

Production Efficiency Analysis of Highland Agriculture : A Case Study of Ang-Khang and Intanon Royal Project Chiang Mai, Thailand

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Introduction

Under the cooperative research work between Kinki University and Chiangmai University in Thailand, a series of study on hill tribes in northern Thailand has been conducted to find out ways and means of giving an impact on the life of hill tribes through the introduction of cultivation of medicinal plants and mushroom to their cropping practices. The study conducted during 1990 resulted in the report amounting to 120 pages. The experimental work conducted in the Ang-Khang and Intanon Royal Project placed emphasis to minimize forest destruction as well as minimize opium cultivation. Attempts have been made to introduce capital intensive cash crops with a view to giving additional income to hill tribes in order to discourage opium cultivation. The studies were made to measure production efficiency as well as pricing efficiency.

Chapter 1. Background

Forest is a valuable natural resources of the country which is now becoming rapidly decreasing. According to survey via remote sensing in 1985 Thailand has forest area only 149,503 km², or 29.05% of the total area of the kingdom (Royal Forestry Department 1986). Northern region is the most densely forest especially, teak. Despite, at present times forest area in the North are still the most important region of the country. Northern region has a forest area about 84,126.0 km² or 49.59% of the total area of region, or 16.39% of the total area of the country in 1985 (Royal Forestry Department 1986). Northern region was not only a major important sources of watershed supply to the low land in Central plain but also to maintain an average forest decreasing rate is becoming serious crisis. In the past 25 years there was a big change, forest area had rapidly decreased trend. In 1961, Thailand has total forest area about 53.30% of the total area of the country, and was decreased to 29.05% of the total area of the country in 1985. During 1973-1985 the rate of forest encroacher was severely steady and more severe during 1961-1973. Northern region rank second after North-Eastern region in encroaching forest, the rate of encroach forest was 3,695 km² annually or 2,309,375 rai/year or 2.18% of forest area in the north in 1973. The severity of forest encroachment had caused the forest area in the North decreased from 66.96% to 49.59% in 1985. Forest encroachment problem was mostly occurred in upper Northern Region, therefore, during 1973-1985 forest area in the North was decreased by 23.43%. Damaging of forest in Northern region was one example of destroying of natural resources and environmental problem. The problem of natural resources and environmental deterioration is difficult to improve and costly.

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1.1 Importance of Problem.

The major cause of forest deterioration in Northern Region was due to slashing and burning of agriculture which is the practiced of mostly hilltribes, together with high birth rate about 3.2%/year (Department of Public Welfare, 1985). Statistical data by Hilltribe Research Center indicated that there are 141,434 hilltribe population from 1,077 village in Chiangmai Province. 103,341 hilltribe population from 593 villages in Chiangrai Province and 77,341 hilltribe population from 637 villages in Mae-Hong-Sorn Province (Hilltribe Research Center 1986). During 1978-1985 the forest area in these three provinces were destroyed by 6.25%, 8.19% and 6.25% of the total area in the North respectively.

Shifting agriculture mostly done by hilltribes. Upland rice, field crop and opium poppy were grown by extensive land use, which not only destroying natural resources and environment but also caused narcotic addiction problem. From Socio-Economic survey of the hilltribes by UN indicated that during 1964/1965 there were 112,000 rai planted area of opium poppy with 145 ton of production. ^{*)}(Office of Narcotic Control Board 1982). In 1984/1985^{*)} in cooperation with Border Patrol Police Region No. 3 made a survey on opium planted area in 8 provinces in the North indicated that there were 54,853.82 rai of opium planted area with 34,674.88 kg. of production. The total opium planted area in Chiangmai, Chiangrai and Mae-Hong-Sorn Province accounted for 24,401.98 rai, 12,389.21 rai and 8,253.51 rai respectively. Opium production in those 3 provinces accounted for 16,207.54 kg., 7,693.55 kg. and 4,803.43 kg. respectively (Office of Narcotic Control Board 1985). The total production in those 3 provinces accounted for about 82.78% of total production in 8 provinces, which was considered as an important production area of opium of the country.

Owing to opium can use as a main ingredients in producing destroy forest by hilltribes not only caused damage of natural resources and environment problem in Northern Region but also caused narcotic addict problem to Thai and the world societies as a whole.

Poverty is the main reason forced hilltribes to destroy and plant opium. Department of Public Welfare (1984) founded that 60% of hilltribes who are poor has direct impact to hilltribe and society. Poverty problem is a drive to caused 2 important problems namely invasion of forest area and planting opium as mentioned earlier. Therefore measure to solve this problem by various agencies by introducing hilltribe to grow other suitable economic crops and efficient land use on highland. Hopefully, this measure will help the generating of income for substitute income from opium. Therefore, permanent agriculture will replace opium growing.

From an observation some hilltribes were shifting agriculture by growing field crop, upland rice and less extensive land use grow more economic crop and stop planting opium.

While some hilltribes are growing field crops, upland rice and still growing opium. A study on what are factors determining the different in decision making of hilltribe on growing economic crop and evaluation technical efficiency of permanent agriculture in order to solve problem.

1.2 Research Objective.

- 1) To study production efficiency of basic crop of hilltribe including factors effect to production efficiency.
- 2) To analyse the cost of crop production and opium.
- 3) To analyse degree of production efficiency of hilltribe and identify the potential of increased efficiency.

There was also the need to study and identify the high potential crops which can be possible to substitute field crop and opium which are now being grown and generating income of the hilltribe.

1. To study the structure and trend of cropping patterns including factors which determined structure and trend that might be favourable to permanent agriculture to an extensive crops.
2. To study crops decision-making behavior of hilltribe farmers and adoption of new technol-

ogy.

3. To study socio-economic factors which caused hilltribe to grow an extensive crop by invading and destroy forest.
4. To study socio-economic of hilltribe in growing opium.
5. Evaluation of crops possibility in opium substitution, considering will be based on social, tradition, culture and farming practice and to provide possible solution to stop growing opium and generating income of the hilltribe.

1.3 Research Scope.

This research project is aim at to study on economic efficiency of various type of crops grown in the Royal Project Ang-Khang Station Fang District and Intanon Station Chom-Thong District, Chiang Mai crop year 1987. Data were collected by interviewed the hilltribe. To study and analyse production efficiency and the cost of crop production.

The research result will be used for policy formulation in increasing production efficiency and development of highland agriculture.

1.4 Selection of Study Area.

The 3 highest hilltribe population and opium planted area in the upper Northern Region i.e. Chiangmai, Chiangrai and Mae-Hong-Sorn were selected (Hilltribe Research Center 1987). The study will concentrated on the Royal Project where other economic crops were introduced for opium substitution. There are 29 stations under the supervision of the Royal Project located in Chiangmai, Chiangrai, Mae-Hong-Sorn and Lampang Provinces (for detail see Map 3.2 annex). Area selected were 3 villages i.e. Ban Koom, Ban Luang and Ban Kob-Doeng villabe Fang District and 4 villages i.e. Ban Khun Klang, Ban Ang-Ka Noi Ban Pa-Mon and Ban Nong-Lom village Chom Thong District (see Map 3.3 and Map 3.4 annex).

The reason to be selected the Royal Project in those 2 districts for studying were as follows :

1. Vegetables, flowers and temperatate fruits were grown for substitution of opium.
2. Royal Project Ang-Khang was introduced some economic crops since 1972 while Intanon was introduced some economic crops since 1979. Therefore, an existing production system can be used to study the economic production effieiciency of vegetable flowers and temperate fruit tree.

1.5 Data Collection And Sampling.

Data collection and simple random sampling in 7 villages in Ang-Khang and Intanon were made by interviewed with 175 samples of the hilltribes (see Table 1.1).

Both primary and secondary data were collected from the Royal Project and Hilltribe Research Center (Department of Public Welfare).

Primary data include.

1. The number of population in household, household structure, socio-economic.
2. Agricultural production data, land use, area planted, type of crop grown, cropping pattern and cropping calendar.
3. Crop labour use, number of hour, family labour, exchange labour, animal labour and machinery.
4. Capital use quantity and value of seed, fertilizer, pest and insecticide, lime etc.
5. Yield, price of produces, distribution of produce, transportation, communication.
6. Management, dicision making, problems.

1.6 Expected Result.

1. To increase economic efficiency of crop production being extension to replace opium

Table 1.1. Number of Sample Selected in an Extension Area Royal Project Ang-Khang, Intanon Chiangmai Province.

