY CROP

PARA-BUBBER

CHANGWAT	RESPONDING		SAVE %	BUY %	BOTH %	SELL SEED
	No.	%				
6	130	72	4	96	1	-
7	54	30	37	63	-	-
BANANA						
6	6	3	100	-	-	-
7	3	1	100	-	-	-
9	3	1	100	-	-	-
MANGO						
6	1	1	100	-	-	-
7	3	1	100	-	-	-
10	1	1	100	-	-	-
LONGAN						
10	2	1	-	100	-	-
LICHEE						
10	2	1	-	100	-	-
ONION						
8	1	1	100	-	-	-
9	4	1	100	-	-	-
10	2	1	50	50	-	-
GARLIC						
8	1	1	100	-	-	-
9	2	1	100	-	-	-
10	13	7	23	77	-	-

Table 14 (continued)

SOURCE OF SEED BY CROP

CHILI

CHANGWAT	RESPONDING		SAVE %	BUY %	BOTH %	SELL SEED
	No.	%				
8	2	1	100	-	-	-
9	11	6	91	9	-	9
10	48	27	96	2	2	7
PINEAPPLE						
6	13	7	100	-	-	-
7	4	2	75	-	25	-
DURIAN						
6	8	4	25	75	-	-
7	36	20	-	97	3	-
JACKFRUIT						
6	3	2	100	-	-	-
POTATO						
6	4	2	100	-	-	-
10	1	1	-	100	-	-
VEGETABLES						
6	72	40	1	86	11	-
9	44	24	34	52	14	-
10	1	1	-	100	-	-
RAMBUTAN						
6	8	4	25	75	-	-
7	12	7	8	75	17	-

Table 14 (continued)

SOURCE OF SEED BY CROP

PUMPKIN

CHANGWAT	RESPONDING		SAVE %	BUY %	BOTH %	SELL SEED
	No.	%				
8	9	6	89	11	-	-
9	1	1	100	-	-	-
10	1	1	-	100	-	-
PEPPER						
7	3	-	-	100	-	33

Table 15

Crop Milling Methods and Quantities

CROP	CHANGWAT	NUMBER OF VILLAGES	PERCENTAGE RESPONDING	METHOD OF MILLING		QUANTITY MILLED(kg)		
				PRIMARY	SECONDARY	AVERAGE	RANGE	
Non-Glutinous Rice	Petchaburi	5	81	Machine	Manual	446	5-10,000	
	Korat	1	100	"	"	1,775	1070-2944	
	Sisaket	5	76	"	"	591	10-5000	
	Kamphaengphet	4	40	"	-	1,781	100-5000	
	Lampang	5	58	"	Manual	537	15-7900	
	Songkhla	5	81	"	"	23	3-50	
	Chanthaburi	5	95	"	"	49	11-1200	
	Roi-et	4	89	"	"	112	12-4800	
	Udon Thani	5	44	"	"	250	12-6000	
	Chiang Mai	5	39	"	-	70	2-300	
Glutinous rice	Petchaburi	3	6	"	Manual	18	40-30	
	Sisaket	3	21	"	-	212	20-1600	
	Lampang	4	42	"	-	425	19-3000	
	Songkhla	3	11	"	Manual	17	11-30	
	Chanthaburi	2	14	"	"	42	75-100	
	Roi-et	4	28	"	"	225	20-1000	
	Udon Thani	5	47	"	"	228	12-2400	
	Chiang Mai	4	41	"	-	50	24-250	
	Maize	Petchaburi	3	6	"	-	1,779	75-3000
		Korat	1	100	"	-	5,300	-
Kapok	Kamphaengphet	4	32	"	Manual	2,453	100-6000	
	Petchaburi	2	8	Manual	Machine	5	3-20	
	Sisaket	4	13	"	"	89	5.3-500	
	Kamphaengphet	1	6	"	-	200	-	
Soybean	Roi-et	2	16	"	-	258	6-50	
	Kamphaengphet	1	88	Machine	Manual	1,773	100-5000	
	Lampang	1	39	Manual	Machine	281	30-1000	
Mung Bean	Chiang Mai	5	27	Machine	Manual	418	5-2500	
	Petchaburi	2	5	Manual	-	10	15-20	
	Kamphaengphet	3	17	"	Machine	602	20-8000	
	Chiang Mai	1	5	Machine	-	757	600-915	

Table 15 (continued)

CROP	CHANGWAT	NUMBER OF VILLAGES	PERCENTAGE RESPONDING	METHOD OF MILLING		QUANTITY MILLED (kg)	
				PRIMARY	SECONDARY	AVERAGE	RANGE
Peanut	Kamphaengphet	4	13	Machine	Manual	4,103	96-38400
	Udon Thani	1	6	"	"	-	-
Bean	Kamphaengphet	2	4	Manual	"	376	-
Castor	Petchaburi	3	10	"	-	64	12-250
Tamarind	Petchaburi	1	2	"	-	8	-
	Songkhla	1	14	"	-	9	2-20

the storage times are only about one month between the time of harvest and the time of sale. Most of the crops are stored un-processed with the exceptions of corn, which is stored both milled and unmilled, rubber, which is stored as latex and as crumb rubber, and cassava, which is stored in root form and as chips or pellets. Details on the storage of different crops are shown in Table 16.

6. Sale of Crops

The rice grown in the survey villages is not only consumed but also sold as a cash crop and in some cases used as an animal feed. The percentage of the total rice production of a household that is consumed decreases as the quantity produced increases. This is shown in Table 17. This trend is especially clear for the plain rice crop in Petchaburi, Korat, Chantaburi, and Kampanghet and for the sticky rice crop in Lampang, Chiang Mai and Udorn Thani. In Srisaket and Songkla the percentage of the plain rice crop that is consumed remains relatively constant indicating that the larger productions are generally associated with larger requirements for food. The same is true for the sticky rice crop in Roi-Et. The quantities of sticky rice consumed in Korat, Songkla and Chantaburi are a relatively constant proportion of the total production because the sticky rice is grown only as a secondary crop for consumption.

The importance of rice as a source of cash income is demonstrated by the quantity of crop sold relative to the quantity produced (see Table 18). The percentage of the crop sold increases with the quantity produced for plain rice in Petchaburi, Korat, Kampanghet, Chantaburi, Roi-Et and Udorn Thani and for the sticky rice in Lampang and Udorn Thani, but not for the sticky rice in Chiang Mai and Roi-Et.

The data in this table clearly indicates that plain rice is a cash crop in Kampanghet, Lampang and Udorn Thani and to a lesser extent sticky rice is a cash crop in Udorn Thani. Otherwise rice is sold in significant quantities only in Petchaburi, Korat and Chantaburi and only by those households with a relatively large production.

If rice is sold, it is usually sold by the villager to a middle man from outside the village. Forty-five percent of those villagers in Petchaburi who sell part of their rice crop said that they sell to a trader from outside the village. The same is true for 59 percent of those from Korat, 56 percent from Srisaket, 60 percent from Kampanghet, 65 percent from Chiang Mai, 60 percent from Roi-Et and 41 percent from Udorn Thani (see Table 19). Direct sales to consumers is important in Lampang, and Songkla where 43 percent and 95 percent of the respondents respectively mentioned this method. Other important buyers are the large rice mills. These were mentioned by 60 percent of the villagers in Chantaburi who sell part of their crop, 49 percent in Udorn Thani, 24 percent in Lampang, 20 percent in Korat and 18 percent in Srisaket.

Table 16
DATA ON CROP STORAGE FOR DIFFERENT
CROPS AND CHANGWAT

CROP	CHANGWAT	NUMBER OF VILLAGES	PERCENTAGE RESPONDING	METHOD OF STORING		AVERAGE LENGTH OF STORAGE (months)	
				PRIMARY	SECONDARY		
rice	Petchaburi	5	71	1	-	12	
	Korat	1	94	1	-	-	
	Sisaket	5	65	1	-	8	
	Kamphaengphet	4	85	1	2	4	
	Songkhla	5	51	1	-	15	
	Chanthaburi	5	72	1	-	11	
	Roi-et	5		1	-	12	
	Udorn Thani	5		1	2	10	
	Chiang Mai	4	42	1	-	10	
Glutinous rice	Sisaket	2	7	1	2	12	
	Lampang	5	85	1	-	9	
	Songkhla	4	8	1	-	9	
	Chanthaburi	1	2	1	-	12	
	Roi-et	2	28	1	-	12	
	Udorn Thani	5	33	1	-	9	
	Chiang Mai	3	62	1	-	11	
	Tobacco	Petchaburi	1	15.7	1	-	12
		Sisaket	4	20	1	-	9
Songkhla		3	7	1	-	11	
Roi-et		5	32	1	-	8	
Chiang Mai		2	40	1	-	7	
corn		Petchaburi	2	11	1	2	6
	Kamphaengphet	2	16	1	2	1	
	Udorn Thani	1	1	1	2	7	
	Roi-et	1	4	1	2	12	
Tamarind	Petchaburi	4	13	1	2	8	
	Songkhla	3	14	1	2	12	
Chili	Petchaburi	1	4	1	2	-	
	Sisaket	5	12	1	-	11	
	Lampang	1	15	1	-	2.6	
	Songkhla	4	3	1	-	10	
	Chiang Mai	2	16	1	-	7	
	Udorn Thani	1	15	1	-	8	

Table 16 (continued)

(2)

CROP	CHANGWAT	NUMBER OF VILLAGES	PERCENTAGE RESPONDING	METHOD OF STORING		AVERAGE LENGTH OF STORAGE (months)
				PRIMARY	SECONDARY	
nut	Petchaburi	1	1.9	1	-	-
	Korat	1	6	1	-	7
	Kamphaengphet	5	7	1	2	3
	Lampang	2	15	1	-	1
	Songkhla	1	1	1	-	12
	Chanthaburi	1	14	1	-	6
	Chiang Mai	2	11	1	2	5
	Udon Thani	2	3	1	-	3
	Roi-et	1	10	1	-	12
	Chanthaburi	2	9	1	2	2
Onion	Petchaburi	1	1	1	-	-
	Sisaket	1	8	2	1	7
	Lampang	2	5	1	-	2
	Udon Thani	1	6	1	-	12
Garlic	Petchaburi	1	1	1	-	-
	Korat	1	1	2	-	12
	Sisaket	1	1	1	-	6
	Lampang	2	9	1	-	5
	Udon Thani	1	4	1	-	12
	Chiang Mai	1	7	1	-	2
Kapok	Petchaburi	2	3	2	1	6
	Sisaket	2	2	1	-	7
Rubber	Songkhla	5	26	2	-	1
	Chanthaburi	4	18	1	2	1
Young bamboo shoot	Petchaburi	2	11	1	other	11
cassava	Korat	1	100	1	-	0.6
	Kamphaengphet	2	16	2	1	0.4
Mango	Petchaburi	1	2	other	-	1
Cotton	Petchaburi	1	8	1	-	1
	Kamphaengphet	1	16	1	-	1
Banana	Kamphaengphet	1	3	2	-	3
	Chanthaburi	1	4	2	-	1

Table 16 (continued)

(3)

CROP	CHANGWAT	NUMBER OF VILLAGES	PERCENTAGE RESPONDING	METHOD OF STORING		AVERAGE LENGTH OF STORAGE (months)
				PRIMARY	SECONDARY	
Cashew nut	Songkhla	1	5	1	-	0.2
Hemp	Roi-et	3	1	1	2	1
Hemp (for seed)	Udorn Thani	1		1	-	4
Pepper	Chanthaburi	1	14	2	-	1
Coconut	Chanthaburi	1	11	1	-	1
Rice (for seed)	Udorn Thani	3	16	1	-	6
Glutinous rice (for seed)	Udorn Thani	2	9	1	-	5
Nut (for seed)	Udorn Thani	1	3	1	-	6

1 - store room after harvesting
2 - store room after processing

Table 17

Average Percentage of Rice Crop Consumed versus Amount Produced
(% of production consumed)

Province	Crop	Product (kg)										
		1-100	101-500	501-1000	1001-2000	2001-3000	3001-4000	4001-6000	6001-8000	8001-10000	Over 10000	
Changwat	Crop											
Petchaburi	Plain Rice	-	94	90	81	76	73	64	61	41	44	
Korat	Sticky Rice	74	95	92	50	-	-	-	-	-	-	
	Plain Rice	100	87	94	91	72	76	63	68	47	27	
Srisaket	Sticky Rice	100	96	93	81	98	73	-	-	99	-	
	Plain Rice	-	50	68	63	55	52	59	55	47	43	
Kampangphet	Plain Rice	-	14	90	66	55	50	35	17	14	21	
Lampang	Sticky Rice	100	99	85	79	85	69	63	50	64	50	
Chiang Mai	Sticky Rice	-	89	81	86	79	80	63	54	30	19	
Songkla	Sticky Rice	79	84	82	-	-	98	-	-	-	-	
	Plain Rice	95	94	96	92	93	96	54	-	-	-	
Chantaburi	Sticky Rice	88	88	93	68	-	-	85	-	-	-	
	Plain Rice	-	59	81	84	69	61	49	47	37	4	
Roi-et	Sticky Rice	-	75	79	80	71	75	76	85	-	10	
	Plain Rice	84	58	37	27	2	-	-	-	1	-	
Udorn Thani	Sticky Rice	-	96	82	79	63	63	60	50	48	5	
	Plain Rice	61	75	41	24	12	23	-	65	-	-	

Table 18

Average Percentage of Rice Crop Sold versus Amount Produced

Changwat	Crop	Product (kg)									
		1-100	101-500	501-1000	1001-2000	2001-3000	3001-4000	4001-6000	6001-8000	8001-10000	Over 10000
Petchaburi	Plain Rice	-	-	3	3	7	16	24	29	51	33
Korat	Sticky Rice	-	1	6	39	-	-	-	-	-	-
	Plain Rice	-	-	-	2	12	16	26	25	51	71
Srisaket	Sticky Rice	-	1	-	6	-	10	-	-	-	-
	Plain Rice	-	-	3	18	15	18	19	19	16	19
Kampangphet	Plain Rice	-	85	-	17	32	21	84	83	70	72
Lampang	Sticky Rice	-	-	-	3	7	3	15	23	16	50
	Plain Rice	-	49	98	8	100	-	-	-	-	-
Chiang Mai	Sticky Rice	-	49	1	-	11	7	9	19	41	2
Songkla	Sticky Rice	3	5	25	-	-	-	-	-	-	-
	Plain Rice	-	1	-	2	2	1	-	-	-	-
Chantaburi	Plain Rice	-	-	2	3	8	17	29	31	33	16
Roi-et	Sticky Rice	-	-	-	6	8	6	13	11	-	2
	Plain Rice	9	31	60	71	96	-	-	-	-	-
Udon Thani	Sticky Rice	-	-	6	90	19	23	30	40	44	6
	Plain Rice	20	16	51	73	79	73	97	33	-	-

Government is an important customer only in Petchaburi where it was mentioned by 46 percent of the respondents. The role of the village middleman is relatively limited except in Srisaket and Kampanghet where 20 percent and 26 percent, respectively mentioned him.

The marketing of most cash crops is done through the factories or traders from outside the village. Only in Songkla is direct sale to consumers a significant marketing channel. Sugar cane is sold primarily to a factory but this varies between regions. The marketing of tobacco is very much determined by the activities of the tobacco monopoly. In Roi-Et most of the respondents sell their crop to the factory but in Srisaket and Chiang Mai tobacco is sold to traders. Corn is marketed through traders or by direct sale to the consumer. The former method is more important in Petchaburi, Kampanghet and Udorn Thani, whereas, the latter is more important in Songkla and Roi-Et. Other products such as cotton, watermelon, and kenaf are sold mostly to traders from outside the village. A breakdown of the use of marketing channels for the different crops is presented in Table 19.

The reason for choosing these different channels was discussed with the villagers. The results are shown in Table 20. The facts that the buyer can provide transport and is easy to make arrangements with are important for the villagers in Srisaket, Roi-Et and Udorn Thani. A more important reason in Udorn Thani is the availability of long term contracts. This reason is also important in Kampanghet and to a lesser degree in Roi-Et. The combination of long term contract and provision of transport is the principal factor in choosing a buyer for the villagers in Petchaburi, Chantaburi and Lampang. In Kampanghet and Petchaburi the fact that the buyers can provide credit is another important consideration. Monopoly situations in which there is only one buyer were rarely mentioned except for tobacco and sugar cane. Family relations were also rarely mentioned. In many instances, the villagers gave no specific reason for selecting a marketing channel for their crops.

