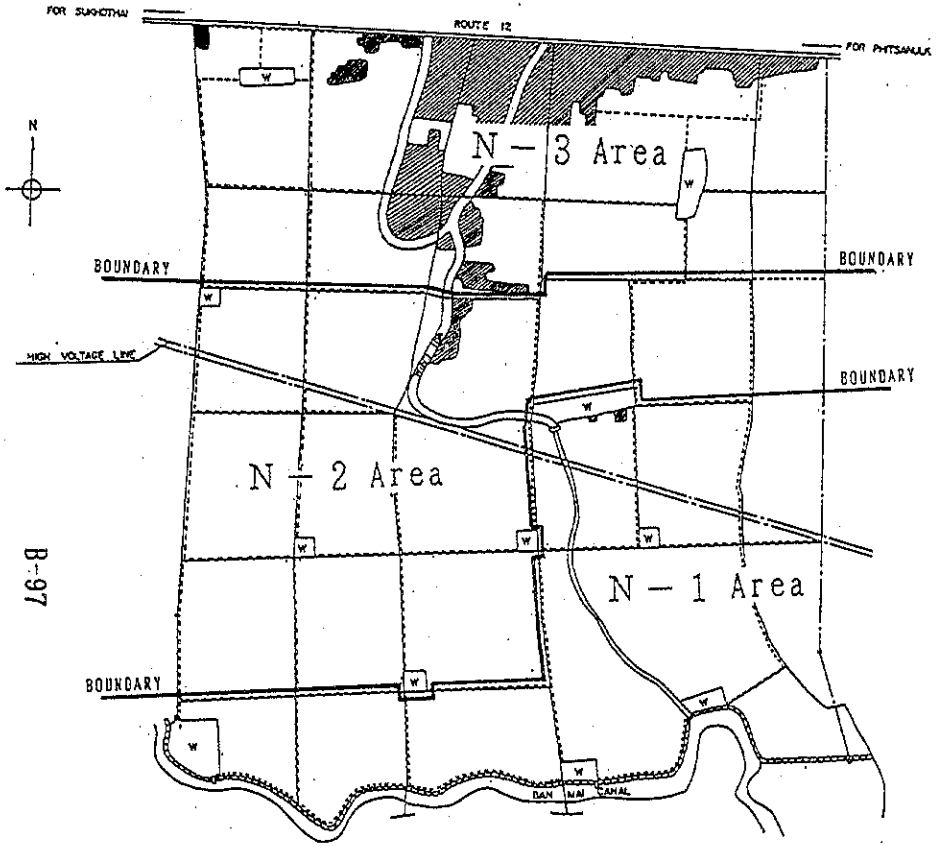


Figure B-5-2

CONSTRUCTION AREA IN NONG KHON KAEN

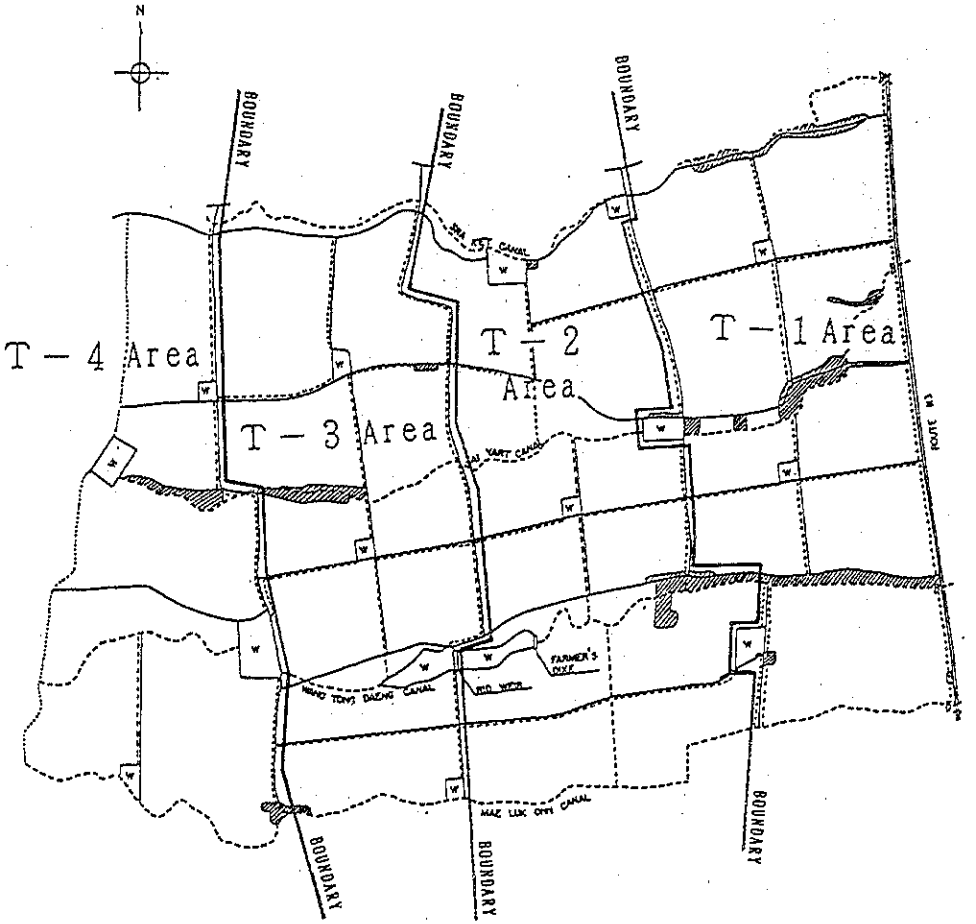


Figure B-5-3 CONSTRUCTION AREA IN THUNG SAI YART

Annual project cost shown in main report is estimated, dividing above each construction cost between 40% of fore and 60% of hind in the same construction term.