Station/Village	Number of household (household)	Number of sample (household)	Percentage (%)
Intanon Project			
1. Ban Khun-Klang	105	43	40.95
2. Ban Ang-Ka-Noi	24	14	58.33
3. Ban Pa-Mon	23	15	65.22
4. Ban Nong-Lom	28	16	57.14
Ang-Khang Project			
1. Ban Koom	28	19	67.85
2. Ban Luang	90	50	55.55
3. Ban Kob-Doeng	23	18	78.26
Total 7 village	321	175	54.51

production and extensive land use

- To use as a guideline for production and marketing technology development of economic crop in order to minimize opium production and also invading and destroy of forest resources and environment.

Chapter 2. General Information and Production Condition in Study Areas

Ang-Khang and Intanon Royal Projects are serve as both research and agricultural extension on highland. There are 29 stations located covering 4 provinces in the upper northern region (see annex map 2.1) by initiative of King Bhumiphol Aduldej in order to stop invasion and destroying forest, and opium poppy cultivation. Hilltribe development aim at an extension of permanent agriculture in generating their income through transfer of proper technical knowledge of agriculture which is suitable to local economic and social conditions by increasing yield per unit planted area.

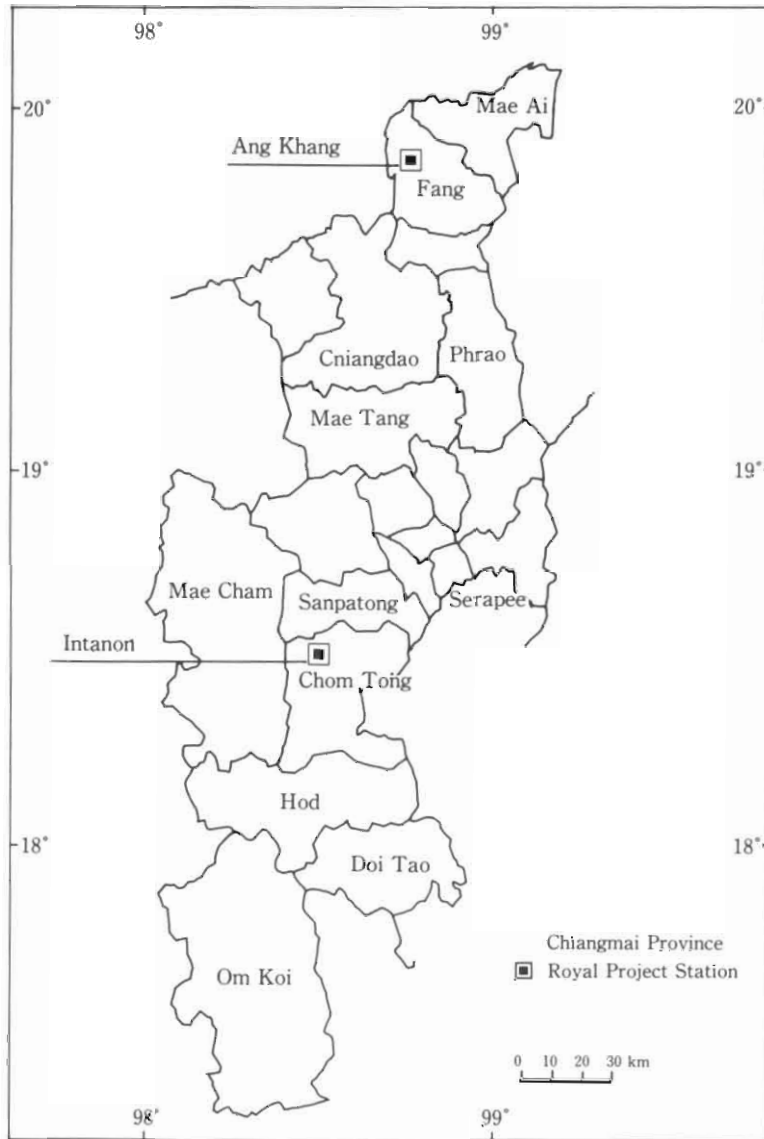
2.1 Situation and Geographical Background.

2.1.1 Intanon Station, Royal Project.

Intanon Station is situated at Moo 5 Mae Ngon Subdistrict, Fang District, Chiangmai Province, 143 kilometers on the Chiangmai-Fang Road. The area comprises of hilly land and mountain, approximately 1,100-1,550 metres above the sea level. Due to most of Area are hilly and mountainous, it has high humidity and low temperature, average 16-20°C, with long rainy season and winter. The rainy season begins in May to September, and winter begins in October to February.

2.1.2 Ang-Khang Station Royal Project.

Ang-Khang Station is situated at Moo7, Ban Luang Subdistrict, Chom Tong District, Chiangmai Province, 31 kilometres on the Intanon-Mae Cham Road and about 90 kilometres from Chiangmai City. Most of the area are hilly and valley with sloped land about 10-60% and approximately 800-1,400 metres above the sea level. Usually the average temperature is 18-22°C.



Map 2.1 The location of Ang Khang Station, and Intanon Station, Royal Project.

2.2 Population and Education.

2.2.1 Ang Khang Station, Royal Project.

Under Ang Khang Station Royal Project there are 4 villages named Ban Luang and Ban Koom which are located in Mae Ngou Subdistrict, and Ban Kob Doeng and Ban Nor Lare which are located in Mhon Pin Subdistrict. Population in the above 4 villages comprise of 6 hilltribes Chinese-Haw, Black Lahu, Red Lahu, Shans Akha and Palaungs. However they stay mostly at Ban Luang village (Table 3.1) and all of them are Chinese Haws. At Ban Luang village, where the Station is situated there are 4 hilltribes-Chinese Haw, Akha, Red Lahu and Shans. However majority of the population are Chinese Haws. Nor-Lare village ranks second in terms of number of population which constitute the chief source of hired labour supply in the study area. The hilltribes in this village are called Palaung.

There are 3 primary schools (see table 3.2) 12 teachers and 267 students at Ang-Khang Station.

2.2.2 Intanon Station Royal Project.

There are 9 villages in Ban Luang District. Majority of the hilltribes are Karen and Mhong (see table 2.3). Mhong hilltribe are located at the center of Khun-Klang village which is the location station. While Karen hilltribes are located in other small villages. Sob-Ahab, Sab-Haad and Mae Klang Luang Villages are out side the extension area of the stution due to there small number of population and situated in remote area.

Table 2.1. General Data of Population in the Promoted Area of Ang-Khang Station Royal Project, 1987.

Name of village	Moo	Subdistrict	No. of households	Population	Tribes
Ban Luang	7	Mae Ngon	90	475	Chinese Haw
Ban Koom	7	Mae Ngon	28	240	Chinese Haw Rad Lahu, Akha, Shans
Ban Kob Doeng	11	Mhon Pin	23	266	Black Lahu
Ban Nor Lare	11	Mhon Pin	30	178	Palaung
Total	—	—	171	1,459	—

Source: Survey.

Table 2.2. Number of School, Teachers and Students in the Ang-Khang Station Royal Project, 1988.

Name of School	No. of Building	No. of teachers	No. of Students			Note
			Boys	Girls	Total	
1. Ban Luang	2	7	58	57	115	Kindergarten to six grade
2. Ban Koom	1	3	41	36	77	Kindergarten to four grade
3. Ban Kob Doeng	1	2	39	36	75	Kindergarten to two grade
Total	—	12	138	129	267	

Source: Survey.

Table 2.3. General Data of Population in the Promoted Area of Intanon Station Royal Project, 1987.

Name of Village	Moo	No. of household	Population	Tribes
1. Ban Khun Klang*	7	105	537	Mhong, Karen
2. Ban Mae Ya Noi*	5	29	222	Mhong, Karen
3. Ban Ang Ka Noi*	8	24	174	Karen
4. Ban Mae Ahab	6	17	126	Karen
5. Ban Pa mon	8	23	204	Karen
6. Ban Sob Ahab	6	14	75	Karen
7. Ban Sob Haad	8	14	73	Karen
8. Ban Mae Klang Luang	8	24	171	Karen
9. Ban Nong Loom	8	28	147	Karen
Total	—	278	1,729	—

Source: Survey

Note: All villages are in Ban Luang Subdistrict.

* Villages which are under the continuing promoted in the Project.

Table 2.4. Number of Schools Teachers and Students in the Intanon Station Royal Project, 1988.

Name of School	No. of Building	No. of teachers	No. of Students			Note
			Boys	Girls	Total	
1. Ban Khun Klang	2	8	66	62	128	Kindergarten to six grade
2. Ban Pa Mon	2	5	45	42	87	Kindergarten to six grade
3. Rug Prai Vithaya	1	3	32	30	62	Kindergarten to four grade
Total	—	16	143	134	277	

Source : Survey.