Most crops are sold either at the farm or in Amphoe market (Table 21). Village markets are important only in Lampang, Songkla, Chantaburi and Roi-Et. The subdistrict markets are important in Songkla and Udorn Thani. Provincial markets are very important in Roi-Et. Sales outside of the province are important for sugar cane in Lampang and Kampanghet and for cassava in Korat. A breakdown of the use of markets by location is presented in Table 21 for the different crops and provinces.

7. Exchange Labor

Exchange labor is a method of sharing responsibilities during periods of peak labor. Two farmers enter into a mutual agreement to supply each other with labor during critical periods in the agricultural cycle. This practice is widespread as can be seen from the data in Table 22. At least two-thirds of the households in each province, except Korat, indicated

Table 19
Who Crop is Sold To
 (percent of households)

		Percent not Responding	1 Village Middle Man	2 Middle Man Outside Village	3 Consumer	4 Government	5 Factory	6 Co- operative	7 Creditor	8 Other
Changwat	Type of Crop									
Petchaburi	Plain Rice	33	2	45	5	46	-	-	-	3
	Corn	16	-	80	11	3	-	-	3	3
	Sugar Cane	14	7	4	-	-	40	4	-	45
	Cotton	17	-	65	-	-	3	3	3	25
Korat	Plain Rice	41	-	59	2	-	20	2	-	16
	Cassava	53	1	18	-	-	77	-	-	5
Srisaket	Plain Rice	62	20	56	-	1	18	1	-	4
	Watermelon	7	-	93	-	-	-	-	-	7
	Tobacco	18	3	72	26	-	-	-	-	-
	Kenaf	4	-	100	-	-	-	-	-	-
Kampangphet	Plain Rice	58	26	60	2	-	7	-	1	4
	Corn	27	7	87	2	-	2	-	-	2
	Cassava	46	19	67	1	-	13	-	-	-
	Sugar Cane	8	16	16	-	-	54	-	16	-

Table 19 (cont)
Who Crop is Sold To
 (percent of households)

		Percent not Responding	1 Village Middle Man	2 Middle Man Outside Village	3 Consumer	4 Government	5 Factory	6 Co- operative	7 Creditor	8 Other
Changwat	Type of Crop									
Lampang	Sticky Rice	16	9	15	43	-	24	3	-	6
	Plain Rice	4	43	14	43	-	-	-	-	-
	Sugar Cane	16	-	-	-	3	97	-	-	-
Chaing Mai	Sticky Rice	15	12	65	23	-	-	-	-	-
	Tobacco	25	25	48	9	2	7	-	2	7
Songkla	Sticky Rice	11	-	-	100	-	-	-	-	-
	Plain Rice	12	-	-	91	-	9	-	-	-
	Watermelon	6	-	36	55	-	-	8	-	-
	Tobacco	3	-	-	100	-	-	-	-	-
	Corn	5	-	-	100	-	-	-	-	-

Table 19(cont)
Who Crop is Sold To
 (percent of households)

		Percent not Responding	1 Village Middle Man	2 Middle Man Outside Village	3 Consumer	4 Government	5 Factory	6 Co- operative	7 Creditor	8 Other
Changwat	Type of Crop									
Chantaburi	Sticky Rice	3	-	-	79	-	21	-	-	-
	Plain Rice	29	12	21	6	-	60	-	-	2
	Cassava	40	2	12	-	-	86	-	-	-
Roi-et	Sticky Rice	33	6	57	19	2	15	-	-	2
	Plain Rice	22	5	64	19	3	9	-	-	-
	Watermelon	20	13	62	22	-	-	-	3	-
	Tobacco	93	5	11	11	1	53	-	18	1
	Corn	6	10	31	60	-	-	-	-	-
	Kenaf	29	47	38	2	-	13	-	-	-
Udon Thani	Sticky Rice	64	1	43	3	2	46	5	-	1
	Plain Rice	35	3	37	-	2	55	2	-	2
	Corn	11	-	63	37	-	-	-	-	-
	Cassava	28	-	25	-	2	71	-	2	-
	Sugar Cane	17	10	50	13	-	23	4	-	-
	Kenaf	5	-	50	-	-	37	-	-	13

Table 20

Why is Crop Sold to This Person
(Percentage of Households)

Changwat, Crop	Percent not Responding	Relative	Long Term Contract	Provides Transport	Reason Provides Credit	Easy To Arrange	Pays Immediately	Only One Available	No Reason	Other
<u>Petchaburi</u>										
Plain Rice	33	5	24	17	-	8	5	-	6	35
Corn	16	-	30	-	17	-	-	3	14	37
Sugar Cane	14	-	-	22	7	4	-	15	7	45
Cotton	17	-	28	13	13	-	-	13	10	25
<u>Korat</u>										
Plain Rice	41	-	9	-	-	4	8	1	31	48
Cassava	53	-	3	4	-	12	2	1	16	63
<u>Srisaket</u>										
Plain Rice	61	1	16	4	1	42	4	6	11	15
Watermelon	7	-	-	50	-	7	-	-	43	-
Tobacco	17	9	9	29	-	18	-	-	26	9
Kenaf	4	-	13	38	13	25	-	-	-	13
<u>Kampangphet</u>										
Plain Rice	57	1	31	12	13	10	3	1	4	24
Corn	27	-	28	13	15	-	-	7	7	30
Cassava	46	4	19	34	10	5	-	5	4	19
Sugar Cane	8	8	16	-	30	8	-	30	8	-
<u>Lampang</u>										
Sticky Rice	16	6	21	15	-	9	9	-	30	9
Plain Rice	4	-	14	43	-	-	-	-	43	-
Sugar Cane	16	-	6	3	61	-	-	21	3	6

Page 20 (cont)
Why is Crop Sold to This Person
 (Percentage of Households)

Changwat, Crop	Percent not Responding	Relative	Long Term Contract	Reason							Other
				Provides Transport	Provides Credit	Easy To Arrange	Pays Immediately	Only One Available	No Reason		
<u>Chiang Mai</u>											
Sticky Rice	15	4	12	31	-	-	-	-	-	38	16
Tobacco	25	-	25	20	7	-	-	-	2	45	-
<u>Songkla</u>											
Sticky Rice	11	-	-	-	-	-	-	-	-	94	6
Plain Rice	12	-	-	-	-	9	-	-	-	91	-
Watermelon	6	-	-	-	-	10	-	-	-	55	35
Tobacco	3	-	-	-	-	-	-	-	-	79	21
Corn	5	-	-	-	-	-	-	-	-	100	-
<u>Chantaburi</u>											
Sticky Rice	3	21	-	-	-	21	-	-	-	59	-
Plain Rice	29	14	14	29	2	4	-	-	2	17	19
Cassava	41	-	33	2	2	24	3	-	-	21	17
<u>Roi-et</u>											
Sticky Rice	33	2	15	8	-	20	13	-	-	37	6
Plain Rice	22	-	5	9	3	25	11	-	-	47	-
Watermelon	20	-	3	59	3	-	-	-	-	31	3
Tobacco	93	1	3	11	19	2	1	-	52	10	-
Corn	6	-	10	31	-	19	-	-	-	40	-
Kenaf	29	-	-	60	-	17	4	-	4	15	-

Table 20 (cont)
Why is Crop Sold to This Person
 (Percentage of Households)

Changwat, Crop	Percent not Responding	Relative	Reason							Other
			Long Term Contract	Provides Transport	Provides Credit	Easy To Arrange	Pays Immediately	Only One Available	No Reason	
<u>Udon Thani</u>										
Sticky Rice	64	2	43	6	4	9	11	1	24	-
Plain Rice	35	-	30	2	3	12	13	2	27	12
Corn	11	-	10	10	-	6	-	6	58	10
Cassava	27	-	31	12	-	24	9	4	16	9
Sugar Cane	17	10	33	6	17	10	4	6	13	-
Kenaf	5	-	24	-	-	24	13	-	-	38

Table 21
Where Crop Marketed

Changwat	Type of Crop	Percent not Responding	1 Home	2 Village Market	3 Subdistrict Market	4 Amphoe Market	5 Province Market	6 Other Province
Petchaburi	Plain Rice	33	92	5	2	2	-	-
	Corn	16	6	-	-	77	-	14
	Sugar Cane	14	59	11	-	7	-	22
	Cotton	17	19	-	-	69	-	13
Korat	Plain Rice	41	-	6	1	92	-	1
	Cassava	53	10	-	12	15	1	63
Srisaket	Plain Rice	62	1	21	12	60	1	5
	Watermelon	7	79	-	7	-	-	14
	Tobacco	18	31	11	11	43	-	3
	Kenaf	4	13	-	25	50	-	13
Kampangphet	Plain Rice	57	89	5	-	2	-	4
	Corn	27	48	-	-	46	5	2
	Cassava	46	82	-	-	10	1	6
	Sugar Cane	8	54	8	-	-	-	38

Table 21 (cont)
Where Crop Marketed

Changwat	Type of Crop	Percent not Responding	1 Home	2 Village Market	3 Subdistrict Market	4 Amphoe Market	5 Province Market	6 Other Province
Lampang	Sticky Rice	16	43	34	3	6	3	12
	Plain Rice	4	57	29	-	-	-	14
	Sugar Cane	16	-	-	-	21	-	79
Chiang Mai	Sticky Rice	15	93	8	-	-	-	-
	Tobacco	25	61	11	18	-	4	4
Songkla	Sticky Rice	11	-	-	69	32	-	-
	Plain Rice	12	5	15	48	33	-	-
	Watermelon	6	18	18	10	56	-	-
	Tobacco	3	-	21	39	39	-	-
	Corn	5	-	10	22	68	-	-
Chantaburi	Sticky Rice	3	61	39	-	-	-	-
	Plain Rice	29	62	23	10	6	-	-
	Cassava	41	3	-	3	85	3	7

Table 21 (cont)
Where Crop Marketed

Changwat	Type of Crop	Percent not Responding	1 Home	2 Village Market	3 Subdistrict Market	4 Amphoe Market	5 Province Market	6 Other Province
Roi-et	Sticky Rice	33	2	6	-	50	43	-
	Plain rice	23	8	-	-	57	35	-
	Watermelon	20	66	31	-	-	-	3
	Tobacco	93	15	24	4	42	15	1
	Corn	6	10	31	10	50	-	-
	Kenaf	29	7	55	-	17	21	-
Udon Thani	Sticky Rice	64	5	3	14	23	55	-
	Plain Rice	35	2	2	8	25	63	-
	Corn	11	-	10	16	27	48	-
	Cassava	28	6	2	40	21	31	-
	Sugar Cane	17	59	17	-	7	17	-
	Kenaf	5	-	-	-	13	87	-

Table 22
USES OF EXCHANGE LABOR

(% of Households)

<u>CHANGWAT</u>	<u>NEVER USE</u>	<u>PLANTING</u>	<u>HARVESTING</u>	<u>THRESHING</u>	<u>OTHER AGRICULTURE</u>	<u>NON- AGRICULTURE</u>
Chiang Mai	33.9	46.3	49.7	43.5	7.3	23.7
Songkla	26.3	41.3	55.9	2.2	44.7	11.7
Chantaburi	17.7	79.6	77.4	42.6	47.5	11.1
Roi-et	24.7	7.4	72.2	61.8	1.9	5.6
Udorn Thani	29.3	27.6	58.7	54.7	5.1	13.8
Petchaburi	14.6	66.7	72.9	44.2	28.1	4.1
Korat	60.2	17.9	18.9	14.3	8.1	12.7
Srisaket	13.1	29.1	75.3	72.8	4.0	12.5
Kampangpet	20.5	61.4	66.7	49.8	26.4	21.7
Lampang	31.8	63.7	45.3	39.8	10.5	11.6

that they participate in some form of labor exchange. Planting and harvesting are the major activities for which exchange labor is used, especially in the provinces of Chantaburi, Petchaburi and Kamphangphet. It is important for harvesting and threshing in Srisaket and Roi-Et but not for planting. The use of exchange for non-agricultural activities is not very common.

The extent to which labor exchange is used can be determined from the data in Table 23 which describes the amount of man-days contributed and received by the respondents. More than 50 man-days were exchanged by about 70 percent of those involved in labor exchange in Chantaburi, 44 percent in Kamphangphet, 36 percent in Petchaburi, 20 percent in Lampang and 17 percent in Songkla. The median number of man-days contributed by the households participating in labor exchange is 1-10 man-days in Korat, Srisaket, Roi-Et and Udorn Thani, 11-20 in Lampang and Chiang Mai, 21-30 in Petchaburi and Songkla, 31-40 in Kamphangphet and over 50 in Chantaburi.

8. Fish Farming

Despite the importance of fish in the diet of the villagers very few fish ponds are owned by the households surveyed. A summary of the findings with regards to fish ponds is shown in Tables 24 to 26. On average 2.5 percent of the households own fishponds. The highest rate of ownership is in Udorn Thani where one-twelfth of the households own one. In Petchaburi and Songkla none of the survey households have a fish pond. The average estimated production of fish ponds is 120 kilograms per year of which about half is sold and the rest is consumed. The fish are sold primarily at the market or to a trader. About two-fifths of the owners provide food for the fish. The basic feed is rice bran obtained from the rice mill. The most common species of fish in these ponds are Siluridae, Serpent head and Climbing Fish.

9. Animal Ownership

Information on animal husbandry activities in the survey villagers was collected for six types of animals; water buffalos, cows, pigs, goats, ducks and chickens. The buffalos are raised for work in the fields. The cows are used mostly for farm work but are also raised as a source of beef. Pigs and chickens are raised for their meat and ducks are raised to produce eggs and meat. The data collected on these animals concerns not only the current ownership but also the transactions which occurred during the previous year including buying, selling and consuming.

In Petchaburi over three-fourths of the households own chickens. The mean number of chickens owned is 16 and 70 percent of the owners possess 6 or more. Pigs, cows and buffalos are owned by 31 percent, 22 percent and 17 percent, respectively, of the households. The median number of animals owned is 2 pigs, 6 cows and 3 buffalo. Only three of the surveyed

Table 23.1
LABOR EXCHANGE-LABOR RECEIVED
 (% of Households)

CHANGWAT	MAN-DAYS						
	0	1-10	11-20	21-30	31-40	41-50	>50
PETCHABURI	18.8	6.8	18.2	15.6	6.3	2.1	32.3
KORAT	71.4	18.9	4.6	3.1	0.5	-	1.5
SRISAKET	18.1	21.6	24.1	8.0	4.5	3.5	20.1
KAMPHAENGPHE	26.9	12.3	7.0	11.1	2.9	4.7	35.1
LAMPANG	34.8	16.4	16.4	10.0	3.5	6.5	12.4
CHIANGMAI	34.5	16.9	12.4	12.4	5.1	5.1	13.6
SONGKLA	35.2	14.0	9.5	8.9	3.4	14.0	15.1
CHANTHABURI	19.3	2.8	4.4	4.4	4.4	2.2	62.4
ROI-ET	38.9	9.9	14.8	8.6	8.6	4.3	14.8
UDORNTHANI	35.1	29.3	19.5	4.6	1.7	1.1	8.6

Table 23.2
LABOR EXCHANGE - LABOR CONTRIBUTED
 (% OF HOUSEHOLDS)

MAN-DAYS CHANGWAT	0	1-10	11-20	21-30	31-40	41-50	>50
PETCHABURI	18.2	10.4	20.3	13.5	6.8	2.6	28.1
KORAT	68.4	25.0	3.6	1.0	1.0	0.5	0.5
SRISAKET	15.1	40.7	16.6	9.0	5.0	4.0	9.5
KAMPHAENGPHET	26.9	18.7	5.8	11.1	5.8	3.5	28.1
LAMPANG	34.3	16.4	18.4	10.4	2.5	3.5	14.4
CHIANGMAI	34.5	22.0	12.4	14.1	2.8	5.1	9.0
SONGKLA	27.9	21.2	13.4	7.3	6.1	11.2	12.8
CHANTHABURI	17.1	3.9	7.2	9.9	5.5	2.8	53.6
ROI-ET	25.3	54.3	14.8	3.1	-	1.2	1.2
UDORNTHANI	30.5	45.4	13.2	8.0	1.1	-	1.7

Table 24
OWNERSHIP OF FISHPONDS
(% of Households)

LAMPANG	1.5
KAMPANGPHET	2.9
SRISAKET	1.0
KORAT	3.6
PETCHABURI	-
CHIANGMAI	0.6
SONGKHLA	-
CHANTHABURI	1.7
ROI-ET	4.3
UDORNTHANI	8.6

Table 26
FISH PONDS-SPECIES

AREA	SPECIES OF THE FISH												
	ปลาตุก SILURI- DAE	ปลาช่อน SERPENT- HEAD	ปลาหมอ CLIMBING FISH	ปลาฉี่ DAE	ปลาไน	ปลาตะเพียน	ปลาเค็ม	ปลาจัน	ปลาแขยง	ปลาชะโอน	ปลาสร้อย	ปลากต	ปลาฝ
1	-						-		-	-	-	-	-
2	-	1	1	5	2	1	-	1	-	-	-	-	-
3	-	-	-	1	-	-	-	-	-	-	-	-	-
4	4	5	4	1	-	3	2	-	2	1	1	1	1
5	1	1	-	2	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-
7	3	3	-	1	-	-	-	-	-	-	-	-	-
8	8	8	6	2	-	-	-	-	-	-	-	-	-
9	11	13	8	10	3	1	-	2	-	-	-	-	-
10	1	-	-	1	1	-	-	-	-	-	-	-	-
TOTAL	28	31	19	23	6	5	2	3	2	1	1	1	1

households owned ducks. The numbers of animals owned and consumed in the last year are shown in Table 27.