B-5-4 Construction Method and Equipment

(1) *Reservoir and Swamp Improvement*

The order of the construction is as follows:

(a) Setting and measuring the construction area
(b) Stripping of surface soil and excavation
(c) Loading excavated soil to other construction area
(d) Lining and protecting reservoir slope
(e) Finishing and cleaning

Considering the effective combination of number of equipments depending on their workability, the major equipment for the construction shall be provided per one set as follows;

Equipment		Unit	Application
Bulldozer	11 tons	2	Excavation & Moving
Frontloader	1.4 m^3	3	Loading
Dump Truck	8 tons	8	Hauling
Back hoe	0.7 m^3	3	Excavation, Loading
Swamp bulldozer	13 ton	2	Excavation, Moving

(2) Dual-purpose canal

Major works are excavation and slope plastic with a back-hoe (0.7 m^3). At the same time, road crossing culvert laying work shall be carried out.

The major equipments for the construction shall be provided per one set are as follows;

Equipment		Unit	Application
Back hoe	0.7 m^3	1	Excavation
Truck crane	2 tons	1	Pipe laying

(3) Canal improvement

Major works are the expansion of canal section and the dike embankment. The excavated soil in reservoir, dual-purpose canal and existing canal is available for the embankment materials. At the same time, dike crossing culvert works and weir construction shall be carried out. The major equipments for the construction shall be

Table B-5-1 CONSTRUCTION COST OF NONG KHON KAEN

A = 1,165 ha (7,283 rai)

(Unit: 000 Baht)

Item	Total	Foreign Currency	Local Currency
Phase I			
- Agricultural infrastructure	17,935	12,347	5,588
- Socila infrastructure	1,483	771	712
- Agricultural production facilities	-	-	-
Sub-total	19,418	13,118	6,300
Phase II			
- Agricultural infrastructure	13,357	9,106	4,251
- Socila infrastructure	2,939	2,334	605
- Agricultural production facilities	546	273	273
Sub-total	16,842	11,713	5,129
Phase III			
- Agricultural infrastructure	5,858	4,032	1,826
- Socila infrastructure	839	618	221
- Agricultural production facilities	546	273	273
Sub-total	7,243	4,923	2,320
Total	43,503	29,754	13,749

Table B-5-2 CONSTRUCTION COST OF THUNG SAI YART

A = 5,365 ha (33,535 rai)

(Unit: 000 Baht)

Item	Total	Foreign Currency	Local Currency
Phase I			
- Agricultural infrastructure	53,756	37,844	15,912
- Socila infrastructure	2,794	1,520	1,274
- Agricultural production facilities	-	-	-
Sub-total	56,550	39,364	17,186
Phase II			
- Agricultural infrastructure	40,854	29,317	11,537
- Socila infrastructure	1,671	945	726
- Agricultural production facilities	1,094	547	547
Sub-total	43,619	30,809	12,810
Phase III			
- Agricultural infrastructure	40,242	28,866	11,376
- Socila infrastructure	7,286	5,664	1,622
- Agricultural production facilities	820	410	410
Sub-total	48,348	34,940	13,408
Phase III			
- Agricultural infrastructure	57,028	40,943	16,085
- Socila infrastructure	9,276	6,828	2,448
- Agricultural production facilities	820	410	410
Sub-total	67,124	48,181	18,943
Total	215,641	153,294	62,347

provided per one set as follows;

Equipment		Unit	Application
Bulldozer	11 tons	2	Excavation, Spreading, Compaction
Back hoe	0.7 m³	2	Excavation, Loading
Dump Truck	8 tons	4 - 6	Hauling
Concrete Mixer	0.6 m³	2	Concrete mixing

The construction shall be carried out on both side of canal in parallel.

(4) Farm Road

The excavated soil in reservoir and dual-purpose canal is available as the embankment materials. The major equipments for the construction shall be provided per one set as follows;

Equipment		Unit	Application
Bulldozer	11 tons	1	Excavation, Spreading, Compaction
Vibration roller		2	Compaction
Water tank truck		1	Adjusting moisture ratio
Motor grader	3.1 m	1	Spreading, Road grading
Dump Truck	8 tons	6	Hauling

(5) Land Leveling

The major equipment for the work shall be provided per one set as follows;

Equipment		Unit	Application
Bulldozer	11 tons	2	Excavation & Moving

B-5-5 Construction Term of Civil Works

(1) Reservoir and swamp rehabilitation

In case of reservoir type I (200 m x 200 m), the construction term was estimated as follows;

- Construction term 92 days
- Volume of excavation 91,500 m³
- Unit construction term per 10,000 cu.m 10 days/10,000 m³

The construction term of each reservoir type and swamp can be estimated based on the volume of excavation. In case that the earth volume is hug, some sets of construction equipments is provided to complete the works in the dry season.