Table 2.5. Planted area, Number of Farmers and Average Yield for Fruit-Tree at Ang Khang Station Royal Project, 1987.

Type of Fruits	Planted Area (rai)	Number of trees	Number of Farmers	Average Yield/tree (kg.)
Improved Peach	73	1,826	22	25
Local Peach	1,840	41,446	103	220
Pear	105	2,521	36	110
Persimmon	12	382	4	10
Plum	18	462	10	18.2
Apricot	80	1,281	11	30
Apple	1.5	60	4	20-30 Baht/tree

Source : Survey
Ang Khang Station Royal Project.**Table 2.6.** Planted Area, Number of Farmers, Average Yield of Rice, Field Crop, Vegetable and Cutting Flowers in the Area of Ang Khang Station Royal Project, 1987.

Type of Crops	Planted Area (rai)	No. of Farmers	Average Yield/rai (kg.)
Lowland Paddy	80	20	450
Upland Paddy	105	23	270
Maize	150	50	1,950
Wheat	22	10	182
Potato	1,500	89	1,950
Cabbage	25	10	750
Kidney bean	27	17	115
Lima bean	20	14	200
Carrot	12	10	178
Parsley	5	10	—
Brussels sprouts	1	1	—
Other Vegetable	40	23	—
Gladiolas	30	27	5,500 flower/rai

Source : Survey and Ang Khang Station Royal Project.

There are 3 primary schools nearby Intanon Station namely Ban Khun Klang, Ban Pa Mon and Rug Prai Vithaya Schools. There are 16 teachers, 277 students.

2.3 Agricultural Production.

2.3.1 Ang-Khang Station Royal Project.

Temperate fruits i.e. local and improved peach, apricot, persimmon, plum and apple are the basic crops of every ethnic hilltribes in every village in the extension area of Ang Khang Royal Project (see table 2.5). Not only temperate fruits, potato is also considered as an economic field crop for the hilltribes, especially Luang and Koom Villages. For temperate vegetables and other field crops i.e. brussels sprouts, purple cabbage, parsley pyrethum, vegetable jelly, wheat and oat, etc. An extension area was mostly grown in Koom and Kob Doeng village. Gladiolas are a cutting flower grown for commercial production which are grown in Kob Doeng village.

Besides, these crops, there were other major crops (surplns) i.e. lowland paddy upland paddy, kidney bean, cabbage, lima bean, sweet peas etc. (see table 2.6). Opium poppy are also grown in Luang, Kob Doeng and Nor Lare villages as there are narcotic addict hilltribes in those villages. From survey hilltribes continuously grow opium poppy, but the planted area has decreased and opium poppy planted area were moved to remote areas as the border police destroy the opium.

2.3.2 Intanon Station Royal Project.

There are about 3,500 rais of agricultural area under the responsibility of Intanon Station. The major areas are under lowland paddy and upland paddy production (see table 2.7). Which is sufficient for consumption in the village only. Khun Klang is only one village which does not rely on rice production, as the hilltribes devote most of their land and labour for other economic crops. An important economic crop being promoted in these villages are temperate vegetables (see table 2.8) and cut flowers (see table 2.9). Khun Klang concentrates in strawberry production (see table 2.10). Other temperate fruit trees are in the experimental stage (see table 2.11). Three types of economic crop production are being promoted as mentioned earlier. Hilltribes obtain technical assistance and factor inputs (in kinds) and market outlet from the Royal Project.

Apart from crop production through Royal Project by hilltribes, in addition hilltribes are engaged in commercial economic crop production and for household consumption, i.e. cabbage, tomato, potato, sweet pea etc. (see table 2.10). There are also vendor trader who come to buy vegetable directly in the village.

For temperate fruit tree production i.e. peach, pear, persimmon, plum, and apple are rare. Hilltribes normally plant fruit trees in the same area with vegetable and flowers as an inter-cropping.

From survey there was no opium poppy cultivation in the study area as the hilltribes that reside in this village are Karens who do not prefer to smoke opium, while the Mhong hilltribes who live in Khun Klang and Mae Ya village eventhough in favour of smoking opium, but the majority of agricultural land are located near governmental office and good road condition, thus, opium cultivation problem was not founded in the study area.

2.4 Occupation and Income

2.4.1 Ang-Khang Station Royal Project.

About 85% of population in the study area (4 villages) are mainly engaged in agriculture. Majority of their income from agriculture gained from temperate fruit trees and potatoes from Ban Koom and Ban Luang village. For the rest 15% of hilltribes are hired labour, trading and services. There are many tourists who come to visit Ang Khang Station Royal Project during October-February. Hilltribes who live in Ban Kob Doeng and Ban Koom village obtain their major source of income from processed-fruits, lodging and selling souvenirs, etc. Hilltribes in

Ban Nor Lare village are engaged in upland and lowland paddy. They have surplus labour for hire in other villages. Hired labour is the major source of their income.

Table 2.7. Planted Area, Number of Farmers, Average Yield/Rai of Upland Paddy, Lowland Paddy and Other Crops in Intanon Station Royal Project, 1987.

Type of Crops	Planted Area (rai)	No. of Farmers	Average Yield/rai (kg.)
Upland Paddy	1,050	184	237
Lowland Paddy	450	139	441
Others (Maizes, Peanut)	52	31	—

Source : Survey and Intanon Station Royal Project.

Table 2.8. Planted Area, Number of Farmers, Average Yield/Rai of Various Vegetables in 5 villages* in Intanon Station Royal Project, 1987.

Type of Vegetable	Planted Area (rai)	No. of Farmers	Average Yield/rai (kg.)
Zucchini	34	32	300
Head Lectuce	35	25	1,150
Turnip	24	48	1,500
Spinach	12	14	1,050
Radish	12	14	1,500
Butter nut	12	12	1,330
Baby Carrot	12	12	1,165
Brussels Sprouts	8	14	870
Parsley	4	8	900
Japanese pumkin	12	12	1,220
Leek	7	15	1,175
Asparagus	2	2	665

Source : Survey and Intanon Station Royal Project.

* Ban Khun Klang, Ban Mae Ya, Ban Ang Ka Noi.

Table 2.9. Planted Area, Number of Farmers and Average Yield/rai of Flower at Intanon Station Royal Project (at Ban Khun Klang, Ban Ang Ka Noi and Ban Pa Mon Villages), 1987.

Type of Flowers	Planted Area (rai)	No. of Farmers	Average Yield/rai (kg.)
Carnation	16	30	38,505 (flowers)
Gladiolus	5	14	12,000 (flowers)
Statis	5	10	32 (kg.)
Gysophila	3	7	10.5(kg.)
Chrysanthemum	1	2	4,000 (flower)
Gerbira	1	2	Early mature stage

Source : Survey.

Table 2.10. Planted Area (Out of the project promotion), Number of Farmers, Average Yield/rai, Intanon Station Royal Project, 1987. For 5 villages.*

Type of Vegetables	Planted Area (rai)	No. of Farmers	Average Yield/rai (kg.)
Cabbage	850	135	1,350
Tomato	126	30	1,150
Sweet pea	5	10	35
Sweet corn	15	8	—

Source: Intanon Station, Royal Project.

* Ban Khun Klang, Ban Mae Ya Noi, Ban Ang Ka Noi, Ban Pa Mon and Ban Nong Loom Villages.

Table 2.11. Planted Area, Number of Farmers and Average Yield/rai for Fruit-Trees At Intanon Station Royal Project, 1987.

Type of Orchard	Planted Area (rai)	Number of trees	Number of Farmers	Average Yield/tree (kg.)
Strawberry*	60	600,000	125	1,200
Peach	39	1,300	12	65
Pear	40	1,200	10	34
Persimmon	9	530	30	12
Apricot	61	1,530	28	5
Coffee	67	27,000	35	na
Apple	7.5	500	12	2.5

Source: Survey every village in the project and Intanon Station, Royal Project.

Remark: na=no data available.

* =planted only at Ban Khun Klang Village.

2.4.2 Intanon Station Royal Project.

About 95% of the population in the study area (9 villages) are mainly engaged in agriculture. Most of their income are derived from stawberry, temperate vegetables and flowers, their market outlet is through the Royal Project. While cabbage and tomatoes are sold through vendor traders in their village.

Another 5% of population are engaged in hired labour and trading espically Ban Khun Klang (tourist spot) and weaving at Ban Pa Mon and Nong Loom villages.