The buffalos are raised for farm work, however, their numbers are small and most of the farm work is done with hand tractors. The only animals which are raised for home consumption are the chickens. About half of the owners ate between 5 and 10 birds in the previous year. Chickens are also raised for sale. One-eighth of the owners purchased a median of 5 chickens while more than two-fifths of the owners sold a median of 8 chickens. Pigs and cows are raised not for meat but for selling as can be seen in the statistics in Table 28. Only a few families consumed one of their pigs during the previous year. A little more than one-third of the pig owning families purchased a median of 2 pigs in the previous year while nearly two-thirds of these families sold a median of 7 pigs. Cows are raised for sale but to a lesser extent than pigs. Most of the cattle purchased in the previous year were for replacement. For buffalos buying is primarily for replacement and the selling and buying was about balanced.

In Korat, the ownership of buffalos is more widespread with nearly half of the households owning a median of 2. About two-fifths of the owners have only one buffalo and less than one-fifth have two. The most commonly owned animals are chickens. Sixty nine percent of the households own chickens and the median number owned is ten. One third of the owners have between 6 and 10 and another 30 percent have between 11 and 15. The chickens are raised as a source of meat. Over one-half of the owners ate a median of 6 birds in the previous year. The other animals, pigs, cows and ducks, are owned by 23 percent, 8 percent and 15 percent respectively of the households. The median number owned is only 1 pig, 2 cows and 5 ducks. The details on ownership and consumption are presented in Table 29, while Table 30 provides data on the buying and selling of these animals.

The buying and selling of cows and buffalos in Korat is for replacing current stock. Less than one-fifth of the owners participated in these activities during the last year. The largest trade was in pigs, but this was largely the purchasing of one or two pigs to be raised for sale later in the year. A third of the owners of ducks purchased additional stock during the previous year, presumably to increase the egg-producing population since none were reported sold during this period.

The ownership of animals in Srisaket is more common than in the previous provinces. Almost 99 percent of the households have chickens, three quarters have buffalos, more than two-fifths have pigs and over one-fourth have cows and ducks. The median number of buffalos owned is 2 with almost equal proportions of the owners having 1, 2, and more than 2. The median number of chickens owned is 11 and approximately equal proportions own less than 6, 6 to 10, 11 to 20 and more than 20. Most of the owners of pigs have only one. The median number of cows and ducks owned is 3 and 5 respectively. The chickens are raised for meat and for

Quantity of Animals Owned and Consumed - Petchaburi
(Number of Households)

Number Owned												Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	3	9	5	1	5	6	2	-	1	-	17	
Cow	5	6	4	3	3	11	1	1	6	3	22	
Pig	25	15	1	-	1	8	7	1	2	-	31	
Duck	1	-	-	1	-	-	-	1	-	-	2	
Chicken	3	6	5	4	5	30	15	30	28	20	76	
Number Consumed												Percentage of Owners Who Consume
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	-	-	-	-	-	1	-	-	-	-	3	
Cow	-	-	-	-	-	-	-	-	-	-	0	
Pig	6	1	-	-	-	-	-	-	-	-	12	
Duck	-	-	-	-	-	-	-	-	-	-	0	
Chicken	5	12	6	2	16	24	8	8	4	3	60	

Table 28

Quantity of Animals Bought and Sold in Last Year - Petchaburi
(Number of Households)

Number Bought												Percentage of Owners who Buy
	1	2	3	4	5	6-10	11-15	16-20	21-30	31-50		
Buffalo	3	-	-	-	1	1	-	-	-	-	-	16
Cow	7	4	2	1	-	1	-	-	-	1	-	37
Pig	12	4	-	1	1	1	1	-	2	-	-	37
Duck	-	-	-	-	-	-	-	-	-	-	-	-
Chicken	2	4	3	-	4	2	-	1	-	1	-	12
Number Sold												Percentage of Owners who Sell
	1	2	3	4	5	6-10	11-15	16-20	21-30	31-50		
Buffalo	3	1	2	2	-	2	-	-	-	-	-	31
Cow	5	3	2	1	2	4	-	-	-	1	-	42
Pig	6	2	-	-	1	20	5	-	3	-	-	62
Duck	-	-	-	-	-	-	-	-	-	-	-	0
Chicken	-	3	4	2	11	19	7	9	2	4	-	42

Table 29

Quantity of Animals Owned and Consumed - Korat
(Number of Households)

Number Owned												Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	31-50		
Buffalo	40	17	16	7	5	7	-	-	-	-	47	
Cow	-	13	-	-	-	1	-	1	-	-	8	
Pig	32	6	1	1	1	1	1	1	2	-	23	
Duck	-	1	1	3	10	11	2	-	1	-	15	
Chicken	1	12	7	4	4	44	15	25	17	6	69	
Number Consumed												Percentage of Owners who Consume
	1	2	3	4	5	6-10	11-15	16-20	21-30	31-50		
Buffalo	-	-	-	-	-	-	-	-	-	-	0	
Cow	-	-	-	-	-	-	-	-	-	-	0	
Pig	-	-	-	-	-	-	-	-	-	-	0	
Duck	1	-	-	-	-	-	-	-	-	-	3	
Chicken	2	4	9	4	14	24	5	5	4	53		

Table 30

Quantity of Animals Bought and Sold In Last Year - Korat
(Number of Households)

Number Bought											Percentage of Owners who Buy
	1	2	3	5	6-10	11-15	16-20	21-30	31-50		
Buffalo	4	3	1	-	-	-	-	-	-	1	10
Cow	-	1	-	-	-	-	-	-	-	-	7
Pig	17	5	-	-	-	-	1	1	-	-	52
Duck	-	1	-	3	6	-	-	-	-	-	34
Chicken	-	3	2	1	2	-	-	-	-	-	6
Number Sold											Percentage of Owners who Sell
	1	2	3	5	6-10	11-15	16-20	21-30	31-50		
Buffalo	13	2	1	-	2	-	-	-	-	1	21
Cow	-	2	-	-	-	-	-	-	-	-	13
Pig	14	5	1	-	-	2	-	1	-	-	50
Duck	-	-	-	-	-	-	-	-	-	-	0
Chicken	-	-	2	1	2	14	2	3	1	-	19

sale. Ducks are raised primarily for eggs but also for meat. Half of the chicken owners reported consuming an average of 6 birds in the previous year while a quarter of the duck owners reported consuming a median of 4 ducks during the same period. None of the other animals are raised for meat. The details on animal ownership and consumption are given in Table 31 and the data on the trading of animals is shown in Table 32.

The buying and selling of the buffalos and cows in Srisaket is directed at maintenance of the supply of working animals. The buying and selling of pigs is relatively balanced in terms of numbers of animals but more families bought than sold pigs in the last year. More chickens were purchased than sold during the previous year. Over half the owners bought a median of 9 chickens while only one-fifth sold a median of 8 chickens. It is unclear whether the purchases were to replenish existing stock which had been consumed or to increase the stock. Ducks were purchased by 38 percent of the owners and sold by 19 percent but the median number bought and sold was about the same. It appears that both ducks and chickens are purchased to raise for food.

In Kampongphet, chickens are raised for meat by about two-thirds of the households, but other animals are not commonly owned. Only 20 percent of the households have buffalos, 12 percent have ducks and 4 percent have pigs. The median number of chickens owned is 15. About half the owners consumed a median of 7 chickens in the previous year. During this same period 62 percent of the owners purchased a median of 10 chickens while only 7 percent sold a median of 6 chickens. As in Srisaket, it appears that the chickens are being purchased and fattened as a source of meat for the family. The median number of buffalos owned is 3. The buffalos are used for field work but the ownership rate is low because tractors are used more frequently, especially for the upland crops. The statistics on the ownership and trading of animals is presented in Tables 33 and 34.

In Lampang a majority of the households own pigs and chickens. The former are raised for sale and the latter are raised for meat (see Tables 35 and 36). Pigs are owned by 51 percent of the households of which about three-fourths own 1 or 2. Two thirds of the pig owners bought and sold animals over the previous year but of these about two-thirds bought or sold only one pig. Chickens are owned by 69 percent of the households. These households own a median of 10 birds and about three-fifths of the owners consumed a median of 5 birds during the previous year. The median numbers bought and sold during the previous year were 6 and 8 birds, respectively, but only about one-third of the owners were involved. Buffalos are kept for use in the field by 36 percent of the households. Only 6 percent of the households own cows. The median number of buffalos owned is 2. Two-thirds of the owners have between 1 and 3 buffalos. The buffalos are bought and sold at a rate to maintain the working population. The cows are bought and sold to obtain income as well as to provide working animals.

Table 31

Quantity of Animals Owned and Consumed - Srisaket
(Number of Households)

Number Owned												Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	47	55	25	13	7	3	-	-	-	-	-	75
Cow	3	18	14	4	5	7	3	-	-	-	-	27
Pig	62	7	7	2	2	2	2	-	-	-	-	42
Duck	1	7	13	4	6	14	2	3	1	2	-	27
Chicken	6	6	12	8	8	43	19	28	20	27	-	89
Number Consumed												Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	-	-	-	-	-	-	-	-	-	-	-	0
Cow	2	-	-	-	-	-	-	-	-	-	-	4
Pig	2	-	-	1	-	-	-	-	-	-	-	4
Duck	1	3	1	3	1	1	-	1	-	2	-	25
Chicken	4	8	6	7	18	29	3	4	3	6	-	50

Table 32

Quantity of Animals Bought and Sold in Last Year - Srisaket
(Number of Households)

Number Bought												Percentage of Owners who Buy
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	29	2	-	-	-	-	-	-	-	-	-	21
Cow	13	4	2	-	-	-	-	-	-	-	-	35
Pig	33	2	3	-	1	2	1	-	-	-	-	50
Duck	1	3	4	2	2	7	-	-	-	-	1	38
Chicken	2	7	10	4	6	31	11	8	16	4	-	56
Number Sold												Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	21	1	2	-	-	-	-	-	-	-	-	16
Cow	5	5	-	1	-	1	-	-	-	-	-	22
Pig	15	7	1	1	-	3	-	1	-	-	-	33
Duck	-	4	-	-	-	2	1	-	-	-	3	19
Chicken	1	1	2	6	3	11	4	3	1	4	-	20

Table 33

Quantity of Animals Owned and Consumed - Kampanghet
(Number of Households)

Number Owned	Over											Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	30		
Buffalo	1	16	8	1	2	5	-	-	1	-	20	
Pig	2	3	2	-	-	-	-	-	-	-	4	
Duck	1	2	2	2	4	8	1	-	-	-	12	
Chicken	-	3	6	4	4	22	16	15	24	13	63	
Number Owned	Percentage of Owners who Consume											
	1	2	3	4	5	6-10	11-15	16-20	21-30	30		
Buffalo	-	-	-	-	-	1	-	-	-	-	3	
Pig	-	1	-	-	-	-	-	-	-	-	14	
Duck	-	-	-	-	-	1	-	-	-	-	5	
Chicken	1	5	3	4	9	19	6	6	4	3	47	

Table 34

Quantity of Animals Bought and Sold in Last Year - Kampanghet
(Number of Households)

Number Bought	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30	Percentage
											of Owners who Buy
Buffalo	9	2	1	-	-	-	-	-	-	-	35
Pig	-	1	-	-	-	-	-	-	-	-	14
Duck	-	1	-	1	3	2	-	-	-	-	35
Chicken	-	4	3	-	5	21	10	9	7	7	62
Number Sold	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30	Percentage
											of Owners who Sell
Buffalo	3	-	-	-	-	-	-	-	-	-	9
Pig	2	1	-	1	-	-	-	-	-	-	57
Duck	-	-	1	-	-	1	-	1	-	-	15
Chicken	-	-	-	1	2	3	-	-	-	1	7

Table 35

Quantity of Animals Owned and Consumed - Lampung
(Number of Households)

Number Owned												Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	17	20	10	8	8	9	-	-	-	-	-	36
Cow	2	4	3	1	-	-	1	1	-	-	-	6
Pig	58	24	8	5	3	3	1	-	-	-	-	51
Duck	-	-	-	-	-	3	1	1	3	-	-	4
Chicken	6	11	10	5	13	25	26	13	16	13	-	69
Number Consumed												Percentage of Owners who Consume
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	-	-	-	-	-	-	-	-	-	-	-	0
Cow	-	-	-	-	-	-	-	-	-	-	-	0
Pig	-	-	-	1	-	-	-	-	-	-	-	1
Duck	-	-	1	-	1	-	-	-	-	-	-	25
Chicken	1	9	7	5	21	24	5	7	5	1	-	62

Table 36

Quantity of Animals Bought and Sold in Last Year - Lampang
(Number of Households)

Number Bought											Over 30	Percentage of Owners who Buy
	1	2	3	4	5	6-10	11-15	16-20	21-30			
Buffalo	9	2	1	-	-	-	-	-	-	-	-	17
Cow	3	2	1	-	-	-	-	-	-	-	-	50
Pig	42	14	6	2	3	-	-	-	-	-	-	66
Duck	-	1	-	-	1	2	-	-	1	-	-	63
Chicken	4	6	4	4	5	8	4	6	3	3	34	
Number Sold											Over 30	Percentage of Owners who Sell
	1	2	3	4	5	6-10	11-15	16-20	21-30			
Buffalo	7	-	3	-	-	-	-	-	-	-	-	14
Cow	3	3	1	-	-	-	-	-	-	-	-	58
Pig	43	12	1	-	-	10	-	-	2	-	-	67
Duck	-	-	-	-	1	1	-	-	-	-	-	25
Chicken	1	2	3	4	6	12	2	3	7	3	31	

In Songkla cows are raised for sale. About two-thirds of the households own a median of 4 cows, and about half of these owners sold between 1 and 2 cows during the previous year. Chickens are raised for food and for sale. Over two-thirds of the households own a median of 11 birds and 36 percent of the owners consumed a median of 5 birds. Pigs are raised for sale rather than consumption by one-fifth of the households. Half of the pig owners sold a median of 1 pig in the previous year while three-fourths bought a median of 1 pig. Ducks are raised for their eggs by one-twelfth of the households. None of the households reported owning buffalos. Farming was done primarily with hand tractors. Additional statistics on the ownership and trading of animals is presented in Tables 37 and 38.

In Chantaburi the only animals which are raised by a large number of households are chickens. Sixty percent of the households own a median of 9 birds. Fifty-five percent of the owners consumed a median of 5 birds during the previous year. Chickens are also raised for sale. Thirty-seven percent of the owners sold a median of 7 birds while only a few households purchased any. Only 4 percent of the households own buffalos. Hand tractors are relied on to do the farming. Cows, pigs, goats and ducks are also owned but by fewer than 20 percent of the households. Pigs and cows are raised for sale. The median number of pigs and cows owned is 6 and 3, respectively. Additional statistics are given in Tables 39 and 40.