The construction term of each reservoir and swamp is as follows;

Description	Volume of Excavation m^3	No. of set of Equipments set	Construction Term Days	Months
Reservoir				
Type I	91,500	2	45	2
Type II	23,300	1	23	1
Type III	21,800	1	22	1
Type IV	395,200	4	99	4
Type V	221,400	3	74	3
Type VI	270,100	3	90	4
Type VII	85,100	1	85	3.5
Type VIII	162,900	3	54	2.5
Swamp				
No. 1	44,800	1	45	2
No. 2	76,000	2	38	1.5
RID weir	200,200	3	67	3
Farmer's Dike	98,000	2	49	2

Note: Working hour is 7 hours per day, and working day is 25 days per month.

(2) Dual-purpose canal

The construction term per 1,000 m is estimated as follows;

- Excavation per 1,000 m 6,000 m^3
- Output of backhoe 0.7 m^3 per hour 56.7 m^3/hr
- Construction term 15.2 day/1,000 m

Taking road crossing works into account, the construction term is estimated as follows;

15.2 day/1,000 m x 1.2 = 19 day/1,000 m

(3) Canal improvement

The construction term per 1,000 m is estimated as follows;

Type	Term per 1,000 m	Application
I	22 days	Mae Luk Onn, W.T. Daeng
II	31	Sai Yat, Sra Ket
III	31	Up-Noi
IV	31	Down-Noi
V	22	Ban Mai

The construction shall be carried out on both side of canal except type V .

(4) Farm road

The construction term per 1,000 m is estimated as follows;

Type		Term per 1,000 m
Main road	W = 6 m	36 days
Lateral road	W = 4 m	21
Branch road	W = 3 m	12

(5) Land leveling

1) Earth volume per hectare

Considering the slope on both projects area, the moved earth volume per hectare is calculated as follows;

Area	Averaged Cut depth	Earth Volume
Nong Khon Kaen	0.10 m	1,000 m^3/ha
Thung Sai Yart	0.20 m	2,000 m^3/ha

2) Output per hour of equipment

Bulldozer 11ton	38 m^3/hr
Moving distance	L = 30 m

3) Construction term

In case of using two unit of bulldozer,

Nong Khon Kaen :
1,000 m^3/ha / 38 m^3/hr / 2 unit = 13 hrs → 2 days

Thung Sai Yart :
2,000 m^3/ha / 38 m^3/hr / 2 unit = 26 hrs → 4 days

B-5-6 Unit Prices

(1) Unit Price of Materials

The cost of construction work is estimated based on the data collected on prices from ALRO and RID as of December 1989, and the data collected in Sukhothai. The unit prices used for estimation of project cost are as follows ;

Table B-5-3 CONSTRUCTION TERM OF NONG KHON KAEN

Description	First Year		Secondary Yera		Third Year	
	Quantity	Term	Quantity	Term	Quantity	Term
- Reservoir Type I	2 place	2 month	-	- month	-	-
Reservoir Type III	1	1	4 place	4	-	-
Reservoir Type VII	1	3.5	-	-	-	-
- Swamp rehabilitation	1	1.5	-	-	1 place	2
- Dual-Purpose Canal	8,680 m	3.5(2)	11,000 m	4.5(2)	12,000 m	3 (3)
- Canal Improvement						
Ban Mai Canal	4,200 m	2 (2)	-	-	-	-
Noi Canal, Up-stream	-	-	4,100 m	2.5(2)	-	-
Noi Canal, down-stream	1,700 m	2	- m		-	-
- Main Farm Road	3,800 m	2.5(2)	-	-	-	-
Lateral Farm Road	1,460 m	1	3,750 m	3	1,600 m	1.5
Branch Farm Road	4,190 m	2	5,100 m	2	5,000 m	2
- Land Leveling	30 ha	2.5	50 ha	4	30 ha	2.5
- Domestic Water Supply	-	-	1 LS	4	-	-
- Rural Electrification	-	-	-	-	1 LS	3
- Multi-Purpose Hall	1 house	4	-	-	-	-
- Multi-Purpose Storage	-	-	2 house	4	2 house	4

Note; ( ) meaans nember of set of construction equipment.