2.5 Land Tenure And Agricultural Land Use.

2.5.1 Ang-Khang Station Royal Project.

In the past many years, hilltribes practiced slash and burn agriculture in the fertile forest for planting opium and upland paddy. At present, hilltribes use their land to grow other economic crops mainly temperate fruit trees. Hilltribes have no land owner certificates. Nowadays, slash and burn agriculture problem for opium cultivation has decreased due to strict control by the government which caused hilltribes to destroy forest in other areas. Their land tenure is ranging from 10-300 rais/household.

2.5.2 Intanon Station Royal Project.

Hilltribe agricultural land tenure in Intanon Royal Project area is quite similar to hilltribe Ang Khank Royal Project and they have no land owner certificates. Most of land utilization by

hilltribes is concentrated in upland paddy and vegetable rather than temperate fruit tree production. Slash and burn agriculture problem is found only in remote villages. Size of land tenure is ranging from 5-50 rais/household. At present, it also appear that some hilltribes rent agricultural land from their neighbours as the population increased and they could not invade to nearby forest. Rent is paid annually on cash basis.

2.6 Labour Utilization.

2.6.1 Ang Khang Station Royal Project.

It has been reported from survey that an average hilltribe household has 8.53 persons and classified into two categories: male and female. An average male/household has 4.77 while female had 3.76 persons. An average member/household with 8.53 persons, 5.76 persons are labour force (15-60 years). There was not enough number of labour force/household in Ban Koom and Ban Luang Villages, so there was a great demand for hired labour from other villages. Besides, household and hired labour, animal labour e.e. ox, buffalo, horse, ass and mule are also important for transporting their produce. Exchange labour was very rare in rice production. Machinery was not used in rice production.

2.6.2 Intanon Station Royal Project.

Survey were being done in 4 villages namely Khun Klang, Ang Ka Noi, Pa Mon and Nong Loom. An average hilltribe member/household has 7.29 persons and can be classified into two categories: male and female. An average male/household has 3.56 persons. while female has 3.73 persons.

An average number of labour force (15-60 years)/household has 4.70 persons. There are enough labour force for agricultural production almost in every village as the intensity of production was quite small. Khun Klang village was an exceptional case. There was not enough labour force so, it depended on exchange labour in their own village and hired labour from other villages. Animal labour has been used only in lowland paddy cultivation. Only one hilltribe used machinery for land preparation.

2.7 Socio Economic of Hilltribe.

2.7.1 Ang Khang Station Royal Project.

There are 3 villages i.e. Ban Koom, Ban Luang and Ban Kob Doeng, situated and in the responsibility of Ang Khang Station. There are 1,459 population, 171 households composed of 679 males and 777 females. Agriculture is the major source of income derived from temperate fruit trees, vegetables and potato production. An average total income/household was 70,044.7 baht/year. An average income for selling produce through Royal Project was 22,186. baht/household/year. An average income for selling produce through vendor trader was 29,684.98 baht/household/year.

An average off-farm income/household/year was 18,173.7 baht. Most of off-farm income derived from hired labour, trading, tourism, handicrafts, Chinese Haw earned more average income than any other 4 ethnic hilltribes, (Black luha, Red Lahu, Shan and Akha). Their main source of income is derived from peaches and pears.

2.7.2 Intanon Station Royal Project.

Survey were being done in 4 villages i.e. Ban Ang Ka Noi, Ban Pa Mon, Ban Nong Loom and Ban Khun Klang villages. There are 1,062 population, 180 household which consist of 476 males, 586 females. Agriculture is the main source of their income derived from vegetables, flowers and strawbeery. Almost all of the hilltribes in Khun Klang village grow strawbery. Hilltribes in 4 villages have an average income of 26,850.2 baht/household/year. The average income obtained

from selling produce through the Royal Project was 22,324.1 baht/household/year. An average income for selling produce through vendor trader was 8,466.4 baht/household/year. An average off-farm income/household/year was 5,150 baht. The main source of income is derived from hired labour, trading, weaving. Mhong hilltribe earned higher average income than Karen. Their average income was 36,714.15 baht/household/year. Most of their income are gained from strawberry, flowers and vegetables. While the Karens grow lowland paddy as a major crop and other extension crops as a minor crop.

2.7 Summary

Hilltribe in Ang Khang and Intanon Royal Project have different source of income. The basic crop of Ang Khang is temperate fruit trees while basic crops in Intanon are vegetable, strawberry and flowers.

From observation in both areas hilltribes in Intanon have more attention on agricultural extension activity with the station. While hilltribes in Ang Khang has less attention with the station activity because most of their activities are concentrated with research work. However, hilltribes in both areas are facing with the same problem, limitation of agricultural area. Intensive agriculture with an attempt to increase agricultural productivity would be one possible solution to this problem.

Chapter 3. Research Result

At present, there are at least 2 major agricultural problems on highland which need abstract policy and means to solve these problems as follows :

1. Shifting agriculture problem.
2. Opium poppy cultivation.

Several efforts had been made by non-governmental Organization (NGO'S) and the Royal Project to solve these two problems seems to have slowly impact on the solution to these problems as several problems were involved.

An objective of this chapter is to present the result of data analysis obtained from field survey of Ang-Khang and Intanon Station Royal Projects. An evaluation has been made on feasibility and propose means to solve these 2 problems.

3.1 Cropping Patterns.

Hilltribes are engaged in rice-based cropping pattern and opium poppy cultivation and possibly some other crops for household consumption.

From Table 3.1 indicated that hilltribes in Ang-Khang Station Royal Project have 23 cropping patterns. From Table 3.2 hilltribes in Intanon Station have 39 cropping patterns. The basic cropping patterns at Ang-Khang Station can be classified by ethics group. About 95% of Chinese Haw who live in Ban Koom and Ban Luang villages are mainly engaged in temperate fruit tree cultivation and growing potato and temperate vegetables as a minor crop, paddy has not been found in those villages.

The total hilltribe population in Ban Kob-Doeng village is Black Lahu. Their basic crops are lowland and upland paddy and the minor crop is vegetable. Almost every village in Ang-Khang Station, hilltribes are still engaged in opium cultivation in remote areas with an average planted area about 1.27 rai/household, as compared to an average opium planted area before an extension by the Royal Project was 5 rai/household, because most of hilltribes at an average age 57.2 year are narcotic addicts.

There are 39 cropping patterns in Intanon Station (see table 3.2). Mhong in Ban Khun-Klang

Table 3.1. Cropping Patterns At Ang-Khang Station, 1987.

Unit : Person

Production Activity	Chinese Haw	Black Lahu	Shan	Akha	Red Lahu	Total
1. Lowland Paddy, Vegetables	—	2	—	—	—	2
2. Lowland Paddy, vegetables, Hire-labour	—	1	—	—	—	1
3. Lowland Paddy, Fruit trees	—	1	—	—	—	1
4. Lowland Paddy, vegetables, Upland Paddy	—	1	—	—	—	1
5. Upland Paddy, Vegetables, Hire-labour	—	1	—	—	—	1
6. Upland Paddy, Fruit trees	—	1	—	—	—	1
7. Upland Paddy, Vegetables, Fruit trees	—	1	—	—	—	1
8. Upland Paddy, Hire-labour	—	2	—	—	—	2
9. Upland Paddy, Opium	—	3	—	—	—	3
10. Upland Paddy, vegetables	—	1	—	—	—	1
11. Vegetables, Fruit trees	13	—	1	1	—	15
12. Vegetables, Fruit trees, Hire-labour	4	—	—	—	2	6
13. Vegetables, Hire-labour	4	—	—	—	—	4
14. Vegetables, Hire-labour, Flowers	—	1	—	—	—	1
15. Vegetables, Flowers	—	1	—	—	—	1
16. Vegetables, Flowers	—	2	—	—	—	2
17. Vegetables, Opium	5	—	—	—	—	5
18. Vegetables, Fruit trees, Treading	14	—	—	—	—	14
19. Vegetables, Hire-labour, Animal raising	2	—	—	—	—	2
20. Vegetables, Fruit trees, Hire-labour, Opium	1	—	—	—	—	1
21. Upland Paddy, Vegetables, Flowers, Opium	—	2	—	—	—	2
22. Upland Paddy, Vegetables, Flowers Fruit trees	—	1	—	—	—	1
23. Fruit trees	16	—	—	—	—	16
Total	59	21	1	1	2	84

Source : Survey

village has more cropping patterns distribution than Karen in 3 villages which grow paddy as a basic crop and vegetables and flowers production as a minor crop. There was no evidence in planting upland paddy in Ban Khun-Klang village at all. Due to agricultural land area is very much higher than the sea level. Paddy yield per rai was low. There are no opium poppy grown in Intanon/Station area. There are about 17 peoples that consume opium all of them are Mhong.