The percentage of households owning animals is higher in Roi-Et than in the other provinces. Buffalos are owned by 91 percent of the households surveyed, chickens by 91 percent, cows by 58 percent, ducks by 40 percent and pigs by 10 percent. The median number of animals owned is 2 buffalos, 14 chickens, 3 cows, 2 pigs and 5 ducks. The buffalos are used for farm work and are only traded to replace stock. Cows are used mostly for work and they are traded at about the same rate as buffalos. Pigs are raised for income rather than meat. In the previous year about three-fifths of the owners sold a median of 3 pigs while two-fifths bought a median of 1 pig. Ducks and chickens are raised for meat and to a lesser extent for eggs and income. About two-thirds of the chicken owners consumed a median of 14 chickens while about half the duck owners consumed a median of 5 ducks. Additional statistics are provided in Tables 41 and 42.

In Udorn Thani the most commonly owned animals were buffalos and chickens. The former are owned by 72 percent of the households and are used for agricultural work. The latter are owned by 70 percent of the households and are raised for meat and for income. The median number of buffalos owned is 2. The median number of chickens owned is 10 and four-fifths of the owners consumed a median of 9 birds while almost two-fifths of them sold a median of 9 birds. Ducks are raised primarily for meat and eggs. About one-third of the households own a median of 5 ducks. A little less than half of the owners consumed a median of 5 ducks in the last year and about one-quarter of the households sold a median of 5 ducks. Relatively few households own cows, pigs or goats as can be seen

Table 37

Quantity of Animals Owned and Consumed in Last Year - Songkla
(Number of Households)

Number Owned												Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Cow	8	16	18	29	21	18	-	1	-	-	-	62
Pig	21	9	4	-	-	1	1	-	-	-	-	20
Duck	-	3	3	5	-	3	-	-	-	-	-	8
Chicken	2	6	2	5	10	36	30	19	10	3	-	69

Number Consumed												Percentage of Owners who Consume
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Cow	1	-	-	-	1	-	-	-	-	-	2	
Pig	-	-	-	-	-	-	-	-	-	-	0	
Duck	-	-	-	-	-	-	-	-	-	-	0	
Chicken	2	6	6	3	11	12	1	3	-	-	36	

Table 38

Quantity of Animals Bought and Sold in Last Year - Songkla
(Number of Households)

Number Bought											Percentage of Owners Who Buy
	1	2	3	4	5	6-10	11-15	16-20	Over 30		
Cow	6	3	-	-	-	-	-	-	-	-	8
Pig	16	8	3	-	-	1	-	-	-	-	78
Duck	-	1	-	1	-	-	-	-	-	-	14
Chicken	2	6	1	-	1	1	-	-	-	-	9
Number Sold											Percentage of Owners who Sell
	1	2	3	4	5	6-10	11-15	16-20	Over 30		
Cow	27	19	3	2	-	-	-	-	-	-	46
Pig	11	5	1	-	-	1	-	-	-	-	50
Duck	-	-	-	1	-	-	-	-	-	-	7
Chicken	1	3	6	2	10	8	4	4	2	-	33

Table 39

Quantity of Animals Owned and Consumed in Last Year - Chantaburi
(Number of Households)

Number Owned	Over											Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	30		
Buffalo	1	-	3	-	2	2	-	-	-	-	-	4
Cow	5	7	7	7	1	5	1	-	-	-	-	18
Goat	1	6	3	4	1	2	-	-	-	-	-	9
Pig	4	2	1	3	2	2	8	-	1	2	-	14
Duck	-	2	1	2	3	2	-	-	1	-	-	6
Chicken	3	5	5	4	6	36	18	12	10	7	-	59
Number Consumed												Percentage of Owners who Consume
	1	2	3	4	5	6-10	11-15	16-20	21-30	30		
Buffalo	-	-	-	-	-	-	-	-	-	-	-	0
Cow	-	-	-	-	-	-	-	-	-	-	-	0
Goat	-	-	-	-	-	-	-	-	-	-	-	0
Pig	-	1	-	-	-	-	-	-	-	-	-	4
Duck	-	-	-	-	-	-	-	-	-	-	-	0
Chicken	3	2	10	2	15	16	3	1	4	2	-	55

Table 40

Quantity of Animals Sold and Bought in Last Year - Chantaburi
(Number of Households)

Number Bought												Percentage of Owners who Sell
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	-	-	-	-	-	-	-	-	-	-	-	0
Cow	-	2	-	-	-	-	-	-	-	-	-	6
Goat	-	1	-	-	-	-	-	-	-	-	-	6
Pig	4	-	1	2	-	1	4	-	2	-	-	56
Duck	-	-	-	1	2	-	-	-	-	-	-	27
Chicken	3	1	-	-	-	2	-	-	-	-	-	6
Number Sold												Percentage of Owners who Buy
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	2	2	-	-	-	-	-	-	-	-	-	50
Cow	3	-	1	-	-	-	-	-	-	-	-	42
Goat	2	1	-	-	-	-	-	-	-	-	-	18
Pig	-	1	1	1	-	9	3	1	2	1	-	76
Duck	-	-	-	-	1	-	-	-	-	-	-	9
Chicken	1	5	4	4	3	11	4	3	2	2	-	37

Table 41

Quantity of Animals Owned and Consumed in Last Year - Roi-Et
(Number of Households)

Number Owned											Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30	
Buffalo	34	46	34	18	10	6	-	-	-	-	91
Cow	6	28	17	12	16	14	1	-	-	-	58
Pig	4	6	1	1	-	3	2	-	-	-	10
Duck	1	11	6	7	10	17	7	1	1	4	40
Chicken	3	10	4	8	9	31	14	26	25	17	91
Number Consumed											Percentage of Owners who Consume
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30	
Buffalo	-	-	-	-	-	-	-	-	-	-	0
Cow	2	1	-	-	-	-	-	-	-	-	3
Pig	-	-	-	-	-	-	-	-	-	-	0
Duck	1	4	3	2	5	8	2	3	2	-	46
Chicken	-	1	-	2	6	27	15	9	11	23	64

Table 42

Quantity of Animals Bought and Sold in Last Year - Roi-ET
(Number of Households)

Number Bought												Percentage of Owners who Buy
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	4	1	-	-	-	-	-	-	-	-	-	3
Cow	3	3	-	-	-	-	-	-	-	-	-	6
Pig	4	2	-	-	-	-	1	-	-	-	-	41
Duck	-	1	1	-	1	1	1	1	-	2	-	12
Chicken	2	3	3	1	1	-	-	-	2	-	-	8
Number Sold												Percentage of Owners who Sell
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	18	12	2	1	1	-	-	-	-	-	-	23
Cow	12	7	1	3	2	1	-	-	-	-	-	27
Pig	-	3	3	-	2	1	1	-	-	-	-	59
Duck	1	5	1	2	2	-	3	-	1	-	-	23
Chicken	2	2	2	-	2	9	2	2	2	6	-	20

in Table 43 and fewer trade in these animals as shown in Table 44. The members of one village own nearly all the cows.

Animal ownership rates are relatively low in Chiang Mai as can be seen in Table 45. Chickens and pigs are the only commonly owned animals with about three-fifths of the households possessing a median of 9 chickens and about one-third of the households possessing a median of 3 pigs. The chickens are raised for meat and income. Over two-thirds of the owners reported consuming a median of 5 birds, while one-fifth of the owners reported selling a median of 7 birds. Cows and buffalos are owned by 20 percent and 15 percent, respectively, of the households. The median number owned is 2 cows and 2 buffalos. These animals are used for agricultural work so there is a very little trading other than for replacement of stock (Table 46).

Two other sources of information on animal ownership are the results from the National Energy Administration's energy survey and data from the National Statistical Organization of Thailand. The former is presented in Table 47 in terms of average animal ownership per household. The latter is presented in Tables 48 to 52 in terms of the distribution of ownership. The NEA data is in general agreement with the baseline survey data. In both surveys buffalo ownership is highest in Korat, Srisaket and Roi-Et. The baseline survey found a larger percentage of owners in Petchaburi and Kampanghet and a smaller percentage in Songkla but the differences were not great. It is not possible to compare the mean of the NEA sample with the median of the baseline survey, because the latter tends to yield a higher number. For cows, the baseline survey has a larger percentage of owners in Petchaburi and a smaller percentage in Korat but again the differences are not great. For pigs the baseline survey has a higher percentage of owners in Srisaket and a lower percentage in Roi-Et. For ducks the results are without major differences. For chickens the ownership rate and the number owned in Petchaburi, Srisaket and Kampanghet are higher in the baseline survey. Although the baseline survey and the NEA survey covered different villages in each province they arrived at similar findings. It seems reasonable to conclude that animal ownership may vary somewhat between villages but the basic variation is provincial or regional in nature.

The NSO data in Table 48 indicates that the pattern of buffalo ownership does not vary significantly between regions or for that matter between provinces. A predominance of families owning 1 or 2 buffalos was found in both the baseline survey and the NSO data. The smaller number of buffalos found by the baseline survey in Songkla and Chantaburi does not correspond to the NSO's data, however, high ownership rates were observed by both sources in Srisaket, Roi-Et and Udorn Thani.

The ownership pattern for cattle varies on both a regional and provincial basis according to the NSO data, in Table 49. However, the NSO data on average ownership does not indicate a range of variation similar to that observed in the baseline survey especially for the small number of

Table 43

Quantity of Animals Owned and Consumed in Last Year - Udorn Thani
(Number of Households)

Number Owned	Over											Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	30		
Buffalo	19	51	24	11	10	10	1	-	-	-	-	72
Cow	4	6	1	1	1	5	1	-	-	-	-	11
Goat	4	1	-	-	-	-	-	-	-	-	-	3
Pig	-	1	-	-	-	3	1	-	-	-	-	3
Duck	1	8	6	5	8	9	8	1	7	1	-	31
Chicken	4	2	6	9	10	35	14	21	16	5	-	70
Number Consumed												Percentage of Owners who Consume
	1	2	3	4	5	6-10	11-15	16-20	21-30	30		
Buffalo	-	-	-	-	-	-	-	-	-	-	-	0
Cow	-	-	1	-	-	-	-	-	-	-	-	5
Goat	-	-	-	-	-	-	-	-	-	-	-	0
Pig	-	-	-	-	-	-	-	-	-	-	-	0
Duck	1	4	3	2	4	8	3	-	-	-	-	46
Chicken	2	5	3	4	10	31	7	14	11	9	-	79

Table 44

Quantity of Animals Bought and Sold In Last Year - Udorn Thani
(Number of Households)

Number Bought												Percentage of Owners who Buy.
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	14	8	-	1	-	-	-	-	-	-	-	18
Cow	-	-	-	-	-	-	-	-	-	-	-	0
Goat	1	-	-	-	-	-	-	-	-	-	-	20
Pig	-	1	-	-	-	2	-	-	-	-	-	60
Duck	1	3	-	-	1	9	5	3	1	-	-	39
Chicken	2	3	1	-	3	3	-	1	1	-	-	11
Number Sold												Percentage of Owners who Sell
	1	2	3	4	5	6-10	11-15	16-20	21-30	31-50		
Buffalo	23	9	3	1	-	-	-	-	-	-	-	29
Cow	2	1	1	-	-	-	-	-	-	-	-	21
Goat	-	1	1	-	-	-	-	-	-	-	-	40
Pig	1	1	-	-	-	2	-	-	-	-	-	80
Duck	1	4	2	1	2	3	-	2	3	1	-	26
Chicken	1	3	1	5	-	14	4	4	10	3	-	37

Table 45

Quantity of Animals Owned and Consumed in Last Year - Chiang Mai
(Number of Households)

Number Owned												Percentage of Households Owning Animals
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	9	7	5	2	-	2	-	-	-	-	-	14
Cow	2	27	1	4	-	1	-	-	-	-	-	20
Pig	24	25	8	-	1	2	-	-	-	-	1	34
Duck	-	-	1	1	-	5	-	-	-	-	-	4
Chicken	1	4	11	7	5	30	14	13	12	6	-	58
Number Consumed												Percentage of Owners who Consume
	1	2	3	4	5	6-10	11-15	16-20	21-30	Over 30		
Buffalo	-	-	-	-	-	-	-	-	-	-	-	0
Cow	-	1	-	-	-	-	-	-	-	-	-	3
Pig	-	-	-	-	-	-	-	-	-	-	-	0
Duck	-	-	-	-	-	-	-	-	-	-	-	0
Chicken	1	7	11	4	13	17	8	3	4	2	-	68

Table 46

Quantity of Animals Bought and Sold in Last Year - Chiang Mai
(Number of Households)

Number Bought											Percentage of Owners who Buy
	1	2	3	4	6-10	11-15	16-20	21-30	Over 30		
Buffalo	4	1	-	-	-	-	-	-	-	-	20
Cow	2	9	-	-	-	-	-	-	-	-	31
Pig	19	20	4	-	1	-	-	-	-	-	72
Duck	-	-	-	1	2	-	-	-	-	-	43
Chicken	-	-	2	4	3	1	2	5	9		25
Number Sold											Percentage of Owners who Sell
	1	2	3	4	6-10	11-15	16-20	21-30	Over 30		
Buffalo	2	-	1	-	-	-	-	-	-	-	12
Cow	1	2	-	1	-	-	-	-	-	-	11
Pig	9	19	4	4	1	4	1	-	1		70
Duck	-	-	-	-	-	1	1	-	-		29
Chicken	-	3	1	1	3	8	2	2	2		21

Table 47
AVERAGE NUMBER OF ANIMALS PER FAMILY BY CHANGWAT
 (NEA SURVEY DATA - PRELIMINARY)

PROVINCE	CATTLE	BUFFALO	GOATS	PIGS	DUCKS	CHICKEN	GEESE	FISH	OTHER
SONGKHLA	1.72	0.04	0.06	1.16	2.63	7.16	-	-	0.32
CHANTABURI	-	0.10	-	0.03	0.20	7.33	0.06	-	-
PETCHABURI	0.83	-	-	1.40	0.73	7.08	-	-	-
SRISAKET	0.77	0.58	-	0.57	7.03	7.58	0.02	-	0.02
NAKORN-RATCHASIMA	1.66	0.69	-	1.09	2.53	6.48	-	-	0.01
ROI-ET	0.97	0.46	-	1.35	5.19	11.30	6.15	124.61	-
KAMPANGPHET	0.06	0.18	-	0.11	0.65	6.82	-	-	0.11

Table 48
BUFFALO OWNERSHIP - NSO DATA

AREA	AVERAGE NUMBER OF ANIMALS PER OWNER	AVERAGE NUMBER OF ANIMALS PER HOUSEHOLD	PERCENTAGE OF HOUSEHOLDS OWNING BUFFALO				
			1-2 ANIMALS	3-4 ANIMALS	5-19 ANIMALS	20-49 ANIMALS	50 OR OVER ANIMALS
SOUTHERN REGION	3.5	0.4	62.4	21.4	14.1	1.8	0.1
NORTHERN REGION	3.1	1.2	52.9	27.9	18.8	0.2	0.02
NORTHEASTERN REGION	2.9	2.1	53.3	28.7	17.8	0.08	0.003
CENTRAL REGION	3.1	0.6	54.8	26.2	18.6	0.2	0.03
KORAT	3.2	1.6	48.5	29.7	21.5	0.1	0.008
SRISAKET	2.5	1.9	61.8	26.7	11.4	0.01	0.001
KAMPANGPHET	3.1	1.3	51.7	30.7	17.3	0.1	0.01
LAMPANG	2.9	1.4	55.1	27.9	16.8	0.04	0.005
CHANTABURI	3.7	0.3	41.5	32.8	25.3	0.24	0.06
ROI-ET	2.2	1.9	67.2	25.2	7.5	0.01	0.0009
UDORNTHANI	3.4	2.5	47.08	28.4	24.3	0.1	0.001
CHIANGMAI	3.2	0.9	55.8	24.0	19.4	0.6	0.05
NAN	2.7	1.1	56.4	28.8	14.6	0.02	-
BURIRUM	3.0	2.3	51.7	28.9	19.1	0.09	0.003
SONGKHLA	3.5	0.1	61.6	20.3	15.4	2.5	0.07

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Table 49

CATTLE OWNERSHIP - NSO DATA

AREA	AVERAGE NUMBER OF ANIMALS PER OWNER	AVERAGE NUMBER OF ANIMALS PER HOUSEHOLD	PERCENTAGE OF HOUSEHOLDS OWNING COWS				
			1-2 ANIMALS	3-4 ANIMALS	5-19 ANIMALS	20-49 ANIMALS	50 OR OVER ANIMALS
SOUTHERN REGION	3.5	1.3	40.07	37.3	22.2	0.2	0.04
NORTHERN REGION	4.5	1.0	66.2	13.2	17.1	2.8	0.5
NORTHEASTERN REGION	4.7	1.0	47.4	21.9	27.7	2.5	0.3
CENTRAL REGION	6.9	1.0	36.8	22.9	34.0	4.5	1.5
KORAT	7.0	1.1	47.7	15.3	28.9	6.6	1.2
SRISAKET	3.4	1.0	54.3	24.2	20.8	0.5	0.5
KAMPANGPHET	4.1	1.0	76.6	10.8	9.1	2.5	0.7
LAMPANG	4.7	1.3	57.4	13.0	26.3	3.0	0.13
CHANTABURI	4.7	0.1	62.3	20.9	15.1	0.8	0.6
ROI-ET	3.3	1.0	53.7	26.3	19.4	0.4	0.03
UDORNTHANI	6.5	7.4	35.6	19.5	38.8	5.4	0.5
CHIANGMAI	4.0	1.0	65.9	13.5	18.0	2.1	0.2
NAN	3.7	1.0	61.5	16.0	21.2	0.9	0.07
BURIRUM	6.2	0.6	41.2	19.9	32.9	5.1	0.6
SONGKHLA	3.7	1.9	33.2	41.3	25.1	0.2	0.02

cows in Kampongphet, Lampang and Udorn Thani. The median number of cows owned in each province is lower in the NSO data. It would appear that the discrepancies between the baseline and NSO results are due to a variation in the ownership of cows which occurs between villages.