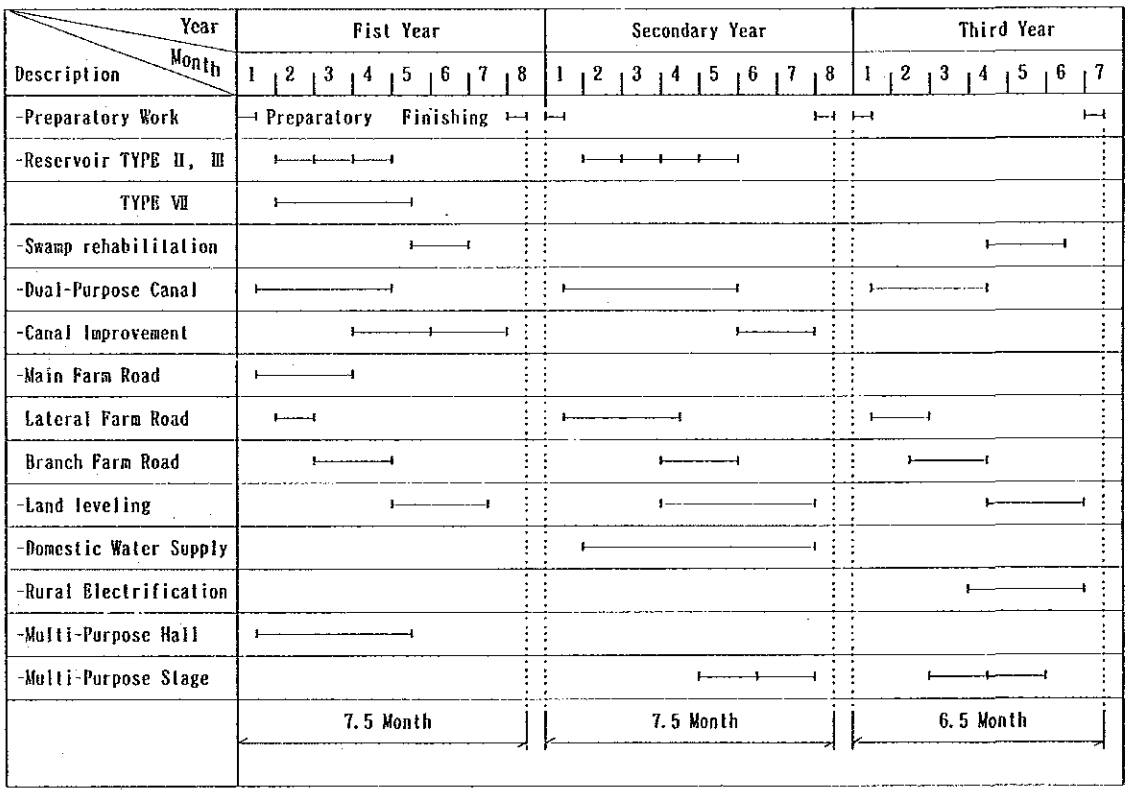


Figure B-5-4 CONSTRUCTION SCHEDULE OF NONG KHON KAEN

Table B-5-4 CONSTRUCTION TERM OF THUNG SAI YART

Description	First Year		Secondary Year		Third Year		Fourth Year	
	Quantity	Term	Quantity	Term	Quantity	Term	Quantity	Term
- Reservoir Type I	2 place	4 (2)	2	4 (2)	3	6 (2)	2	4 (2)
Reservoir Type IV	-	-	-	-	-	-	-	-
Reservoir Type V	1	3 (3)	-	-	-	-	1	3 (3)
Reservoir Type VI	1	4 (3)	-	-	-	-	-	-
Reservoir Type VIII	-	-	1	2.5(3)	-	-	-	-
- Swamp rehabilitation	-	-	1	2 (2)	1	3 (3)	-	-
- Dual-Purpose Canal	15,750 m	4 (3)	14,250 m	3.5(3)	16,040 m	4.5(3)	17,000 m	4.5(3)
- Canal Improvement								
Sra Ket	3,300 m	4	2,800 m	3.5	2,500 m	3	-	-
Sai Yat	3,100 m	4	2,600 m	3.5	2,300 m	3	2,000 m	2.5
W.T. Daeng	1,800 m	1.5	2,900 m	2.5	1,300 m	1	2,600 m	2.5
Mae Luk Onn	2,000 m	2	3,800 m	3.5	2,200 m	2	3,400 m	3
- Main Farm Road	2,550 m	2 (2)	2,600 m	2 (2)	2,300 m	2 (2)	7,950 m	4 (3)
Lateral Farm Road	1,600 m	1.5	-	-	1,500 m	1.5	-	-
Branch Farm Road	9,850 m	2.5(2)	12,650 m	3 (2)	12,400 m	3 (2)	4,300 m	2
- Land Leveling	140 ha	4.5(5)	140 ha	4.5(5)	140 ha	4.5(5)	110 ha	4.5(4)
- Bridge	2 place	4 (2)	-		-		-	
- Domestic Water Supply								
Piped System	-	-	-	-	2 place	6	-	-
Hand Pump	1 place	1	1 place	1	1 place	1	4 place	4
- Rural Electrification	-	-	-	-	-	-	1 LS	6
- Multi-Purpose Hall	1 house	4	-	-	-	-	-	-
- Meeting Hall	2 house	6	2 house	6	-	-	-	-
- Multi-Purpose Storage	-	-	4 house	4 (2)	3 house	6	3 house	6

Note; ( ) meaans nember of set of construction equipment.