In summary, only 7.95% of hilltribe household in Intanon Station area planted upland paddy which is considered as an extensive land use patters which was a major source of destroying forest. Besides, about 92.05% are engaged in stabilizing agriculture. Especially, the latter group concentrated in intensive land use pattern which is no harm to destroy forest. Hilltribe household in Ang-Khang Station area are engaged in upland paddy cultivation about two times higher than hilltribe household in Intanon Station area. About 14.94% of hilltribe household in Intanon Station area are engaged in upland paddy, the rest are engaged in permanent agriculture which is concentrated in intensive land use, more capital intensive to produce high value crop produc-

tion.

3.2 Hilltribe Decision Making.

Cropping patterns in those 2 stations originated from an initiative by the Royal Project, which is the result of introducing agricultural extension to hilltribe farmers. Hilltribes decision making on selecting type of crops grown depend on habit of ethics group, believe, location and influence of market mechanism.

This part cover about hilltribe decision making on

1. Hilltribe decision making on planting opium substitution crop.
2. Hilltribe decision making on opium cultivation.

3.2.1 Decision making on opium replacement crop.

Hilltribes' decision making on crop production based on target, alternative, and limitation. Their real decision making of hilltribe always has limitation such as if they want to make the highest profit on production. Their alternative is to select various set of factor inputs utilization to acheive target under budget and time limitation.

In general, hilltribe may probably have different economic target based on an influence to be determined such target i.e. value system of their tribe level of economic status (per capita income) food consumption, geographical environment i.e. elevation, climate soil condition, rain fall, sun shine, temperature, etc., and social institution i.e. rule, regulation and law, etc. For hilltribes who are involved with Royal Project also influence from outside group which can be said that the economic target of hilltribes is seeking the highest profit.

Most of hilltribe cropping pattern as mentioned earlier in 3.1 have a trend to respond to market demand rather than to adjust the level of living. If this assumption is true once we can see quite clear about the scope of alternative on production decision making under existing limitation.

Table 3.3 a set of limitations in Ang-Khang and Intanon area can be divided into 4 major groups as follows:

1. Group limitation.
2. Geographical limitation.
3. External social institution limitation.
4. Royal Project limitation.

Form table 3.1 there are 23 cropping patterns in Ang-Khang Station area which is less complicated than 39 cropping patterns in Intanon Station area (Table 3.2). Hilltribes in Ang-Khang area are engaged in vegetable, temperate fruit tree, which are basic crops. The main extension policy of Ang-Khang Station is temperate fruit tree. Table 3.1 indicated that most hilltribe who grew temperate fruit tree and opium poppy were Chinese Haw. In the long run temperate fruit tree can provide more stable income, but they also try to grow vegetable in order to earn short term working capital and some household are engaged in hire labour and trading. As compared to Black Lahu who live in the same area their behavior is quite different to Chinese Haw. Due to their economic stability depend on rice as a basic crop. So their decision making on cropping pattern is based on rice. (17 households), 4 of them do not grow rice and 2 of them grow opium poppy. However, some of Black Lahu grow temperate fruit tree which is an influence of the Royal Project.

From Table 3.2 Intanon Station area in 1987, the decision making on crop production between Karen and Mhong are different and Mhong has more production distribution within their own group.

Only one Karen household do not grow rice, but grow only vegetables. Most of Karen are also engaged in rice production because of an economic stability as well as Black Lahu at Ang-Khang Station. Only one Karen household grow vegetable. Strawberry is not recommended in Karen

Table 3.2. Cropping Patterns at Intanon Station, 1987.

Unit : Person

Production Activity	Karen	Mhong	Total
1. Lowland Paddy, Vegetables	7	2	9
2. Lowland Paddy, Vegetables, Hire-labour	2	—	2
3. Lowland Paddy, Vegetables, Weaving	2	—	2
4. Lowland Paddy, Animal-raising	1	—	1
5. Upland Paddy, Vegetables	—	1	1
6. Upland Paddy, Vegetables, Hire-labour	—	1	1
7. Upland Paddy, Vegetables, Weaving	—	1	1
8. Upland Paddy, Vegetables, Weaving, trading	—	1	1
9. Lowland Paddy, Vegetables, Weaving	14	—	14
10. Lowland Paddy, Vegetables, Hire-labour	3	—	3
11. Lowland Paddy, Vegetables	7	2	9
12. Lowland Paddy, Vegetables, Weaving, Black smith	1	1	2
13. Lowland Paddy, Strawberry, Trading	—	1	1
14. Lowland Paddy, Strawberry	—	1	1
15. Lowland Paddy, Vegetables, Strawberry, Fruit trees, Opium, Hire-labour	—	1	1
16. Vegetables, Trading	—	1	1
17. Vegetables, Strawberry, Trading, Hire-labour	—	4	4
18. Vegetables, Strawberry, Trading	—	4	4
19. Vegetables, Strawberry, Hire-labour	—	5	5
20. Vegetables, Strawberry, Fruit trees, Hire-labour	—	1	1
21. Vegetables, Strawberry, Fruit trees, Hire-labour, Trading	7	2	9
22. Strawberry, Trading	—	1	1
23. Strawberry	—	1	1
24. Upland Paddy, Vegetables, Flowers	1	—	1
25. Upland Paddy, Lowland paddy, Vegetables, Weaving	1	—	1
26. Lowland Paddy, Vegetables, Strawberry, Fruit trees, Weaving	—	1	1
27. Lowland Paddy, Vegetables, Flowers	2	—	2
28. Lowland Paddy, Vegetables, Flowers Weaving	2	—	2
29. Vegetables	1	—	1
30. Vegetables, Flowers, Fire-labour	—	1	1
31. Vegetables, Strawberry	—	7	7
32. Vegetables, Strawberry, Fruit trees	—	3	3
33. Vegetables, Strawberry, Fruit trees, Trading	—	2	2
34. Vegetables, Strawberry, Flowers	—	1	1
35. Vegetables, Strawberry, Flowers, Trading	—	1	1
36. Vegetables, Strawberry, Flowers, Fruit trees	—	1	1
37. Strawberry, Flowers, Fruit trees	—	1	1
38. Strawberry, Flowers, Hire-labour	—	1	1
39. Upland Paddy, Vegetables, Strawberry, Hire-labour	—	1	1
Total	38	50	88

Source : Survey

Table 3.3. Limitations Which Were Effectuated on Production Decision Making of Hilltribe Ang-Khang and Intanon Station Royal Project, 1987.

Item	Royal Project	
	Ang-Khang Station	Intanon Station
1. Group limitation		
1.1 Tribes	Chinese Haw, Black Lahu, Shan, Akha, Red Lahu,	Karen, Mhong
1.2 Language	Tribes language	Tribes language
1.3 Belief, social value,	Different according to tribe	Different according to tribe
1.4 Number of drug addict	73	17
1.5 Hired-labour	Surplus	Shortage
2. Geographical limitation		
2.1 Amount of rain fall (mm./year)	na	na
2.2 Lowest temperature (°C)	-1°C	3°C
2.3 Highest temperature (°C)	31.5°C	33°C
2.4 Elevation (from sea level) ft.	1,100-1,800	800-1,400
2.5 Slope (%)	20-72.5	10-60
2.6 Size of land holding (rai/fam.)	53.51	12.78
3. External institution limitation		
3.1 Law (opium cultivation is not allowed)	Same	Same
3.2 Communication	Remote	Convenient
3.3 Number of agencies	More	Less
4. Limitation of the Royal Project		
4.1 Basic objective of station	Research & experiment	Extension of alternative crop.
4.2 Basic policy	Temperate fruit tree	Flowers, vegetables strawberry
4.3 Irrigation system	Scarcity	Good

na = not available

group as they have no experience.

From experiment only 2 households out of 5 households are successful in strawberry cultivation.⁽¹⁾

On the contrary, most of Mhong hilltribe 143 households in Intanon Station are engaged in strawberry production, vegetables, trade, or hire labour. Only few of them (7 households) do not grow strawberry. It was noticed that good road also has an impact on hilltribes' decision making on production and extension policy of the Royal Project. Especially, Intanon Station located near the main road, many tourists come to visit as a sight-seeing spot, so that trading has become a minor source of their income. Another external major factor which has an effect on decision making of vegetable and strawberry production at Intanon Station is that vendor trader can come to buy cabbage in this area very easily. Despite, cabbage is not directly an extension crop by the Royal Project but the project initially prepare the experience of the hilltribe to grow cabbage.