The NSO data on pig ownership (Table 50) is similar to the baseline survey data with the highest rates of ownership in Lampang and Chiang Mai and the lowest in Chantaburi and Udorn Thani. The NSO data on the number of animals owned is higher than the baseline survey data and the ownership rates for the provinces differ between the two sources. As with cows it appears that the differences between villages are significant enough to affect the baseline survey summary by province.

The NSO data on chicken ownership (Table 51) indicates rates of ownership in the survey provinces between two-thirds and just over three-fourths. The only significant difference between the NSO and baseline survey data is the relatively low rate in Chantaburi observed by NSO. The baseline survey has a lower median number of chickens owned in the provinces perhaps due to the small proportion of large chicken farms included in the sample. The baseline survey found the median number of chickens owned varied between 9 and 15 while the NSO averages varied between 12 and 25.

For ducks the NSO data in Table 52 indicates a low percentage of households owning ducks in all provinces except Roi-Et and Songkla. The baseline survey had higher percentages of duck-owning household in both Roi-Et and Udorn Thani and lower percentages in Songkla, Kampongphet and Chiang Mai. The numbers owned tended to be larger in the NSO sample but the small sample size in the baseline survey and the absence of any large duck farms may be responsible for this difference. Clearly the variation between villages had a significant effect on the survey data. Larger samples would be required to make any estimates for the provinces.

10. Location of Animals and Types of Animal Feed

The potential use of animal dung as an energy source is affected not only by the number of animals owned and the distribution of ownership but also by where the animals are kept and how they are fed. In the first five provinces surveyed, the heads of households were asked where they kept their animals. Since the question was asked at the end of the winter season, the results were generally for that season. In the second phase of the survey the question was expanded to differentiate between seasons. In most of the provinces the buffalos and cows are allowed to graze or are tethered or penned. Pigs are generally kept in pens. Ducks and chickens are usually kept within the house compound but are sometimes confined to a pen.

Table 50
PIG OWNERSHIP - NSO DATA

AREA	AVERAGE NUMBER OF ANIMALS PER OWNER	PERCENTAGE OF HOUSEHOLDS OWNING PIGS	PERCENTAGE OF HOUSEHOLDS OWNING PIGS				
			1-2 ANIMALS	3-4 ANIMALS	5-19 ANIMALS	20-49 ANIMALS	50 OR OVER ANIMALS
SOUTHERN REGION	3.4	37.2	80.92		17.6	1.3	0.09
NORTHERN REGION	3.3	41.6	82.1		16.1	1.4	0.2
NORTHEASTERN REGION	3.0	25.7	84.8		13.7	12.7	0.14
CENTRAL REGION	9.1	26.1	60.7		29.8	7.0	2.4
KORAT	2.9	34.5	87.0		11.2	1.4	0.19
SRISAKET	2.7	29.1	86.0		12.9	0.9	0.08
KAMPANGPHET	4.4	22.7	77.0		19.8	2.7	0.3
LAMPANG	2.5	58.1	88.0		11.2	0.7	0.05
CHANTABURI	8.9	8.7	49.8		39.7	8.7	1.6
ROI-ET	3.0	20.4	82.9		15.6	1.3	0.1
UDORNTHANI	3.5	12.8	80.1		18.0	1.6	0.12
CHIANGMAI	2.9	59.2	84.1		14.9	0.7	0.08
NAN	2.9	65.4	86.6		12.7	0.5	0.02
EURIRUM	2.7	43.6	88.2		10.5	1.0	0.14
SONGKHLA	3.6	39.1	89.0		19.2	0.09	0.02

Table 31
CHICKEN OWNERSHIP - NSO DATA

AREA	AVERAGE NUMBER OF ANIMALS PER OWNER	PERCENTAGE OF HOUSEHOLDS OWNING CHICKENS	PERCENTAGE OF HOUSEHOLDS OWNING CHICKENS	
			1-19 ANIMALS	20 or more
SOUTHERN REGION	17.3	70.67	70.16	29.8
NORTHERN REGION	18.6	72.3	63.8	36.1
NORTHEASTERN REGION	13.2	65.9	76.7	23.2
CENTRAL REGION	45.7	52.8	58.4	41.5
KORAT	17.3	68.6	67.6	32.3
SRISAKET	13.0	68.5	76.2	23.7
KAMPANGPHET	17.3	67.8	61.8	38.1
LAMPANG	17.2	n/a	66.5	33.4
CHANTABURI	25.5	30.2	72.2	27.7
ROI-ET	12.4	74.3	78.2	21.7
UDORNTHANI	12.8	61.9	78.6	21.3
CHIANGMAI	19.2	74.9	69.26	30.7
NAN	15.9	77.8	68.74	31.2
BURIRUM	13.4	73.9	73.86	26.1
SONGKHLA	18.5	71.8	73.3	26.6

n/a Not available

DUCK OWNERSHIP - NSO DATA

AREA	AVERAGE NUMBER OF ANIMALS PER OWNER	PERCENTAGE OF HOUSEHOLDS OWNING DUCKS	PERCENTAGE OF HOUSEHOLDS OWNING DUCKS	
			1-19 ANIMALS	20 or more
SOUTHERN REGION	16.3	12.5	78.2	21.7
NORTHERN REGION	12.4	12.3	80.0	19.9
NORTHEASTERN REGION	7.7	17.9	90.5	9.4
CENTRAL REGION	54.0	15.5	67.9	32.0
KORAT	10.9	16.8	84.8	15.12
SRISAKET	5.6	17.4	92.7	7.2
KAMPANGPHET	9.6	15.0	77.9	22.0
LAMPANG	10.4	4.3	86.6	13.3
CHANTABURI	87.2	4.6	72.8	27.1
ROI-ET	5.5	27.1	92.8	7.1
UDORNTHANI	8.2	14.4	90.5	9.4
CHIANGMAI	17.5	9.2	75.4	24.5
NAN	6.3	11.6	92.9	7.0
BURIRUM	8.1	23.0	87.8	12.1
SONGKHLA	23.5	9.3	73.9	26.0

In Petchaburi, half of the owners keep their cows and buffalos on a tether or in a pen (see Table 53). The rest left the animals to graze. Three quarters of the pig owners pen their pigs and the rest tether or otherwise restrain them within the area of the house compound. Five-sixths of the owners of chickens let them run free within the area of the house compound.

In Korat about half of the owners of buffalos and cows allow them to graze on their land or in the village. Most of the other owners herd them (see Table 54). Nearly all of the pigs are kept in pens and nearly all of the ducks and chickens are allowed to roam within the confines of the house compound.

In Srisaket, nearly all of the cows and buffalos are allowed to graze either on the owners land or more likely in the village (see Table 55). Only about a third of the pig owners keep their pigs in a pen. Most of the other owners let their pigs roam within the confines of the house compound. The ducks and chickens are confined to the house compound by most owners.

In Kamphangphet about two-thirds of the owners of the buffalos keep them tethered or in a corral, the rest allow them to graze (see Table 56). Pigs are kept in pens. Most of the ducks and chickens are allowed to roam within the house compound.

In Lampang about two-thirds of the buffalo owners let their animals graze on their own land or in the village (see Table 57). About half of the owners of cows allow their cows to graze but most of the rest keep them tethered or confined to a pen or the household compound. Pens are used to contain nearly all the pigs, about two-fifths of the ducks and one-sixth of the chickens. The rest of the ducks and chickens are kept within the house compound but not penned.

For the remaining five provinces, the location where the animals are kept in different seasons is presented in Tables 58 to 62. The change of seasons does not have a significant effect on where the animals are kept except in the case of buffalos and cows. Even for these animals the shift in location is marginal and usually consists in transferring some of the stock from open grazing in the summer to being herded or otherwise restricted in the rainy season.

In Songkla, the percentage of owners allowing their cows to graze on open land decreases from 46 percent in the summer to 29 percent in the winter (see Table 58). The number of owners who keep their animals tethered increases during this period. The location in which pigs are kept does not change significantly with seasons. About one-half the owners keep their pigs in pens, another fifth keep them tethered and the rest permit them to roam within the family compound. In one village the

Table 53

Where Animals Are Kept - Petchaburi
(% of Households Owning Animals)

	Pen 1	Tether 2	House Compound 3	Herd 4	Graze on Own Land 5	Graze in Village 6	Graze on Both 7	Other 8	Total Households
Buffalo	33	18	-	9	3	24	3	9	33
Cow	23	32	-	11	-	16	2	2	38
Pig	78	13	5	-	-	-	2	-	62
Chicken	9	2	83	-	-	-	-	-	143

Table 54

Where Animals Are Kept - Korat
 (% of Households Owning Animals)

	Pen 1	Tether 2	House Compound 3	Herd 4	Graze on Own Land 5	Graze in Village 6	Graze on Both 7	Other 8	Total Households
Buffalo	5	1	2	36	4	10	14	17	92
Cow	6	-	-	47	6	12	6	24	17
Pig	98	2	-	-	-	-	-	-	47
Duck	16	-	81	-	-	3	-	-	31
Chicken	1	-	97	-	-	1	-	-	141

Table 55

Where Animals Are Kept - Srisaket
(% of Households Owning Animals)

	Pen 1	Tether 2	House Compound 3	Herd 4	Graze on Own Land 5	Graze in Village 6	Graze on Both 7	Other 8	Total Households
Buffalo	-	9	-	5	14	53	16	3	152
Cow	-	18	-	6	6	46	20	4	54
Pig	34	15	46	-	-	2	2	1	89
Duck	19	-	79	-	-	2	-	-	58
Chicken	2	1	89	-	-	-	-	-	165

Table 56

Where Animals Are Kept - Kamangphet
(% of Households Owning Animals)

	Pen 1	Tether 2	House Compound 3	Herd 4	Graze on Own Land 5	Graze in Village 6	Total Households
Buffalo	44	27	6	3	6	15	34
Pig	100	-	-	-	-	-	9
Duck	27	-	68	-	-	-	21
Chicken	11	-	82	-	1	-	104

Table 57

Where Animals Are Kept - Lampung
(% of Households Owning Animals)

	Pen 1	Tether 2	House Compound 3	Herd 4	Graze on Own Land 5	Graze in Village 6	Graze on Both 7	Other 8	Total Households
Buffalo	7	11	4	9	3	36	28	3	75
Cow	8	23	8	8	8	15	23	-	12
Pig	92	6	-	-	-	-	1	-	108
Duck	38	-	50	-	-	-	-	-	7
Chicken	17	-	75	1	1	1	1	-	142

Table 58

Where Animals Are Kept By Season - Songkla
(% of Households Owning Animals)

Animal	Season	No Response	Pen	Tether	House Compound	Graze on Own Land	Graze in Village	Total Households
Cow	Summer	4	-	41	9	8	38	111
	Rainy	3	1	65	3	11	18	111
	Winter	70	-	21	1	4	5	111
Pig	Summer	3	49	19	27	-	3	37
	Rainy	3	57	19	22	-	-	37
	Winter	89	8	3	-	-	-	37
Duck	Summer	21	-	-	79	-	-	14
	Rainy	21	-	-	79	-	-	14
	Winter	79	-	-	21	-	-	14
Chicken	Summer	10	2	2	86	-	-	124
	Rainy	10	2	2	86	-	-	124
	Winter	65	1	1	33	-	-	124

pigs roam freely among the houses creating a relatively unhealthy environment. Ducks and chickens are kept within the family compound by most owners in all seasons.

In Chantaburi the buffalos are allowed to graze during the summer and winter seasons but are herded during the rainy season while the crops are under cultivation (see Table 59). About one-fifth of the owners keep their buffalos within the house compound throughout the year. The place where the cows are kept also changes with season. About one-half of the owners let their cows graze but many move their cows from village land to their own land during the rainy and winter seasons. Another one-fifth of the owners keep their cows within the house compound while the rest keep them tethered or in herds. Pigs are kept in a pen in all seasons. Ducks are kept mostly within the household compound or to a lesser extent in pens. Chickens are kept within the house compound by 95 percent of the owners.

In Roi-Et during the rainy season, the buffalos are tethered or their grazing area is shifted to prevent the destruction of the crops. During the rest of the year about 70 percent of the owners let their buffalos graze while the other owners keep them on a tether (see Table 60). Less than one-fifth of the cow owners tether their animals in summer but this increases to two-fifths in the rainy season and then decreases to one-quarter in the winter season. Most of the other cow owners permit their animals to graze, but the grazing area is restricted during the rainy season. The pigs are kept in pens throughout the year. Nearly all of the ducks and chickens are restricted to the household compound in all seasons.

In Udorn Thani the practices are similar to Roi-Et (see Table 61). Many owners restrict their buffalos grazing on to their own land during the rainy season and on into the winter season. Some of the owners of the cows graze them on their own land or tether their animals during the rainy season. The pigs are kept in pens throughout the year. Most of the ducks and chickens are kept within the household compound throughout the year. About one-sixth of the duck owners keep the ducks in pens during the rainy and winter seasons and then let them roam in the household compound in the summer.

In Chiang Mai, buffalos are kept in the same location throughout the year (see Table 62). About 45 percent of the owners leave their animals to graze on open land throughout the year. The percentage of owners who tether their buffalos increases from 24 percent in the summer to 28 percent in the rainy season and 36 percent in the winter. The owners of cows are more likely to keep their animals tethered or to restrict their grazing habits during the rainy season. Pigs are kept in pens and chickens within the house compound throughout the year. Only three-fourths of the duck owners keep them penned or in the family compound.