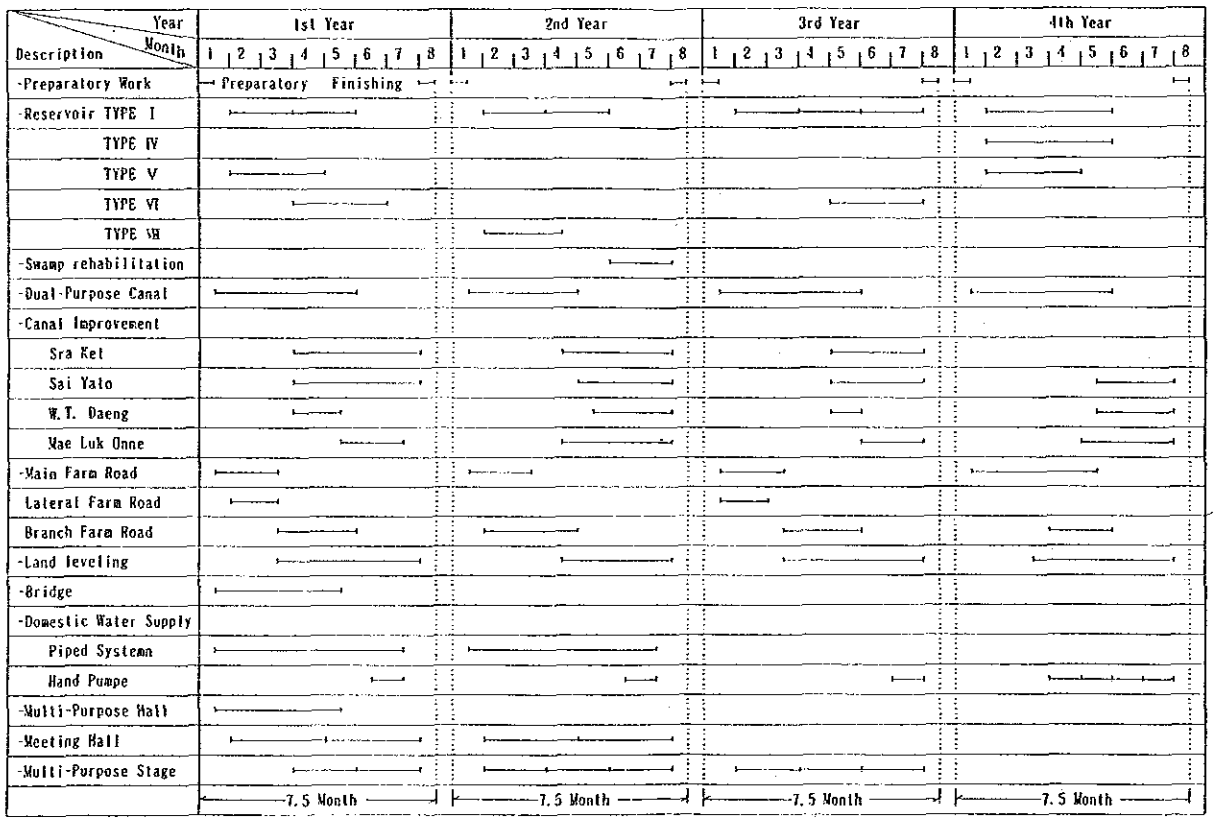


Figure B-5-5 CONSTRUCTION SCHEDULE OF THUNG SAI YART

1) Labour unit price

Item	Rate (Baht/day)
Foreman	160
Equipment Operator	150
Driver	120
Steel Worker	200
Concrete Worker	80
Carpenter	150
Mechanic	190
Electrician	170
Mason	135
Common Labour	75

2) Unit price of materials

Item	Unit	Rate (Baht)	
Sand	cu.m	230	
Gravel	cu.m	230	
Riprap	cu.m	200	
Laterite	cu.m	235	
Reinforcement Bar	ton	12,200-13,000	excluding Transport.
Cement	ton	1,600	
Diesel Oil	litre	6.4	in Sukhothai
Timber (Soft)	cu.m	7,100	excluding Transport.
Timber (Hard)	cu.m	12,300	excluding Transport.
RC Pipe ϕ 1,000 mm	m	1,050	

Note : Unit price don't include transportation charge

(2) Rate of foreign and local currency

Rate of foreign and local currency portion on each unit prices is normally applied as follows :

Description	Rate of Foreign Currency	Rate of Local Currency
Cement	60%	40%
Steel bar	70%	30%
Timber	20%	80%
Fuel & Oil	80%	20%
Labour	-	100%
Spare parts	90%	10%
Gravel	-	100%
Sand	-	100%
Laterite	-	100%
Concrete block	40%	60%
Reinforced concrete pipe	50%	50%

(3) Operation cost of major equipment

The basic data for estimation of unit cost is consisted of purchase price, life time, depreciation rate, repair rate, maintenance rate, operation rate and fuel/oil consumption for the construction equipment.

The purchase price of the construction equipment is estimated making reference to data collected in Thailand and Japan. The depreciation rate, the life time and operation rate are obtained considering the prevailing situation of construction works in Thailand. The repair rate, maintenance rate and fuel/oil consumption are from standard data used in Japan.

The portion of foreign and local currency are decided as follows :

- Depreciation cost : 100 percent of foreign portion assuming the construction equipment will be imported.
- Repair cost : 80 percent of foreign portion and 20 percent of local portion, for spare parts and labour costs, respectively.
- Maintenance cost : 50 percent of foreign and 50 percent of local portion, for tools and equipment and labour costs, respectively.

The operation costs for major construction equipment are shown in Table B-5-5.