In summary, 4 sets of limitations has a great impact on hilltribe production decision making as a result there were the differences of cropping pattern in Ang-Khang and Intanon Station. Therefore, the formulation of development policy should take those 4 limitation into account for instance, for Ang-Khang Station bad road and long distance, inconvenience of transportation are the major limitation factor, therefore temperate fruit tree, improved variety of tuber and seed

¹ From interview with Intanon Royal Project field officer another reason was the village is located in remote area. There is inconvenience in transporting strawberry because it is highly perishable.

production recommended along with improved variety of upland paddy and other crops should be recommended because Karen and Black Lahu consume rice as a staple food.

3.2.2 Decision making on opium poppy production.

In the past, the decision making of hilltribes to grow opium poppy originated from narcotic addict necessity, for medicine, as a cash in exchange of goods and service i.e. hire-labour for rice harvesting and also other factors such as Sriboonchita et al. (1988) which is determining decision making on opium production.

1. Market certainty.
2. Market convenience.
3. High price and income.
4. Infinite market absorption.
5. Price stability.
6. Long storibility.
7. Light weight and small volume.
8. As a medium of exchange.
9. Being a liquid asset.
10. Low capital requirement.
11. Low technology.
12. Drug addicts.

However, if we consider in more detail we will see that decision making of hilltribe on opium poppy production has many limitations as similar to some conditions already mentioned in Table 3.3 low and policy to grow alternative crops to replace opium poppy should be the highest

Table 3.4. Reasons for Decision in Growing Opium of Farmers at Ang-Khang Station and Intanon Station Royal Project.

Tribe	Total	Free-time	Less investment	Consumption used	High price	Certainty market
<i>Ang-Khang Station Used to Plant</i>						
1. Chinese Haw	22	2	4	3	9	4
2. Black Lahu	8	—	—	6	2	—
3. Red Lahu	2	—	—	—	2	—
4. Thai	1	—	—	—	1	—
<i>On Planting</i>						
1. Chinese Haw	6	—	1	1	3	1
2. Black Lahu	7	—	—	7	—	—
Total	46	2	5	17	17	5
	100.00	(4.34)	(10.87)	(36.96)	(36.96)	(10.87)
<i>Intanon Station Used to Plant</i>						
1. Mhong	23	—	—	7	10	6
2. Karen	5	—	—	1	3	1
Total	28	—	—	8	13	7
	100.00			(28.57)	(46.43)	(25.00)
Grand total	74	2	5	25	30	12
	100.00	(2.70)	(6.76)	(33.78)	(40.54)	(16.22)

11 = Selling at farm gate

Source: Survey.

Note: Data () = Percent of interviewed samples.

limitation. Table 3.1 and 3.4 indicated that some hilltribes are growing opium poppy and in some area they grow opium poppy as an inter cropping with other substitution crops.

It was noticed that in an area which has convenient communication opium planted area is less. According to the government officer, hilltribes try to grow opium poppy in the remote areas and more hidden places. One reason confirmed why opium poppy cultivation still exist and probably increase in some years due to drug addict problem and good price is an important incentive (see table 3.4).

It was believed that if the government officers are very active in their prevention and control of opium cultivation an increasing of production efficiency of other extension crops is one possibility for better alternative means of hilltribes or lowland people who grow opium poppy on the highland.

3.3 Cost of Production and Return.

Decision making in production of hilltribe may reflect in the form of cropping pattern which involved with cost of production and return, whenever combine these together it will reflect the level of income of hilltribe in each station in some certain degree.

3.3.1 Ang-Khang Station Royal Project.

Cabbage, potato, kidney beans, gladiolus and local peach were selected for study. In 1987 local peach has the highest planted area and gladiolus has the least planted area (see Table 3.5). The number of hilltribes who grow potato and local peach are almost the same. Potato obtained more return per rai, higher than local peach. This due to potato price was high in 1987. Potato provide the highest potential as compared to other crops. Data in the same table also show hilltribes net income obtained from selling produces through Royal Project.

Table 3.6 covering of 20 crops which classified into lowland and upland paddy 9 vegetables, gladiolus, 8 temperate fruit trees. Five major crops have been selected for study in terms of a number of growers and total income. A number of upland paddy grower was higher than lowland paddy. Potato has a great number of grower and total income was also higher than every type of vegetables. Local peach was more important than other fruits.

Table 3.7 to 3.11 indicated factor input used, cost of production and return for cabbage, gladiolus, potato, kidney beans and local peach. Type of factor input used both in nursery and planting plot were shown by activity. Cost of production and return for some crop may be different from season to season or age of that crop. Net profit derived from potato was the

Table 3.5. General Data on Studied Crops at Ang-Khang Station Royal Project.

Item	Type of Crops				
	Cabbage	Potato	Kidney Beans	Local Peach	Gladiolus
Planted Area (rai)	122	1,044	48	2,840	24
No. of Farmers (persons)	72	232	24	231	26
Total Production (kg.)	325,360	1,580,000	5,340	6,361,600	153,000
Sold Production (kg.)	260,500	1,500,000	3,100	6,126,000	142,550
Average Yield/rai (kg.)	2,653	1,513	110	2,240	6,310
Average Income/rai (baht)	5,916	6,052	935	5,600	8,817
Net Income	580,915	6,000,000	—	1,531,500	215,825

Source: Ang-Khang Station.

Table 3.6. General Data of Crops at Ang-Khang Station, 1987.

Type of Crop	No. of farmers	Planted area (rai)	Yield (kg.)	Average yield/rai (Baht)	Total income	Average ¹ Cost
<i>Rice</i>						
Lowland Paddy	7	25	9,040	344.5	—	—
Upland Paddy	11	27.5	6,430	229.8	—	—
<i>Vegetable</i>						
Cabbage	11	18.75	52,700	2,653.33	62,584	1,104.54
Lima bean	7	5.5	9,450	3,750	10,350	1,341.56
Green Pea	1	0.5	350	700	4,500	2,236.8
Vegetable-jelly	3	2	646	184	15,480	—
Wheat	2	3	300	100	2,250	—
Kidney bean	11	8.5	749	106.6	6,310	1,322.94
Oat	1	1	150	150	1,500	—
Red cabbage	5	6	5,850	895.24	23,150	1,942.88
Potato	61	276.65	351,030	1,513.23	599,225	1,918.28
<i>Cutting flower</i>						
Gladiolus	17	19.54	123,300	6,310	76,425	1,421.36
<i>Fruit trees</i>						
Local Peach	86	1,367.25	239,610	175.25	1,329,203.50	1,813.38
Peach	17	61.5	10,285	167.23	237,250	3,108.92
Local Pear	11	42.25	—	—	—	—
Pear	23	108.25	28,370	86.15	474,750	—
Apricot	16	50	660	55	18,000	1,152.93
Persimmon	8	9.75	120 ²	40	4,000	2,108.08
Plum	7	30.75	140 ³	46.6	5,600	2,144.91
Apple	2	1.25	—	—	—	4,666.86

Source : Survey.

¹: Yield about 12 rais (planting age 5 year).

^{2,3}: Yield about 3 rais.

highest as compared to cabbage and kidney beans. If we compare net return from potato in Table 3.9 with net return from gladiolus in Table 3.8 net return from potato per unit of area = 1.47 baht/m² lower than gladiolus = 21.27 baht/m². In case of local peach net return will vary according to age of tree by net return/rai will have positive value after planting for 3 years and thereafter net return will increase year by year better than other crops (except gladiolus by the same unit of area). Local peach provided net return = 3.4 baht/m² after 3 years.

3.3.2 Intanon Station Royal Project.

Crops to be studied under the responsibility of this station were cabbage, upland paddy, strawberry, tomato zucchini from statistics of Intanon Station (Table 3.12) indicated that an average return of 5 crops (except field crop) were varied from 7,687 baht to 59,160 baht, which show a satisfactory return. Such conclusion was not correct because cost of production was not included. However, (from Table 3.13) one can see that all crops being studied (except upland

Table 3.7. Factors Input, Cost and Income of Cabbages, Ang-Khang Station, 1987.