Table 59
Where Animals Are Kept By Season - Chantaburi

(% of Animal Owners)

Animal	Season	No Response	Pen	Tether	House Compound	Herd	Graze on Own Land	Graze in Village	Graze on Both	Total Households
Buffalo	Summer	-	-	-	22	-	-	78	-	9
	Rainy	-	-	-	22	67	11	-	-	9
	Winter	-	-	-	22	-	-	78	-	9
Cow	Summer	6	-	12	21	9	24	27	-	33
	Rainy	3	-	15	21	9	33	18	-	33
	Winter	3	-	12	21	9	33	21	-	33
Pig	Summer	4	96	-	-	-	-	-	-	27
	Rainy	4	96	-	-	-	-	-	-	27
	Winter	4	96	-	-	-	-	-	-	27
Duck	Summer	-	18	-	82	-	-	-	-	11
	Rainy	-	18	-	82	-	-	-	-	11
	Winter	-	18	-	82	-	-	-	-	11
Chicken	Summer	-	4	-	95	1	1	-	-	109
	Rainy	-	4	-	95	1	1	-	-	109
	Winter	-	4	-	95	1	1	-	-	109

Table 60
Where Animals Are Kept By Season - Roi-Et
 (% of Animal Owners)

Animal	Season	No Response	Pen	Tether	House Compound	Herd	Graze on Own Land	Graze in Village	Graze on Both	Total Households
Buffalo	Summer	8	1	19	1	3	34	34	1	150
	Rainy	-	1	39	1		57	2	-	150
	Winter	-	1	25	1	3	45	26		150
Cow	Summer	-	-	18	-	3	33	40	6	95
	Rainy	-	1	40	1		53	4	1	95
	Winter	2	-	27	-	-	40	28		95
Pig	Summer	-	100	-	-	-	-	-	-	19
	Rainy	-	100	-	-		-	-	-	19
	Winter		100	-	-	-	-	-	-	19
Duck	Summer	1	9	-	90	-	-	-	-	69
	Rainy	3	7	-	88	-	1	-	-	69
	Winter	3	7	-	88	-	1	-	-	69
Chicken	Summer	1	-	-	99	-	-	-	-	151
	Rainy	1	-	-	99	-	-	-	-	151
	Winter	1	-	-	99	-	-	-	-	151

Table 61

Where Animals Are Kept By Season - Udorn Thani

(% of Animal Owners)

Animal	Season	No Response	Pen	Tether	House Compound	Herd	Graze on Own Land	Graze in Village	Graze on Both	Other	Total Households
Buffalo	Summer	4	7	8	2	20	14	45	-	1	133
	Rainy	-	7	2	2	15	38	31	5	1	133
	Winter	4	7	4	2	15	30	38	-	1	133
Cow	Summer	-	5	5	11	21	11	42	5	-	19
	Rainy	-	5	11	11	16	11	37	11	-	19
	Winter	16	5	11	11	16	5	37	-	-	19
Pig	Summer	-	100	-	-	-	-	-	-	-	6
	Rainy	-	100	-	-	-	-	-	-	-	6
	Winter	-	100	-	-	-	-	-	-	-	6
Duck	Summer	-	7	-	90	-	-	3	-	-	58
	Rainy	-	16	-	78	-	3	3	-	-	58
	Winter	2	16	-	78	-	2	3	-	-	58
Chicken	Summer	-	5	-	89	-	2	2	1	2	131
	Rainy	-	12	-	82	-	3	2	1	2	131
	Winter	1	7	-	86	-	3	2	-	2	131

Table 62

Where Animals Are Kept By Season - Chiang Mai

(% of Animal Owners)

Animal	Season	No Response	Pen	Tether	House Compound	Herd	Graze on Own Land	Graze in Village	Graze on Both	Other	Total Households
Buffalo	Summer	8	12	24	-	4	28	20		4	25
	Rainy		16	28	-	4	24	20	4	4	25
	Winter	4	12	36	-	4	24	16		4	25
Cow	Summer	6	19	31	6	3	17	19		-	36
	Rainy		22	36	6	3	22	8	3	-	36
	Winter	3	19	36	6	3	22	11		-	36
Pig	Summer	-	98	-	2	-	-	-		-	65
	Rainy		98	-	2	-	-	-	-	-	65
	Winter	-	98	-	2	-	-	-		-	65
Duck	Summer	-	29	-	43	-	14	-		14	7
	Rainy		29	-	43	-	14	-	-	14	7
	Winter	-	29	-	43	-	14	-		14	7
Chicken	Summer	1	9	-	90	-	-	-	-	-	106
	Rainy		9	-	90	-	-	-	1	-	106
	Winter	1	9	-	90	-	-	-		-	106

11. Animal Feed

In the second phase of the survey the heads of households were asked what they fed their animals in the different seasons. The results are shown in Tables 63 to 67. The type of animal feed does not change significantly with season except for buffalos and cows which are fed straw during the rainy season. Pigs, ducks and chickens are fed on by-products from the rice harvest, such as bran, broken rice, rice and rice husk. Process feed is used only rarely.

In Songkla most of the cows are fed grass throughout the year. The pigs are fed a variety of foods including rice bran, broken rice, process feed and food residues. Ducks are fed the same food as pigs except that rice husk is added. About two-fifths of the owners of chickens feed them rice husk but more than a third leave them to scavenge. The data on Songkla in Table 63 provides no information on winter feeding because the villagers identified only two seasons, the rainy and dry seasons.

In Chantaburi the buffalos and cows were fed on grass and straw (see Table 64). The latter is most important during the summer and winter months. The pigs are fed bran, broken rice and some process feed throughout the year. The chicken and ducks are fed rice husk, bran, broken rice and food residues. About three-fourths of the owners of chickens and three-fifths of the owners of ducks feed them rice husks.

In Roi-Et most of the cows and buffalos are fed grass during summer months and grass and straw in the rainy season, and to a lesser extent during the winter (see Table 65). Pigs are fed rice bran, broken rice and process feed, but the former is most widely used. Ducks are fed bran husk or broken rice throughout the year. Chickens are fed rice husk by one-third of the owners, rice by another third, broken rice by one-fourth, and a combination of these by the rest of the owners. The feed did not change with the season for pigs, chickens, or ducks.

In Udorn Thani straw is used to supplement the grass fed to the buffalos and cows in the winter and summer months (see Table 66). The pigs are fed bran sometimes in combination with broken rice or process feed. The feed given to the ducks and chickens is similar to that in Roi-Et. There is no seasonal change in food for these animals.

In Chiang Mai, the buffalos and cows are fed straw and grass throughout the year with a slight increase in the use of straw during the summer and winter months (see Table 67). The pigs are fed on rice bran, process feed or a combination of the two. The ducks are fed rice husk, rice bran, or process feed. Most of the chickens are fed rice or a combination of rice, broken rice, husk and bran. There is very little change in feed type with season for any of these animals.

Table 63.

What Animals are Fed by Season in Songkla
(Number of Owners)

Feed	Cow			Pig			Duck			Chicken		
	S	R	W	S	R	W	S	R	W	S	R	W
Rice Bran	-	-	-	5	6	-	1	1	1	4	6	3
Rice Husk	3	3	2	-	-	-	4	5	1	54	57	18
Broken Rice	-	-	-	-	-	-	-	-	-	6	6	4
Rice	-	-	-	2	2	-	-	-	-	3	3	1
Grass	02	04	31	-	-	-	-	-	-	1	1	-
Bran, Broken Rice	-	-	-	1	1	-	-	-	-	1	1	1
Bran, Process Feed	-	-	-	4	4	1	2	2	-	-	-	-
Husk, Rice	-	-	-	-	-	-	-	-	-	5	5	1
Straw, Grass	3	3	1	-	-	-	-	-	-	-	-	-
Rice, Food Residue	-	-	-	-	-	-	-	-	-	5	5	1
Bran, Broken Rice, Process Feed	-	-	-	6	6	-	-	-	-	-	-	-
Food Residue	-	-	-	4	4	-	2	3	1	-	-	-
Bran, Food Residue	-	-	-	-	-	-	1	1	-	-	-	-
Bran, Banana Leaf	-	-	-	-	-	-	-	-	-	-	1	-
Total	111	111	111	32	32	37	14	14	14	123	123	123

Table 64

What Animals are Fed by Season in Chantaburi
(Number of Owners)

Feed	Buffalo			Cow			Pig			Duck			Chicken		
	S	R	W	S	R	W	S	R	W	S	R	W	S	R	W
Rice Bran	1	1	1	1	1	1	8	8	8	1	1	1	7	7	7
Rice Husk	-	-	-	1	1	1	-	-	-	6	6	6	74	74	74
Broken Rice	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-
Rice	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2
Straw	3	1	-	3	1	3	-	-	-	-	-	-	1	1	1
Grass	3	5	6	18	21	18	-	-	-	-	-	-	-	-	-
Bran, Broken Rice	-	-	-	-	-	-	2	2	2	-	-	-	1	1	1
Bran, Process Feed	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
Straw, Grass	1	1	1	9	8	9	-	-	-	-	-	-	-	-	-
Process Feed	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-
Rice, Food Residue	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2
Bran, Broken Rice, Process Feed	-	-	-	-	-	-	15	15	15	-	-	-	2	2	2
Food Residue	-	-	-	-	-	-	-	-	-	1	1	1	10	10	11
Bran, Food Residue	-	-	-	-	-	-	-	-	-	1	1	1	4	4	4
Bran, Banana Leaf	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
Total	8	8	8	32	32	32	27	27	27	10	10	10	104	104	104

Table 65

What Animals are Fed by Season in Roi-Et
(Number of Owners)

Feed	Buffalo			Cow			Pig			Duck			Chicken		
	S	R	W	S	R	W	S	R	W	S	R	W	S	R	W
Rice Bran	-	1	1	-	-	1	15	15	15	29	28	29	4	4	4
Rice Husk	1	1	1	-	-	-	-	-	-	31	31	30	50	51	49
Broken Rice	-	-	-	-	-	-	1	1	1	6	6	6	21	21	22
Rice	1	1	1	-	-	1	-	-	-	1	1	1	48	45	47
Straw	-	5	11	2	6	9	-	-	-	-	-	-	-	-	-
Grass	143	80	100	90	44	63	-	-	-	-	-	-	-	-	-
Bran, Broken Rice	-	-	-	-	-	-	1	1	1	1	1	1	-	-	-
Bran, Process Feed	-	-	-	-	-	-	2	2	2	-	-	4	-	-	-
Husk, Rice	-	-	-	-	-	-	-	-	-	-	-	-	24	25	24
Straw, Grass	5	62	36	3	45	21	-	-	-	-	-	-	-	-	-
Process Feed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Total	150	150	150	95	95	95	19	19	19	67	67	67	147	147	147

Table 66

What Animals are Fed by Season in Udorn Thani
(Number of Owners)

Feed	Buffalo			Cow			Pig			Duck			Chicken		
	S	R	W	S	R	W	S	R	W	S	R	W	S	R	W
Rice Bran	-	-	-	-	-	-	2	2	2	23	22	22	13	12	13
Rice Husk	-	-	-	-	-	-	-	-	-	16	20	21	33	35	34
Broken Rice	-	-	-	-	-	-	-	-	-	5	4	2	7	8	7
Rice	-	-	-	-	-	-	-	-	-	1	-	-	33	31	32
Straw	26	4	15	1	-	-	-	-	-	-	-	-	-	-	-
Grass	45	58	32	8	12	5	-	-	-	-	-	-	-	-	-
Bran, Broken Rice	-	-	-	-	-	-	2	2	2	4	4	4	2	2	3
Bran, Process Feed	-	-	-	-	-	-	2	2	2	-	-	-	1	1	1
Husk, Rice	1	1	1	-	-	-	-	-	-	6	5	6	27	26	26
Straw, Grass	60	68	83	10	7	14	-	-	-	-	-	-	-	-	2
Process Feed	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Hay	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
Rice, Broken Rice	-	-	-	-	-	-	-	-	-	-	-	-	3	2	2
Bran, Broken Rice, and Husk	-	-	-	-	-	-	-	-	-	3	3	3	5	5	5
Husk and Broken Rice	-	-	-	-	-	-	-	-	-	-	-	-	6	6	5
Total	132	132	132	19	19	19	6	6	6	58	58	58	131	131	131

Table 67

What Animals are Fed by Season in Chiang Mai
(Percentage of Owners)

Feed	Buffalo			Cow			Goat			Pig			Duck			Chicken		
	S	R	W	S	R	W	S	R	W	S	R	W	S	R	W	S	R	W
Rice Bran	-	-	-	-	-	-	-	-	-	25	25	25	2	2	2	4	4	4
Rice Husk	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2	6	6	6
Broken Rice	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-	8	8	8
Rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	69	69	69
Straw	3	3	3	6	5	6	1	1	1	-	-	-	-	-	-	-	-	-
Grass	8	11	11	11	16	13	-	-	-	-	-	-	-	-	-	-	-	-
Bran	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-
Bran, Broken Rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	9	9
Bran, Process Feed	-	-	-	-	-	-	-	-	-	26	26	26	-	-	-	-	-	-
Husk, Rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4	4
Straw, Grass	14	11	11	18	14	16	-	-	-	1	1	1	-	-	-	-	-	-
Process Feed	-	-	-	1	1	1	-	-	-	10	10	10	2	2	2	-	-	-
Rice, Broken Rice	-	-	-	-	-	-	-	-	-	2	2	2	-	-	-	5	5	5
Husk, Broken Rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
Total	25	25	25	36	36	36	1	1	1	65	65	65	7	7	7	106	106	106

12. Use of Dung

The use of the dung from different animals was determined by asking the head of household if dung is used for fertilizer on his own land, sold as a fertilizer, fed to fish or not used. The responses by type of animal and province are presented in Table 68. The primary use of dung is as a fertilizer. Negligible quantities are sold or used for fish food.

The use of buffalo and cow dung as a fertilizer was reported by more households than reported owning buffalos in all provinces except Srisaket where the numbers were equal and in Kamphangphet where very little use of manure was reported. The provinces with the greatest difference between ownership and use are: Petchaburi, where 22 percent of the households own cows but 40 percent use the manure for fertilizer; Korat, where the cow ownership is 8 percent but 20 percent reported using the manure; Lampang, where 36 percent of the households own buffalos and 6 percent own cows but 55 percent use buffalo manure and 16 percent use cow manure; and Chantaburi where 4 percent own buffalos but 29 percent use manure for fertilizer. More households own pigs than use the manure in all provinces except Udorn Thani. Particularly low rates of utilization occur in Korat, Srisaket, Songkla, and Petchaburi. The manure from chickens and ducks is used by two-fifths or less of the owners in all provinces except for in Srisaket, Lamapang, Roi-Et and Udorn Thani.

13. Overview of Agricultural Activities

The survey enumerators prepared essays describing the agricultural activities in their village including the type of crops, the source of seed, the method of land preparation and seeding, the use of fertilizer and irrigation, the methods of cultivation and weeding, the type of equipment used and the access to and use of government programs and new agricultural technologies. The results of these essays were categorized and are presented in Table 69. Another essay was prepared on the marketing channels used by the farmers, the degree of control the farmer has over these markets, and the ways in which the farmer might improve his position relative to these markets. The responses were categorized and are summarized by village in Table 70. These responses are more subjective than the ones in the previous table since the questions are more speculative.