(4) Unit Cost of Works

The unit cost for the construction works is estimated taking into account the costs such as efficiency of the construction equipment, labour, materials and operation cost the construction equipment. The estimated unit costs for major works are shown in Table B-5-6.

B-5-7 Rate of Overhead for Contractor

Calculation formula for the rate of overhead, which is generally used by RID, is shown as follows;

Table B-5-5 : OPERATION COST OF MAJOR EQUIPMENT

Description	Purchase Price (x 10^3 ฿) (1)	Life Time hr (Year) (2)	Depreciation F.C. (3)	Repair Cost			Fuel & Lubricant			Operator & Labour L.C. (10)	Administrative Cost			Total F.C. (14)	Total L.C. (15)
				Rate (4)	Parts F.C. (5)	Labour L.C. (6)	Fuel (l/hr) (7)	F.C. (8)	L.C. (9)		Rate (11)	Tools F.C. (12)	Labour L.C. (13)		
		(10 years)													
- Bulldozer 11 ton	2,500	10,000	250	0.65	130.0	32.5	11.0	64.8	16.2	75	0.07	87.5	87.5	282.3	211.3
- Backhoe 0.7 m^3	3,200	10,000	320	0.55	140.8	35.2	15.0	88.3	22.1	25	0.07	112.0	112.0	341.1	194.3
- Dump Truck 8 ton	950	10,000	95	0.60	45.6	11.4	13.0	76.5	19.1	20	0.10	47.5	47.5	169.6	98.0
- Motor Grader 3.1 m.	2,450	10,000	245	0.50	98.0	24.5	7.6	44.7	11.2	50	0.07	85.8	85.8	228.5	171.5
- Tire Roller 8 ton	720	10,000	72	0.50	28.8	7.2	5.0	29.4	7.4	50	0.07	25.2	25.2	83.4	89.8
- Nobration Roller 2.8 ton	600	10,000	60	0.50	24.0	6.0	2.5	14.7	3.7	50	0.07	21.0	21.0	59.7	80.7
- Truck Crane 2 ton	440	10,000	44	0.45	15.8	4.0	3.1	18.3	4.5	32.5	0.10	22.0	22.0	56.1	63.0
- Water Tank Truck 6,000 l	900	10,000	90	0.50	36.0	9.0	5.2	30.6	7.7	32.5	0.07	31.5	31.5	98.1	80.7
- Farm Tracter 6 ton	600	10,000	60	0.60	28.8	7.2	7.0	41.2	10.3	50	0.07	21.0	21.0	91.0	88.5
- Portable Concrete Mixer 0.6 m^3	340	10,000	34	0.70	19.0	4.8	-	-	-	25	0.05	8.5	8.5	27.5	38.3
- Soil Compacter 90 kg.	40	4,500	8.9	0.45	3.2	0.8	0.8	4.7	1.2	25	0.05	1.1	1.1	9.0	28.1
- Swamp Bulldozer 13 ton	2,900	10,000	290	0.65	150.8	37.7	12.0	70.7	17.6	50	0.07	101.5	101.5	323.0	206.8
- Front Loader 1.4 m^3	1,800	10,000	180	0.70	100.8	25.2	13.0	76.5	19.1	50	0.07	63.0	63.0	240.3	157.3

(3) = (1)/(2)
(5) = (1)/(2) x (4) x 0.8
(6) = (1)/(2) x (4) x 0.2
(8) = 6.40 x (7) x 1.15* x 0.8
(9) = 6.40 x (7) x 1.15* x 0.2
(12) = (1)/(2) x (11) x T x 0.5
(13) = (1)/(2) x (11) x T x 0.5
(14) = (5) + (8) + (12)
(15) = (6) + (9) + (10) + (13)

(1) Marketing Price in Bangkok
(2) Thailand Standard (RID 1988)
(3) Thailand Standard (RID 1988)
(4) Japanese Standard
(7) Japanese Standard
(11) Japanese Standard
T ; Life Year
Diesel Oil 6.40 ฿/l
* - Lubricant & Greese are appropriated 15% oil Fuel. (Thailand Standard; RID)

Table B-5-6 LIST OF UNIT COST

(Unit: Baht)