(1,600 m²)

Type of Input	Quantity Used	Price of Input (Baht/unit)	Cash cost (Baht)
<i>Nursery plot</i>			
1. Seed (gm.)	118.75	4.00	4.75
2. Composed fertilizer (litre)	68.60	0.114	7.82
3. Chemical fertilizer (kg.)	2.06	6.00	12.37
4. Insecticide (cc.)	75.00	0.268	20.10
5. Fungicide (gm.)	10.02	0.12	1.20
<i>Planting plot</i>			
1. Chemical fertilizer (kg.)	55.00	5.95	327.48
2. Composed (litre)	600.00	0.114	68.4
3. Insecticide (cc.) (gm.)	300.00	0.50	150.00
4. Insecticide (cc.)	155.00	0.24	37.50
5. Wetting-matter (cc.)	155.00	0.032	4.96
Total Cost			1,104.54
Total Income ¹ (2.34 baht/kg.)			1,212.70
Net Income			108.16

Source: Sriboonchita, et. al. (1988) Table 1e 3A Ank: p. 20.

¹: Table 1e 4C. Ank: p. 25.Table 3.8. Factors Input, Cost and Income of Gladiolus, Ang-Khang Station, 1987.¹(400 m²)

Type of Input	Quantity Used	Price of Input (Baht/unit)	Cash cost (Baht)
1. Tubers	1,288.00	1.00	1,288
2. Lime	—	—	—
3. Chemical fertilizer (kg.)	20.00	6.00	120.00
4. Insecticide (gm.)	165.00	0.178	29.37
5. Fungicide (gm.)	165.00	0.190	31.35
6. Wetting-matter (cc.)	82.50	0.032	2.64
Total Cost			1,471.36
Total Income ²	4,158.60 (Jan-Feb)	4,388.00 (March-April)	
	3,542.55 (May-June)	3,642.45 (July-Aug.)	
Net Income ³	2,479.37 (Sept.-Oct.)	3,384.38 (Nov.-Dec.)	
	3,599.23 - 1,471.36 =	2,127.87	

Source: Sriboonchita, et. al. (1988) Table F1.2A. Ank: p. 15.

¹: No nursery plot²: Table F1.2D: Ank: p. 18.³: Calculate from average total income

Table 3.9. Factors Input, Cost and Income of Potatoes, Ang-Khang Station Royal Project, 1987.¹(1,600 m²)

Type of Input	Quantity Used	Price of Input (Baht/unit)	Cash cost (Baht)
1. Tuber (kg.)	30.00	6.00	1,800.00
2. Chemical fertilizer (kg.)	13.76	6.00	82.56
3. Composed fertilizer (litre)	33.40	0.114	13.81
4. Manure (litre)	40.20	0.125	5.03
5. Insecticide (cc.)	—	—	—
6. Fungicide (cc.)	113.53	0.24	27.25
7. Wetting-matter (cc.)	107.50	0.032	3.44
Total Cost			1,918.25
Total Income			4,264.00
Net Income			2,345.72

Source: Survey.

¹: No nursery plot.Table 3.10. Factors Input, Cost and Income of Kidney Bean, Ang-Khang Station Royal Project, 1987.¹(1,600 m²)

Type of Input	Quantity Used	Price of Input (Baht/unit)	Cash cost (Baht)
1. Seed (kg.)	7.35	12.00	88.20
2. Chemical fertiliaer (kg.)	16.50	6.00	99.00
3. Manure (litre)	912.00	0.125	11.40
4. Insecticide (cc.)	113.72	0.238	27.07
5. Fungicide (cc.)	122.24	0.12	14.67
Total Cost			1,332.94
Total Income			3,236.00
Net Income			1,903.06

Source: Survey.

¹: No nursery plot.

Table 3.11. General Data of Crops at Intanon Station Royal Project, 1987.

Item	Cabbage	Rice	Strawberry	Tomato	Zucchini
Planted area (rai)	838	450	64	70.75	24
No. of farmers (person)	170	112	154	30	24
Total Production (kg.)	2,672,000	50,400	130,500	355,518	6,920
Sold Production (kg.)	1,650,000	—	109,528.75	254,195.9	4,930
Average Yield/rai (kg.)	3,075	450	1,711.39	5,024.98	288.33
Average Income/rai (baht)	7,687	—	33,339.19	15,828.72	59,160
Net Income (baht)	—	—	2,113,708.25	895,905.36	41,412

Source: Intanon Station Royal Project.

Table 3.12. General Data of Crops at Intanon Station Royal Project, 1987.

Type of Crop	No. of farmers (person)	Planted area (rai)	Total yield (kg.)	Average yield/rai (kg.)	Total Income (baht)	Average Cost (baht)
<i>Rice</i>						
Lowland Paddy	41	257	85,670	333.30	—	—
Upland Paddy	8	32	5,120	160	—	—
<i>Vegetable</i>						
Cabbage	42	82	258,055	3,147.01	209,474	1,164.56
Zucchini	26	10.5	8,745	205.76	64,586	3,454.0
Tomato	19	34	156,620	4,606.47	358,102	8,851.18
Carrot	9	3.25	2,640	812.30	11,901	2,416.0
Turnip	7	2.25	1,912	849.78	12,584	2,820.28
Radish	6	1.5	1,180	786.67	7,026	1,630.36
Squash	6	1.75	2,222	1,269.7	12,858	2,653.80
Butternut	6	2	3,888	1,944	14,634	2,432.6
Japanese Pumkin	4	2.5	2,765	1,106	13,365	4,225.6
<i>Cutting flowers</i>						
Carnation	6	12,200(m ²)	194,600 (flowers)	15.95 (flowers/m ²)	219,900	34,294.24
Gysophira	2	600(m ²)	121	0.2 (kg/m ²)	16,800	40,448.0
Statis	4	1,600(m ²)	570(kg.)	0.36(kg/m ²)	85,500	17,006.08
<i>Orchard</i>						
Strawberry	40	50.8	152,765	3,541	1,132,838	6,140.01
Local Peach	11	37.33	5,805	155.6	21,625	—
Improved Peach	3	2.01	118	58.7	1,900	—
Apple	2	1.06	—	—	—	—
Local Pear	4	5.19	—	—	—	—
Grape	1	0.91	—	—	—	—

Source: Survey.

paddy) has high proportion on planted area as compared to other crops in Intanon Station.

In considering the factor input used in production of each crop being studied (except upland paddy) all crops have been used new input, net return/m² for production of cabbage was 0.3669 baht, tomato 6.35 baht, zucchini 14.82 baht and strawberry 42.05 baht respectively.

When we consider in more detail about income of hilltribes in Ang-Khang and Intanon Station, it can be classified into 3 major categories.

1. Income derived from sale produce through Royal Project.
2. Income derived from selling produce outside Royal Project.
3. In come from Hire-labour (off-farm).

3.4 Summary.

Detail being presented in Chapter 3 is the result of cropping pattern analysis. Economic activities such as animal raising, hirelabour, trade, weaving were include for consideration.

Finding confirmed that there were differences in the number of cropping patterns in Ang-khang

Table 3.13. Factors Input, Cost and Income of Cabbage Intanon Station Royal Project, 1987.

Type of factor input	Quantity (baht/unit)	Price of factor input (baht/unit.)	Cash cost (baht)
<i>Nursery Plot</i>			
1. Seed	106.25 (gm.)	4.00 (baht/gm.)	425.00
2. Composed fertilizer	114.00 (liter)	0.114 (baht/liter)	13.00
3. Chemical fertilizer	5.40 (kg.)	4.58 (baht/kg.)	24.73
4. Insecicide	138.64 (cc.)	0.13 (baht/cc.)	18.02
5. Fungicide	150.00 (cc.)	0.42 (baht/cc.)	63.00
<i>Planting Plot</i>			
1. Chemical fertilizer	65.30 (kg.)	5.74 (baht/kg.)	374.82
2. Insecticide	1,200.00 (cc.)	0.193 (baht/cc.)	231.60
3. Wetting-matter	450.00 (cc.)	0.032 (baht/cc.)	14.40
Total Cost			1,164.56
Total Income			5,492.00
Net Income			4,327.44

Source : Sriboonchitta, et al. (1988) Table Le. 3A. Int. : p. 17.

¹: Table Le. 3C Int. : p. 19.

Table 3.14. Factors Input, Cost and Income of Tomato, Intanon Station Royal Project, 1987.