Table 68
Uses of Dung by Type of Animal
(% of Household by Changwat)

Changwat	Animal Type	Percentage of Families Owning	Fertilizer	Fertilizer For Sale	Fish Feed
Petchaburi	Buffalo	17	21.4	-	1
	Cow	22	39.6	-	-
	Pig	31	8.3	-	-
	Duck	2	-	-	-
	Chicken	76	22.0	-	1
Korat	Buffalo	47	49.5	0.5	0.5
	Cow	8	20.4	0.5	-
	Pig	23	11.7	0.5	1.5
	Duck	15	5.6	0.5	-
	Chicken	69	24.0	-	1.5
Srisaket	Buffalo	75	74.9	0.5	1.0
	Cow	27	33.2	-	0.5
	Pig	42	8.0	-	0.5
	Duck	27	15.1	-	2.0
	Chicken	89	41.7	11.0	2.5
Kampangphet	Buffalo	20	4.1	-	0.6
	Pig	4	.6	-	-
	Duck	12	-	-	1.2
	Chicken	63	2.3	-	8.8
Lampang	Elephant	2	1.5	-	-
	Buffalo	36	54.7	-	-
	Cow	6	15.9	0.5	-
	Pig	51	36.8	0.5	1.5
	Duck	4	4.5	-	-
	Chicken	69	37.8	-	0.5
Chiang Mai	Buffalo	14	20.9	1.7	0.6
	Cow	20	20.3	2.3	0.6
	Pig	34	27.7	1.7	-
	Chicken	58	8.5	-	-
Songkla	Cow	62	70.4	-	0.6
	Pig	20	1.7	-	-
	Chicken	69	26.8	-	-
Chantaburi	Buffalo	4	28.7	1.1	-
	Cow	18	21.0	0.6	-
	Pig	14	8.3	-	-
	Duck	6	1.7	-	-
	Chicken	59	9.4	-	-

Table 68 (continued)
Uses of Dung by Type of Animal
 (% of Household by Changwat)

Changwat	Animal Type	Percentage of Families		Fertilizer For Sale	Fish Feed
		Owning	Fertilizer		
Roi-et	Buffalo	91	96.3	-	-
	Cow	58	64.2	0.6	-
	Pig	10	7.4	-	-
	Duck	40	14.2	-	-
	Chicken	91	50.0	-	-
Udon Thani	Buffalo	72	79.9	-	-
	Cow	11	10.9	-	-
	Pig	3	8.6	-	-
	Duck	31	28.7	-	0.6
	Chicken	70	10.4	-	1.0

Table 69
AGRICULTURAL ACTIVITIES ESSAY

	VILLAGE	MAJOR CROPS								SOURCE OF SEED			LAND PREPARATION				SEEDING			
		RICE	ANNUAL CROPS OR KITCHEN GARDEN CROPS	CASSAVA	BEANS	FIBER PLANTS	TOBACCO	RUBBER	PERRENIAL PLANTS	COCONUT	FROM LAST YEAR	BUY	FREE FROM GOVERNMENT	PLOUGH 1 TIME	PLOUGH 2 OR MORE TIMES	DIGGING, HOEING, MOUNDING	BROADCAST SEEDING	DRILLING PLANTING BUTTS OR SMALL BRANCHES	STICK IN THE GROUND	BUD GRAFTING
CHIANGWAT	1	x	x																	
	2	x	x		x								x	x	x	x	x			
	3	x	x										x	x	x	x	x			
	4	x	x										x	x		x				
	5	x	x										x	x	x	x	x			
PETCHABURI	1	x		x									x		x	x	x			
	2	x											x	x	x	x	x			
	3	x											x	x	x	x	x			
	4	x											x	x		x				
	5	x											x	x	x	x	x			
KORAT	1	x		x									x		x	x	x			
	2	x		x									x			x				
	3	x		x									x			x				
	4	x		x									x			x				
	5	x	x		x								x			x				
SRISAKET	1	x	x										x		x	x				
	2	x				x	x						x	x	x	x				
	3	x				x	x						x	x	x	x				
	4	x	x										x	x		x				
	5	x	x										x			x	x			
KAMPANGPHET	1	x	x		x								x	x		x				
	2	x		x	x								x			x				
	3	x		x	x								x			x				
	4	x	x	x									x			x	x			
	5	x	x		x								x		x	x	x			
LAMPANG	1												x		x	x	x			
	2	x	x										x			x				
	3	x			x								x		x	x	x			
	4	x											x			x				
	5	x			x								x		x	x	x			

Table 69
AGRICULTURAL ACTIVITIES ESSAY

	VILLAGE	MAJOR CROPS								SOURCE OF SEED			LAND PREPARATION			SEEDING			
		RICE	ANNUAL CROPS OR KITCHEN GARDEN CROPS	CASSAVA	BEANS	FIBER PLANTS	TOBACCO	RUBBER	PERRENIAL PLANTS	COCONUT	FROM LAST YEAR	BUY	FREE FROM GOVERNMENT	PLOUGH 1 TIME	PLOUGH 2 OR MORE TIMES	DIGGING, HOEING, MOUNDING	BROADCAST SEEDING	DRILLING PLANTING BUMPS OR SMALL BRANCHES	STICK IN THE GROUND
CHIANGWAT	1	x	x							x	x	x	x		x	x	x		x
	2	x										x	x		x	x	x		x
	3	x			x					x	x	x	x		x	x	x		x
	4	x								x		x	x		x	x	x		x
	5	x								x		x	x			x	x		x
SONGKHLA	1	x		x						x		x			x	x	x	x	
	2	x										x			x	x	x		x
	3	x								x		x			x	x	x		x
	4	x								x		x			x	x	x		x
	5	x								x		x				x	x		x
CHANTABURI	1	x		x						x		x			x	x	x	x	
	2	x								x				x	x	x	x	x	
	3	x								x				x	x	x	x	x	
	4	x								x	x				x	x	x	x	
	5	x							x						x	x	x	x	
ROI-ET	1	x				x	x			x	x				x	x	x		
	2	x					x			x	x					x	x		
	3	x				x	x			x				x		x	x		
	4	x				x	x			x			x			x	x		
	5	x	x							x	x		x	x		x	x		
UDOMTANI	1	x	x	x						x					x	x	x	x	
	2	x	x	x						x					x	x	x	x	
	3	x								x					x	x	x	x	
	4	x	x	x						x				x	x	x	x	x	
	5	x	x							x				x	x	x	x	x	
CHIANGMAI	1	x	x							x	x			x	x	x	x		
	2	x	x			x				x	x	x				x			
	3	x								x					x	x	x		
	4	x								x	x				x	x	x		
	5	x								x					x	x	x		

Table 69 (continued)

	VILLAGE	FERTILIZER USE				CULTIVATION PRACTICE					IRRIGATION			WEEDING			HARVESTING LABOR		
		MANURE	CHEMICALS	DO NOT USE	NO RESPONSE	CONSTANT ATTENTION	SOMETIMES NEED ATTENTION	NOT NEED ATTENTION	WHEN PLANTS ARE SMALL DURING PADDY SEASON	RAINWATER ONLY	WATER PUMP, OTHER SOURCE	PUMPED BY IRRIGATION DEPT.	IRRIGATION CANALS	MANUAL WEEDING	HERBICIDES	NO PROBLEM, NEVER WEED	HOUSEHOLD LABOUR	EXCHANGE LABOUR	HIRE LABOUR
CHANGWAT	1		x	x		x	x									x	x		
	2		x			x		x	x						x			x	
	3		x		x			x	x						x		x		
	4		x				x	x					x	x					
	5	x	x		x	x	x			x			x	x					
PETCHABURI	1		x		x	x			x			x	x					x	
	2			x									x					x	
	3		x		x			x	x			x			x		x		
	4		x				x	x					x	x					
	5	x	x		x	x	x			x			x	x					
KORAT	1		x		x	x			x			x	x					x	
	2			x									x					x	
	3	x			x				x	x			x					x	
	4	x		x					x	x			x		x			x	
	5	x		x					x	x			x					x	
SRISAKET	1	x	x			x			x	x			x	x	x	x			
	2			x	x	x				x			x	x	x	x	x		
	3			x	x	x			x				x	x	x	x	x		
	4	x	x				x		x	x			x			x			
	5	x			x	x			x				x		x			x	
KAMPANGPHET	1		x		x	x	x						x	x					
	2			x		x							x	x					
	3			x	x	x	x						x	x					
	4			x	x								x	x				x	
	5		x	x	x	x	x						x	x	x				
LAMPANG	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2		x						x				x					x	
	3	x				x				x								x	
	4	x				x				x								x	
	5			x					x				x	x		x		x	

Table 69 (continued)

CHANGWAT	VILLAGE	FERTILIZER USE				CULTIVATION PRACTICE					IRRIGATION				WEEDING			HARVESTING LABOR		
		MANURE	CHEMICALS	DO NOT USE	NO RESPONSE	CONSTANT ATTENTION	SOMETIMES NEED ATTENTION	NOT NEED ATTENTION	WHEN PLANTS ARE SMALL	DURING PADDY SEASON	RAINWATER ONLY	WATER PUMP, OTHER SOURCE	PUMPED BY IRRIGATION DEPT	IRRIGATION CANALS	MANUAL WEEDING	HERBICIDES	NO PROBLEMS, NEVER WEED	HOUSEHOLD LABOUR	EXCHANGE LABOUR	HURED LABOUR
SONGKHLA	1	x	x		x	x		x		x			x	x		x		x		
	2		x		x	x			x	x				x	x					
	3		x		x	x			x	x				x	x					
	4		x			x	x		x				x	x	x					
	5		x	x		x			x				x	x						
CHANTABURI	1		x	x		x			x				x	x	x				x	
	2		x	x		x			x				x	x	x				x	
	3		x	x		x			x				x	x					x	
	4	x	x			x			x	x			x	x	x				x	
	5			x	x	x						x	x	x					x	
ROI-ET	1				x	x			x		x		x	x					x	
	2	x	x		x	x			x			x	x	x			x			
	3	x	x	x					x	x			x	x		x			x	
	4	x	x	x		x	x			x				x					x	
	5	x	x			x			x	x	x			x		x			x	
UDORN THANI	1			x	x	x								x						
	2			x	x	x								x					x	
	3								x				x						x	
	4	x			x	x			x										x	
	5		x										x	x						
CHIANGMAI	1				x		x						x	x	x				x	
	2	x	x		x								x	x		x			x	
	3			x	x				x	x			x	x	x				x	
	4	x	x	x	x				x	x									x	
	5	x	x																x	

Table 69 (continued)

	VILLAGE	EQUIPMENT USED			POWER SOURCE			RICH AND POOR FARMERS			NEW AGRIC TECHNOLOGIES		WHY NOT USE NEW TECHNOLOGIES			CHANGES IN TECHNOLOGY			
		TWO WHEEL TRACTOR	PLOUGH	TRACTOR	WATER PUMP	SPRAYER	MAN POWER	ANIMAL POWER	THE SAME	RICH OWN GOOD EQUIPMENT POOR RENT OR OWN OLD EQUIPMENT	YES, MOST OF THEN DO	NO	TRADITIONAL TECH. GIVES HIGHER YIELDS	DIFFICULT, WASTE TIME AND LABOUR	COST	LACK OF TECHNICAL ASSISTANCE	MODERN MACHINES	BETTER IRRIGATION	NEW SEED VARIETIES, AGRICULTURAL PROCESSES AND FERTILIZER
CHIANGWAT																			
	PETCHABURI	1	x		x		x			x							x	x	
		2	x	x			x	x	x								x	x	
		3	x		x			x	x								x	x	
		4	x	x		x		x	x								x	x	
	5			x	x		x	x								x		x	
-111- KORAT		1		x			x		x								x		x
		2	x		x		x	x		x							x	x	x
		3		x				x	x								x	x	x
		4		x				x	x								x		x
		5		x		x		x	x								x	x	x
SRISAKET		1		x		x	x		x		x	x					x	x	x
		2					x	x	x				x						x
		3		x				x	x					x					x
		4						x	x						x			x	x
		5						x	x									x	x
KAMPANGPHET		1			x		x			x	x				x				x
		2			x		x				x				x				x
		3	x	x	x	x		x		x									x
		4	x	x				x	x		x			x				x	x
		5	x		x	x		x			x								x
LAMPANG		1																	
		2		x			x	x		x								x	x
		3		x		x		x										x	x
		4						x	x					x					
		5						x	x					x					

Table 69 (continued)

	VILLAGE	GOVERNMENT PROGRAMS			MAJOR FARM PROBLEMS			FARM INCOME PROBLEMS			POSSIBLE USES OF NEW TECHNOLOGY		
		IRRIGATION	DEVELOP NON-AGRICULTURAL ACTIVITY	FARMING PROMOTION	IRRIGATION WATER SUPPLY, FLOOD CONTROL	LACK AGRICULTURAL INVESTMENT	LACK AGRICULTURAL KNOWLEDGE	LOW YIELDS, LOW PRICES	SMALL AREAS, INEFFICIENT LAND USE	NO OFF-FARM EMPLOYMENT	COMMUNICATION AND TRANSPORTATION	IMPROVED IRRIGATION	AGRICULTURAL POWER EQUIPMENT
CHANGWAT	1	x			x						x		
	2	x			x						x		x
	3	x			x						x		
	4				x						x		
	5		x		x						x		
PETCHABURI	1	x			x						x		
	2	x			x						x		
	3	x			x						x		
	4				x						x		
	5				x						x		
KORAT	1	x			x						x		
	2	x	x		x	x					x		
	3	x	x		x	x					x		
	4		x		x						x		
	5	x			x			x			x		
SRISAKET	1		x		x						x	x	
	2		x		x						x	x	
	3				x						x	x	
	4	x			x						x	x	
	5				x				x		x	x	
KAMPANGPHIET	1		x		x	x					x	x	x
	2		x		x						x	x	x
	3				x						x	x	
	4	x	x		x						x	x	
	5		x		x	x				x	x	x	
LAMPANG	1				x	x				x	x	x	
	2		x		x						x	x	
	3	x	x		x						x	x	
	4				x			x			x	x	
	5	x			x			x			x	x	

Table 69 (continued)

	VILLAGE	GOVERNMENT PROGRAMS			MAJOR FARM PROBLEMS									
		IRRIGATION	DEVELOP NON-AGRICULTURAL ACTIVITY	FARMING PROMOTION	IRRIGATION WATER SUPPLY, FLOOD CONTROL	LACK AGRICULTURAL INVESTMENT	LACK AGRICULTURAL KNOWLEDGE	LOW YIELDS, LOW PRICES	SMALL AREAS, INEFFICIENT LAND USE	NO OFF-FARM EMPLOYMENT	COMMUNICATION AND TRANSPORTATION	IMPROVED IRRIGATION	AGRICULTURAL POWER EQUIPMENT	BETTER EQUIPMENT
CHANGWAT	1	x	x		x			x				x		x
	2				x			x				x		
	3		x		x			x				x		x
	4	x			x		x	x					x	
	5		x		x	x		x				x		x
SONGKHLA	1		x		x			x				x	x	
	2		x		x				x				x	
	3		x		x			x				x	x	
	4	x	x						x			x	x	
	5	x			x			x				x	x	x
CHANTABURI	1		x		x			x				x	x	
	2		x		x				x				x	
	3		x		x			x				x	x	
	4	x	x						x			x	x	
	5	x			x			x				x	x	x
ROI-ET	1		x		x				x			x	x	
	2	x	x		x				x			x		
	3	x						x				x	x	
	4	x			x				x			x	x	x
	5	x		x	x	x						x	x	
UDORN TANI	1		x			x		x				x	x	
	2		x	x	x			x				x	x	
	3	x			x			x				x		
	4		x		x			x				x		
	5	x	x		x	x		x					x	
CHIANGMAI	1	x	x		x			x				x		x
	2	x						x				x		
	3		x		x							x	x	
	4		x			x	x	x						
	5	x						x					x	x

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Table 70

	VILLAGE	ABILITY TO DELAY SALE				EQUIPMENT FOR DRYING, MILLING			PROCESSORS MONOPOLY			METHOD TO INCREASE YIELDS			NEED FOR MORE PROCESSING			HOW TO EXPAND MARKET					
		CAN WAIT FOR A GOOD PRICE	CANNOT, PRODUCTS CANNOT BE STORED	CANNOT, NEED MONEY TO PAY LOANS, EXPENSES	CAN WAIT FOR SOME PRODUCTS	VILLAGERS	PEOPLE OUTSIDE THE VILLAGE	MERCHANTS	SELL ONLY TO THEM	CAN SELL TO ANYONE	SOME PRODUCTS SOLD ONLY TO THEM	CONSTRUCT MORE IRRIGATION CANALS, DAMS, RESERVOIRS OR ARTESIAN WELLS	INTRODUCE AND PROMOTE NEW TECHNIQUES AND SEEDS	MORE EXTENSIVE AND PRODUCTIVE USE OF THE LAND	PRICE OF ALREADY GOOD	GOOD QUALITY PICKLING, DRYING, THRESHING, BAKING	NO RESPONSE	INTRODUCE FACTORIES OR EQUIPMENT	NOT NECESSARY MANY MARKETS	NO DATA	GOOD COOPERATIVE SOCIETIES	NO CONTROL OVER MARKET	ORGANIZE A FARMER'S GROOP
CHANGWAT																							
PETCHABURI	3		x			x	x				x										x		
	4		x	x		x					x										x		
	5		x	x		x	x				x					x					x		
KORAT	1	x				x					x	x				x					x		
	2	x					x				x					x					x		
	3	x				x					x					x					x		
	4				x	x		x			x					x					x		
KAMPANGPHET	4			x		x			x		x	x				x					x		
	1			x		x					x					x					x		
LAMPANG	2			x		x		x			x						x					x	
	3					x					x					x					x		
	4	x				x					x					x					x		

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Table 70 (continued)