Description	Unit	Equipment Depreciation F.C.	Labour, Material & Repair Cost F.C.	Labour, Material & Repair Cost L.C.	Total Cost	Remarks
1. Water Resources Facilities						
Reservoir Type I 200 m x 200 m	place	1,028,000	1,400,000	833,000	3,261,000	
Reservoir Type II 100 m x 150 m	"	227,000	290,000	192,000	709,000	
Reservoir Type III 100 m x 100 m	"	202,000	259,000	172,000	633,000	
Reservoir Type IV 600 m x 400 m	"	4,707,000	6,490,000	3,780,000	14,977,000	
Reservoir Type V 400 m x 250 m	"	2,661,000	3,659,000	2,138,000	8,458,000	with Fish Pond
Reservoir Type VI 300 m x 300 m	"	3,106,000	4,267,000	2,485,000	9,858,000	with Fish Pond
Reservoir Type VII 200 m x 200 m	"	972,000	1,313,000	783,000	3,068,000	with Fish Pond
Reservoir Type VIII 400 m x 250 m	"	1,928,000	2,629,000	1,546,000	6,103,000	
Swamp Rehabilitation No. 1	"	481,000	645,000	380,000	1,506,000	with Fish Pond
Swamp Rehabilitation No. 2	"	819,000	1,099,000	632,000	2,550,000	with Fish Pond
Swamp Rehabilitation RID Weir	"	2,200,000	2,995,000	1,680,000	6,875,000	with Fish Pond
Swamp Rehabilitation Farmer's Dike	"	1,121,000	1,530,000	869,000	3,520,000	
Weir Overflow - Type I	"	3,400	26,600	173,700	203,700	Thung Sai Yart, Sai Yat, Sraket
Weir Overflow - Type II	"	2,400	21,700	143,000	167,100	Thung Sai Yart, Mae Luk, W.T.Daeng
Weir Overflow - Type III	"	2,900	23,900	156,400	183,200	Nong Khon Kaen, Swamp
Weir with Gate Facilities	"	6,500	80,900	92,800	180,200	Nong Khon Kaen, Ban Mai Canal
2. Agricultural Land Infrastructure						
2-1 Irrigation & Drainage System on Farm						
Irrigation & Drainage Ditch W = 0.5 m	m	35	37	21	93	
Road Crossing RC pipe A ϕ1,000 m/m	place	93	5,295	6,812	12,200	Pipe Length 9.0 m
Road Crossing RC pipe B ϕ1,000 m/m x 3 series	place	280	15,900	20,400	36,580	Existing Canal
2-2 Drainage System for Inundation						
Canal Improvement Type I	m	136	150	100	386	Mae luk-On, Wang Tong Daeng Canal
Canal Improvement Type II	"	213	258	163	634	Sai Yat, Sra Ket Canal

(Unit: Baht)

Description	Unit	Equipment Depreciation F.C.	Labour, Material & Repair Cost F.C.	Labour, Material & Repair Cost L.C.	Total Cost	Remarks
Canal Improvement Type III	m	214	259	163	636	Noi Canal, Down-Stream
Canal Improvement Type IV	"	255	318	196	769	Noi Canal, Up-Stream
Canal Improvement Type V	"	68	75	50	193	Ban Mai Canal
Dike Crossing Culvert	"	1,400	52,900	63,800	118,100	
Bridge	"	8,500	418,200	596,300	1,023,000	Road Crossing on Route 1113
2-3 Farm Road						
Main Road W = 6.0 m	m	135	182	241	558	Improve (30% of unit cost)
Lateral Road W = 4.0 m	"	72	102	144	318	Improve (30% of unit cost)
Branch Road W = 3.0 m	"	33	44	58	135	Improve (30% of unit cost)
2-4 Miscellaneous						
Embankment of Canal Improvement	m	68	75	50	193	
Embankment of Reservoir	"	37	39	23	99	
Lean Concrete	m^3	-	340	564	904	
Plain Concrete	"	-	422	867	1,289	
Reinforced Concrete Heavy 150 kg/cm^2	"	-	1,721	2,118	3,839	
Reinforced Concrete Heavy 125 kg/cm^2	"	-	1,600	2,065	3,665	
Reinforced Concrete Heavy 100 kg/cm^2	"	-	1,385	1,973	3,358	
RC Pipe Laying ϕ600 m/m	m	9	274	296	579	
RC Pipe Laying ϕ1,000 m/m	"	9	552	574	1,135	
Clay Coating	m^3	10	12	7	29	
Laterite Pavement	"	42	75	126	243	Include Transportation Fee
Riprap z	"	-	-	250	250	Include Transportation Fee
Stone Pitiching (Riprap with Mortar)	"	3	54	522	579	Include Transportation Fee
Mansory	"	3	119	841	963	Include Transportation Fee
Land levelling Cut depth 20 cm	ha	13,500	15,300	11,500	40,300	Thung Sai Yart
Land levelling Cut depth 10 cm	"	6,800	7,600	5,700	20,100	Nong Khon Kaen
Digging at Swamp	m^2	21	29	16	66	Dig depth 2.0 m

(Unit: Baht)

Description	Unit	Equipment Depreciation F.C.	Labour, Material & Repair Cost F.C.	Labour, Material & Repair Cost L.C.	Total Cost	Remarks
3. Social Infrastructure						
3-1 Domestic Water Supply						
Deep Well ϕ150 Depth = 50 m	LS	-	82,500	35,500	118,000	Thung Sai Yart
Deep Well ϕ200 Depth = 60 m	"	-	132,000	56,000	188,000	Nong Khon Kaen
Deep Well ϕ200 Depth = 100 m	"	-	220,000	94,000	314,000	Thung Sai Yart
PVC Pipe ϕ60 (2 ½")	m	-	97	41	138	Include Joint
PVC Pipe ϕ50 (2")	"	-	59	25	84	Include Joint
PVC Pipe ϕ25 (1")	"	-	23	10	33	Include Joint
PVC Pipe ϕ13 (½")	"	-	12	5	17	Include Joint
Water Account Meter	nos	-	480	120	600	
Elevated Tank 15 m^3	"	-	130,000	71,000	201,000	
Pump House	m^2	-	1,750	1,750	3,500	
Handy Pump Facilities	LS	-	147,000	70,000	217,000	
3-2 Rural Electrification						
High Voltage Power Line	m	-	100	25	125	
Low Voltage Power Line	"	-	104	26	130	
Transformer 20 KVA	nos	-	32,000	8,000	40,000	
Transformer 30 KVA	"	-	32,800	8,200	41,000	
Connection Line 10 A	house	-	2,480	620	3,100	
Connection Line 20 A	"	-	3,640	910	4,550	
3-3 Meeting Facility						
Multi-purpose Hall	m^2	-	2,500	2,500	5,000	
Meeting Hall	"	-	2,000	2,000	4,000	
Cable Broadcasting Equipment	set	-	19,200	1,800	21,000	
Speaker	nos	-	1,080	120	1,200	
Speaker Wire	m	-	6	2	8	
Radio Broadcasting Equipment	LS	-	20,000	-	-	