(1,600 m²)

Type of factor input	Quantity (baht/unit)	Price of factor input (baht/unit.)	Cash cost (baht)
<i>Nursery Plot</i>			
1. Seed (gm.)	75.00	3.60 (baht/gm.)	270.00
2. Chemical fertilizer (kg.)	2.25	5.65 (baht/gm.)	12.71
3. Insecticide (cc.)	59.28	0.368 (baht/gm.)	21.82
4. Wetting-matter (cc.)	46.43	0.032 (baht/gm.)	1.49
5. Fungicide (cc.)	3.57	0.28 (baht/cc.)	1.00
6. Fungicide (gm.)	21.43	0.533 (baht/gm.)	11.42
<i>Planting Plot</i>			
1. Lime (kg.)	123.60	1.00 (baht/kg.)	123.60
2. Chemical fertilizer (kg.)	183.28	6.89 (baht/kg.)	1,262.80
3. Insecticide (cc.)	1,257.14	0.351 (baht/cc.)	441.2
4. Insecticide (gm.)	552.35	0.353 (baht/gm.)	194.98
5. Fungicide (cc.)	573.79	0.357 (baht/cc.)	215.17
6. Fungicide (gm.)	783.86	0.451 (baht/gm.)	353.52
7. Wetting-matter (cc.)	1,544.3	0.320 (baht/cc.)	49.42
8. Wood pole (unit)	1,843.00	1.00 (baht/unit)	1,843.00
9. Nail (kg.)	2.00	25.001 (baht/kg.)	50.00
Total Cost			8,851.18
Total Income ¹	25,192.74 (Jan.-Feb.)	13,029.08 (Mar.-Apr.)	
	14,158.83 (May-June.)	20,389.37 (July-Aug.)	
	22,486.52 (Sept.-Oct.)	18,851.72 (Nov.-Dec.)	
Net Income ²			10,166.74

Source : Sriboonchitta, et al. (1988) Table Ar. 4A. Int : p. 114.

¹: Table. Fr. 4D. Int : p. 117.²: Calculation from total average income/year=19,017.92 baht

Table 3.15. Factors Input, Cost And Income Of Zucchini, Intanon Station Royal Project, 1987.¹(400 m²)

Type of factor input		Quantity (baht/unit)	Price of factor input (baht/unit.)	Cash cost (baht)
1. Seed	(gm.)	61.54	6.50 (baht/gm.)	400.01
2. Lime	(kg.)	15.00	1.00 (baht/kg.)	15.00
3. Chemical fertilizer	(kg.)	30.70	6.44 (baht/kg.)	197.71
4. Composed fertilizer	(litre)	400.00	0.125 (baht/litre)	50.00
5. Insecticide	(cc.)	760.53	0.16 (baht/cc.)	121.68
6. Insecticide	(gm.)	659.17	0.12 (baht/cc.)	79.10
Total Cost				863.50
Total Income ²		5,662.58 (Jan.-Feb.)	5,604.10 (March-April)	
		8,093.91 (May-June)	8,240.86 (July-Aug.)	
		7,456.06 (Sept.-Oct.)	5,699.50 (Nov.-Dec.)	
Net Income ³				5,929.34

Source: Sriboonchitta, et al. (1988) Table Fr. 1A. Int.: p. 98.

¹: No Nursery Plot²: Table Fr. 1D. Int.: p. 101.³: Calculation from total average income.

and Intanon and the difference within the same tribe and different tribe. An analysis in production decision making pointed out that highland agricultural system has several limitations i.e. economic, social, geography and institutions.

An analysis of crop cost and return in both station indicated that hilltribes obtained satisfactory return from planting 10 crops. Hilltribes who grew 10 crops had different technical efficiency even though, some crops, such as strawberry, tomato, upland paddy zucchini at Intanon Station. Cabbage, gladiolus, kidney bean at Ang-Khang Station has rather high technical efficiency. Technical efficiency rating index of several crops has efficiency problem. By the same time it reflects an opportunity to solve problem in order to improve technical efficiency. An analysis also pointed out production environment may cause the different in technical efficiency in each station for the same crop and different station for the same crop.

Chapter 4. Conclusion

Hilltribe who are inhabited in upper Northern Region of Thailand are being criticized by public that they are destroying environment and natural resources such as forest, soil and water. Damaged resulted from encroaching forest land for slash and burn agriculture including opium poppy cultivation. At present, hilltribes' land holding are illegal which caused flooding and loss of valuable of forest resources and animals etc. According to economic social and political reason several government and non-governmental agencies are engaged in operating of rural development on the highland, and extension hilltribes to grow alternative crops other than opium poppy in stabilizing agricultural system.

Royal Project is one of the most important project which is trying to develop and improve hilltribes' living condition through cooperation with other government agencies.

Objective of this study is to evaluate the level of technical production efficiency of hilltribes under Ang-Khang and Intanon Station Royal Project. Production cost and return are also

included in this study in seeking of means to improve extension crop production efficiency to achieve high potential for each particular crop in order to make use of good decision-making on substitution crops for opium.

Study area covers 3 villages in Ang-Khang and 4 villages in Intanon Station.

175 hilltribes farmers in both areas were selected as a samples by simple random sampling method. Assembling data on population, production and marketing were made through interview by using questionnaire and field observation. Analysis has been classified into 4 types of data :

1. Cropping patterns,
2. Decision-making,
3. Crop cost of production and returns,
4. Technical efficiency (frontier lines) by using linear programming.

Result of analysis will be used to answer an important questions, how we can solve the problem of destroying forest, and opium poppy cultivation, through extension of substitution crops for opium.

4.1 Summary of Analysis.

4.1.1 Cropping patterns.

There are 23 cropping patterns of hilltribes' household in Ang-Khang Station and 39 cropping patterns in Intanon Station. About 86.21% of hilltribes' household in Ang-Khang were engaged in land intensive crops and stabilizing agriculture, while only 13.79% engaged in land extensive crops. For Intanon Station most of hilltribes' household were engaged in land intensive crops, while only 7.95% engaged in land extensive crops.

We can summarized that hilltribes in both Ang-Khang and Intanon Station are engaged in stabilizing agriculture, they are growing economic crops with intensive land use. Those cropping patterns are very important in decreasing to destroy forest resources.

4.1.2 Hilltribes' decision making on production.

An important factor which has a major role on decision making of hilltribes is the price of produce, price must be attractive in the sense should provide enough profit and market certainty by compared to opium.

4.1.3 Production cost and return.

The study result reveals that 10 crops is being studied at Ang-Khang Station, cabbage, kidney bean and potato, cabbage, zucchini and upland paddy at Intanon Station provided lower net return than opium poppy in the same unit of land. While gladiolus, local peach at Ang-Khang, strawberry and tomato at Intanon Station provided higher return than opium. Gladiolus provided the highest return at Ang-Khang and strawberry provided the highest return at Intanon Station.

4.1.4 Production efficiency.

Cabbage, gladiolus and kidney bean of hilltribes at Ang-Khang Station has high level of production efficiency, it is difficult to increase more than an existing condition. It is possible to increase production efficiency for potato and local peach. While an increasing efficiency of hilltribes' in Intanon Station has rarely opportunity which is mean an opportunity to increase for hilltribes in Intanon Station are quite low.

4.2 Proposed Policy.

In order to minimize destroying forest resources and opium cultivation problems. Government should extended stabilizing agriculture in other areas. Crops to be extended should be economic crops which provide high income and can be substitute field crops and opium poppy.

Crops being introduced should be capital intensive rather than extensive land use crops with certainty market together with increasing efficiency of production are also necessary to compete with opium poppy cultivation.

However, hilltribes has capital shortage and no collateral problem in production. Therefore sound loan should be provided by the government.

It is widely accepted that improvement of production technology can life up higher production level. Sriboonchitta et. al. (1988), pointed out hilltribes has a tendency to accept easy production technology. Technology improvement should be done for other hilltribe despite the rate of adoption is slower.

4.3 Proposed Research To Be Explored.

Economic efficiency can be divided into 2 types production or technical efficiency and pricing efficiency. This study is to measure production efficiency. Measurement of pricing efficiency was not study yet. Measurement of pricing efficiency may obtain a solution on increasing income of hilltribes and extension crop production may compete with opium poppy cultivation. Therefore new research should be explored.

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タイ国，チェンマイのアンカーンおよびインタノン 王立プロジェクトにおける高地農業の生産効率の分析

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摘 要

近畿大学とタイ国チェンマイ大学との共同研究事業『タイ国における有用植物の栽培とその薬理効果に関する研究』は、北部タイの山岳民族の社会的・経済的地位の向上を目的に農学的、薬学的、医学的な分野での現地調査・研究に加えて、北部タイ山岳民族の社会的・経済的地位の調査を行っている。本報は1990年度に実施した実験・調査結果の一部であ

る。アンカーンおよびインタノン王立プロジェクトで行った実験調査は、森林破壊およびケシ栽培に対する有効な防止策を見いだすことが重要な目的である。山岳民族のケシ栽培に対する防止策として、別の収入源になる換金作物の導入が行われた。本報では、導入された換金作物の生産効率の分析結果が述べられた。