	VILLAGE	ABILITY TO DELAY SALE			EQUIPMENT FOR DRYING, MILLING			PROCESSORS MONOPOLY			METHOD TO INCREASE YIELDS			NEED FOR MORE PROCESSING			HOW TO EXPAND MARKET					
		CAN WAIT FOR A GOOD PRICE	CANNOT, PRODUCTS CANNOT BE STORED	CANNOT, NEED MONEY TO PAY LOANS, EXPENSES	CAN WAIT FOR SOME PRODUCTS	VILLAGERS	PEOPLE OUTSIDE THE VILLAGE	MERCHANTS	SELL ONLY TO THEM	CAN SELL TO ANYONE	SOME PRODUCTS SOLD ONLY TO THEM	CONSTRUCT MORE IRRIGATION CANALS, DAMS, RESERVOIRS OR ARTESIAN WELLS	INTRODUCE AND PROMOTE NEW TECHNIQUES AND SEEDS	MORE EXTENSIVE AND PRODUCTIVE USE OF THE LAND	PRICE OF ALREADY GOOD	GOOD QUALITY PICKLING, DRYING, THRESHING, BAKING	NO RESPONSE	INTRODUCE FACTORIES OR EQUIPMENT	NOT NECESSARY MANY MARKETS	NO DATA	GOOD COOPERATIVE SOCIETIES	NO CONTROL OVER MARKET
CHANGWAT																						
LAMPANG	5			x		x			x		x					x			x			
SONGKHLA	1		x			x				x	x				x							
	2				x	x			x		x				x		x		x			
	3			x		x			x			x			x		x			x		
	4		x	x		x	x		x				x				x					
	5		x	x		x			x		x	x			x				x			
CHANTABURI	1				x	x			x			x				x			x			
	2				x	x			x			x				x			x			
	3				x	x			x		x	x				x			x			
	4				x	x			x			x			x							
	5				x	x			x		x				x					x		
ROI-ET	1				x	x			x		x				x				x			
	2			x		x			x		x				x							

Agricultural Marketing and Processing Essay

Table 70 (continued)

	CHANGWAT	ABILITY TO DELAY SALE				EQUIPMENT FOR DRYING, MILLING			PROCESSORS MONOPOLY			METHOD TO INCREASE YIELDS			NEED FOR MORE PROCESSING			HOW TO EXPAND MARKET						
		VILLAGE	CAN WAIT FOR A GOOD PRICE	CANNOT, PRODUCTS CANNOT BE STORED	CANNOT, NEED MONEY TO PAY LOANS, EXPENSES	CAN WAIT FOR SOME PRODUCTS	VILLAGERS	PEOPLE OUTSIDE THE VILLAGE	MERCHANTS	SELL ONLY TO THEM	CAN SELL TO ANYONE	SOME PRODUCTS SOLD ONLY TO THEM	CONSTRUCT MORE IRRIGATION CANALS, DAMS, RESERVOIRS OR ARTESIAN WELLS	INTRODUCE AND PROMOTE NEW TECHNIQUES AND SEEDS	MORE EXTENSIVE AND PRODUCTIVE USE OF THE LAND	PRICE OF ALREADY GOOD	GOOD QUALITY PICKLING, DRYING, THRESHING, BAKING	NO RESPONSE	INTRODUCE FACTORIES OR EQUIPMENT	NOT NECESSARY MANY MARKETS	NO DATA	GOOD COOPERATIVE SOCIETIES	NO CONTROL OVER MARKET	ORGANIZE A FARMER'S GROUP
ROI-ET		3		x		x				x	x	x					x							
		4		x			x			x		x	x				x							
		5	x	x		x				x		x	x							x				
UDORNTANI		1			x	x		x		x							x			x				
		2			x	x				x			x		x						x			
		3		x		x				x		x	x					x			x			
		4			x	x				x			x				x							x
		5	x	x		x				x			x			x		x						
CHIANGMAI		1		x		x				x		x				x			x					
		2		x		x				x		x					x			x				
		3		x		x	x			x			x					x		x				
		4		x		x				x		x	x				x							
		5		x		x				x		x	x					x						

11/9/

Animal Ownership for Biogas Production

Table 71

Kampangphet	Percentage of Families Having			
	1 buffalo	2 cows	3 cows	9 pigs
Petchaburi	17	19	16	6
Urat	47	8	1	2
Srisaket	75	25	17	1
Kampangphet	20	-	-	-
Lampang	36	5	3	1
Songkla	-	58	47	1
Chantaburi	4	15	12	6
Roi-et	91	55	37	1
Udorn Thani	18	-	-	-
Chiang Mai	14	19	3	1

14. Conclusions

The agricultural area controlled by the households are greater than the areas actually owned because of supplemental tenure arrangements such as land from parents, public lands, rented land, and sharecropped land. The median area controlled exceeds the median area owned in Lampang, Chiang Mai, Songkla, and Roi-et by 1-3 rai while in the other provinces the increment is between 5 and 8 rai. The provinces in which the median area controlled is 20 rai or more include Petchaburi, Srisaket, Kampanghet, Roi-et, and Udorn Thani. Median areas of 6 and 7 rai occur in Lampang and Chiang Mai, respectively. If the area actually planted (allowing for multiple cropping) is used as an index, then the provinces with the largest median areas are Srisaket, Kampanghet, Roi-et, and probably Udorn Thani, and those with the smallest median area (6 to 9 rai) are Chiang Mai, Lampang, Songkla, and Chantaburi.

The production of rice provides the best measure of agricultural productivity, especially when trying to determine the availability of agricultural residues. In terms of the median quantity of rice produced, Kampanghet has the greatest amount, followed by Udorn Thani, Petchaburi, Korat, and Srisaket. The smallest median quantities are in Lampang and Songkla, followed by Chiang Mai and Chantaburi. For the total sample the median quantity produced is 3100 kilograms and the median area planted is about 10 rai. The quantity of biomass field residue (stalks left standing in the field) can be calculated either by multiplying the production by a residue weight factor or by multiplying the area planted by the average field residue per unit area. In the survey report "Biomass Samples" the collection of field residues produced an average yield of 3.4 kilograms of dry matter per square meter.¹⁾ This implies about 54,000 kilograms of stalk for the median area planted or an average quantity of stalk of 17.5 kilograms per kilogram of padi. The husk and bran obtained from the padi is about 35% of the weight according to the survey report, "Rural Industry". This would imply for the median agricultural production about 1100 kilograms of husk and bran, most of which would remain with the local rice mill. Not included in this calculation is the straw which is cut with the padi and then either burned in the field or collected for animal feed.

The higher yields per rai obtained in Chiang Mai, Songkla, and Lampang would result in higher yields of stalk per rai whereas the relatively low yields in Srisaket and Roi-et would result in lower stalk yields. The

1) The quantity of stalk left in the field varies with the quantity of rice produced and method of harvesting (height of cut). The coefficient of variation for rice stalk yield per square meter is 63%. The rice yields per rai have a comparable coefficient of variation. The coefficient of variation in height of cut was not analyzed. The median values for stalk yield and rice yield provide only a first order approximation of the residue weight factor.

median yields for the provinces are 400 kg per rai or more in Kamphangphet, Lampang, Songkla, and Chiang Mai; about 300 kg per rai in Petchaburi, Korat, and Chantaburi; 250 kg per rai in Udorn Thani; 200 kg per rai in Srisaket; and 160 kg per rai in Roi-et. The non-rice residues should be significant for cassava in Korat; the corn, cassava, and sugar cane in Kamphangphet; and the cotton, corn, and sugar cane in Petchaburi.

For non-rice crops the median area planted for all the survey households was about 2 rai. This area would yield about 14,400 kilograms of field residue if planted in sugar cane; about 11,800 kilograms if planted in cassava; about 4300 kilograms if planted in corn; and about 3400 kilograms if planted in tobacco.¹⁾

The per capita availability of rice husk in the village does not vary significantly since only that part of the crop used for home consumption is milled at the small mills in the village. The surplus is sold to middlemen from outside the village or to the large mills located in the amphoe towns and provincial capitals. The rice husk from this surplus can only be obtained by transporting it from the larger towns to the villages. The same is true for the cash crops which are sold to the factories or to middlemen from outside the village. The percentage of these crops which is consumed in the village and which could therefore provide milling residues is smaller than for rice.

The importance in village agriculture of the commercial activity of the large mills and factories as well as traders from outside the village should be considered when introducing agricultural-related technologies. The chicken-raising activity in many villages has been increased by the incentives of the large chicken processing industries. Similarly, the tobacco industries have not only encouraged the growing of tobacco but have assisted the farmers in obtaining the fertilizer. The introduction of technologies for solar drying of crops and for the gasification, pyrolysis, or anaerobic digestion of field and milling residues might be brought to the attention of the farmers by their regular purchasing agents.

The introduction of renewable energy technologies such as biogas digesters, pyrolytic converters, and solar crop drying units, which serve one or a few households but require more construction labor than a household can provide, might be accomplished through the use of exchange labor. This is especially true in Petchaburi, Songkla, Kamphangphet, and Chantaburi where there is a large use of exchange labor.

¹⁾ The coefficients of variation for sugar cane, cassava, and tobacco are all about 52% and comparable to variations in yield; however, the coefficient of variation for corn is 85% and the estimate of field residue is less reliable.

The ownership of buffalos, cows, and pigs is very important for the introduction of biogas digesters which require manure as a raw material. The number of animals required to provide sufficient manure for a digester depends on:

1. the size of the family;
2. the location in which the animals are kept;
3. the size of the animals; and
4. what the animals are fed.

The dung production for each type of animal was determined in the "Biomass Samples" report. The average dry weight of dung produced daily by two adult buffalos is about 11-1/2 kilograms. The same weight of dry matter is produced by 5 cows or 20 pigs. The latter number would be smaller for large swine. These numbers appear to agree with the rule-of-thumb value of 1.5 kilograms of dry matter per 100 kilograms of animal weight.

The biogas requirement per capita can be estimated by assuming that biogas has an average calorific content of 5500 kilocalories per cubic meter and that the biogas burner has an efficiency of 22%. When this is compared with the estimated stoves efficiencies as reported in the "Stoves" report and the average per capita fuel consumption for wood and charcoal as reported in the "Cooking, Lighting, and Heating" report, then gas requirements per capita are estimated to be about .2 to .25 cubic meters per adult. A biogas digester with a daily output of 1-1/4 to 1-1/2 cubic meters should be adequate for the typical village household.

The gas yield per dry matter of manure depends on a number of factors. Assuming an energy conversion of 30% and using the calorific content determined in the "Biomass Samples" report, the production of gas per kilogram of dry matter dung should be .16 cubic meters for buffalo and cow manure and .2 cubic meters for pig manure. The number of animals required would therefore be .2-.25 buffalo per capita, .5-.65 cows per capita, and 1.8-2.2 pigs per capita. For a family of 6.5, about 4.5 adult equivalents, the number of animals required to produce enough biogas for cooking would be about 1 buffalo, 2-1/2 cows, or 9 pigs (or about 4 large swine). The number of households in each province having these quantities of animals are shown in Table 71. The provinces with the greatest potential for widespread use of biogas based on the availability of animals are Roi-et for both buffalo and cow manure, Srisaket primarily for buffalo manure, and Songkla for cow manure. The provinces which would have participation limited by their small animal populations are Chantaburi, Udorn Thani, and Kampanghet. Very few families have enough pigs to supply a digester in any of the provinces. However, the families that own large swine (but were recorded under the category of "pig") could use pig manure-fueled digesters.

Pigs would be the most desirable source of manure since they are usually kept penned within the family compound. The practice of grazing cows and buffalo in Korat, Srisaket, and Lampang would reduce the collection of manure. The tethering or penning of buffalo and cows is often seasonal so that more manure would be available in the rainy season. Also, the buffalo are more likely to be left to graze than the cows. Buffalo dung is already used for fertilizer by one-half or more of the families in Korat, Srisaket, Lampang, Songkla, Roi-et, and Udorn Thani. Cow manure is less frequently used. Only in Petchaburi, Srisaket and Roi-et do more than one-third of the families use cow dung for fertilizer. The only province in which pig manure is used by a significant proportion of the households is Lampang.

The use of agricultural residues as a feed for animals will compete with their potential use as a fuel. Rice husk is fed to chickens and ducks, while rice straw is fed to buffalos and cows.

Table A1
Animal Owership Statistics By Village

CHANGWAT VILLAGE		BUFFALO				COW				PIG			
		No hshlds	Total Animals	Ave	Max	No hshlds	Total Animals	Ave	Max	No hshlds	Total Animals	Ave	Max
PETCHBURI	1	10	69	6.9	23	1	30	30	30	25	80	3.2	16
	2	11	66	6	15	3	53	17.7	50	23	127	5.5	25
	3	7	15	2.1	4	12	89	7.4	50	4	11	2.8	7
	4	2	6	3	5	16	204	12.8	40	1	7	7	7
	5	2	8	4	6	11	108	9.8	24	7	55	7.9	22
KORAT	1	25	67	2.7	6	3	6	2	2	11	31	2.8	12
	2	21	59	2.8	7	5	10	2	2	9	11	1.2	2
	3	10	41	4.1	6	5	28	5.6	20	1	25	25	22
	4	16	36	2.3	8	1	7	7	7	10	38	3.8	21
	5	15	18	1.2	3	1	2	2	2	12	34	2.8	19
SRISAKET	1	39	86	2.2	5	-	0	0	0	6	21	3.5	11
	2	26	90	3.5	7	9	43	4.8	13	4	41	10.3	13
	3	27	53	2	4	14	41	2.9	6	23	46	2	8
	4	26	48	1.8	6	7	19	2.7	6	11	14	1.3	2
	5	27	61	2.3	5	24	106	4.4	14	22	32	1.5	7
KAMPHANGPHET	1	-	0	-	0	-	0	-	0	-	0	-	0
	2	-	0	-	0	-	0	-	0	-	0	-	0
	3	22	103	4.7	30	-	0	-	0	3	8	2.7	3
	4	12	31	2.6	5	-	0	-	0	4	6	1.5	2
	5	-	0	-	0	-	0	-	0	-	0	-	0
LAMPANG	1	28	104	3.7	10	-	0	-	0	17	22	1.3	3
	2	6	26	4.3	7	-	0	-	0	25	47	1.9	13
	3	3	7	2.3	5	0	0	-	0	23	47	2.0	7
	4	14	26	1.9	4	6	12	2	3	19	42	2.2	5
	5	21	59	2.8	6	6	38	63	16	18	40	2.2	7

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Table A1 (continued)
Animal Ownership Statistics By Village

CHANGWAT VILLAGE		BUFFALO				CCW				PIG			
		No hshlds	Animals			No hshlds	Animals			No hshlds	Animals		
		Total	Ave	More	Total	Ave	More	Total	Ave	More	Total	Ave	More
CHAINGMAI	1	28	21	.8	7	-	4	-	2	17	9	.5	2
	2	6	4	.7	2	-	13	-	2	25	35	1.4	6
	3	3	13	4.3	4	0	41	-	9	23	26	1.1	3
	4	14	13	.9	3	6	418	69.7	4	19	19	1	3
	5	21	8	.4	3	6	8	1.3	3	18	292	16.2	264
SONGKHLA	1	33	0	-	0	-	143	-	9	1	7	7	6
	2	-	0	-	0	21	88	4	8	5	29	5.8	13
	3	-	0	-	0	29	137	4.7	20	7	10	1.4	2
	4	-	0	-	0	17	75	4.4	7	6	23	3.8	3
	5	-	0	-	0	4	11	2.8	3	0	1	-	1
CHANTABURI	1	-	0	-	0	13	68	5.2	11	1	25	25	25
	2	2	8	4	5	5	20	4	6	1	7	7	5
	3	1	1	1	1	4	12	3	4	1	4	4	4
	4	3	12	4	6	7	10	1.4	4	4	20	5	15
	5	2	11	5.5	6	2	10	5	8	16	214	13.4	56
ROI-ET	1	34	104	3.1	10	18	67	3.7	9	6	23	3.8	14
	2	18	49	2.7	6	14	59	4.2	11	2	13	6.5	7
	3	26	89	3.4	5	14	52	3.7	6	2	17	8.5	15
	4	28	67	2.4	5	16	51	3.2	6	3	12	4	9
	5	35	82	2.3	7	30	121	4	8	4	9	2.3	3
UDORN-TANI	1	29	66	2.3	7	1	2	2	2	1	9	9	9
	2	26	101	3.9	10	4	29	7.3	14	1	11	11	11
	3	29	76	2.6	5	1	1	1	1	1	6	6	6
	4	16	32	2	5	6	13	2.2	5	2	12	6	10
	5	25	94	3.8	13	7	39	5.6	10	-	0	-	0

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