(Unit: Baht)

Description	Unit	Equipment Depreciation F.C.	Labour, Material & Repair Cost F.C.	Labour, Material & Repair Cost L.C.	Total Cost	Remarks
3-4 Public Sanitary	set	-	1,500	1,500	3,000	
4. Post-Harvest and Marketing Facility Multi-purpose Storage	m^2	-	1,900	1,900	3,800	

Table B-5-7 UNIT COST OF EARTH WORK BY MACHINERY

(Unit: Baht)

Description	Unit	Equipment Depreciation	Labor, Material & Repair Cost		Total Cost	Remarks	
		(F.C.)	(F.C.)	(L.C.)			
1. Machinery Works						Q; OUTPUT (m^3/hr)	(m^2/hr)
Stripping by Bulldozer 11 ton	m^3	3.06	3.44	2.57	9.06	Moving Distance L=10 m	Q=81.8
Stripping by Bulldozer 11 ton	"	6.58	7.42	5.56	19.56	Moving Distance L=30 m	Q=38.0
Spreading by Bulldozer 11 ton	"	3.40	3.84	2.87	10.11	D = 30 cm	Q=73.5
Compaction by Bulldozer 11 ton	"	2.10	2.37	1.77	6.24	D = 30 cm, T = 4 time	Q=119.4
Spreading & Compaction by Bulldozer 11 ton	"	5.50	6.21	4.65	16.36	D = 30 cm, T = 4 time	Q=45.5
Spreading by Bulldozer 11 ton	"	3.78	4.26	3.19	11.23	D = 20 cm	Q=66.3
Compaction by Bulldozer 11 ton	"	3.93	4.43	3.32	11.68	D = 20 cm, T = 5 time	Q=63.7
Spreading & compaction by Bulldozer 11 ton	"	7.70	8.69	6.51	22.90	D = 20 cm, T = 5 time	Q=32.5
Common Excavation by Backhoe 0.70 m^3	"	5.63	6.00	3.41	15.04	Circular angle 90°	Q=56.7
Hauling by Dump Truck 8 ton	m^3	4.38	7.82	4.52	16.72	Hauling Distance L = 300 m	Q=21.7
Hauling by Dump Truck 8 ton	"	9.04	16.15	9.33	34.52	Hauling Distance L = 2000 m	Q=10.5
Hauling by Dump Truck 8 ton	"	22.04	39.35	22.74	84.13	Hauling Distance L = 10 Km	Q=4.31
Hauling by Dump Truck 8 ton	"	40.76	72.76	42.04	155.56	Hauling Distance L = 20 Km	Q=2.33
Compaction by Vibration Roller	"	2.50	2.48	3.36	8.34	D = 30 cm, N = 4 time	Q=24.0
Compaction by Vibration Roller	"	4.69	4.66	6.30	15.65	D = 20 cm, N = 5 time	Q=12.8
Compaction by Tire Roller	"	0.38	0.44	0.48	1.30	D = 30 cm, N = 4 time	Q=189
Compaction by Tire Roller	m^3	0.71	0.83	0.89	2.43	D = 20 cm, N = 5 time	Q=101
Compaction by Soil Compactor 90 Kg	"	1.78	1.80	5.62	9.20		Q= 5
Grading by Motor Grader 3.1 m	m^2	2.92	2.71	2.04	7.67		Q=838
Spray by Water Tank Truck 6000 l	"	0.05	0.06	0.05	0.16		Q=1724
Stripping by Swamp Bulldozer 13 ton	m^3	7.02	7.82	5.00	19.84	Moving Distance L= 30 m	Q=88.9
Spreading by Swamp Bulldozer 13 ton	"	4.47	4.97	3.18	12.62	D = 20 cm	Q=65.0
Compaction by Swamp Bulldozer 13 ton	"	0.49	0.55	0.35	1.39	D = 20 cm, T = 2 time	Q=592
Spreading & compaction by S.B 13 ton	"	4.96	5.52	3.54	14.02	D = 20 cm, T = 2 time	Q=58.6
Portable Concrete Mixer 0.6 m^3 Class	"	2.41	1.95	2.72	7.08		Q=14
Loading by Front Loader 1.4 m^3	"	3.67	4.90	3.21	11.78		Q=49.0

$$\text{Rate of Overhead} = \frac{\{1+(1)\} \times \{1+(2)\}}{\{1-(3)\} \times \{1-(4)\} \times \{1-(5)\}}$$

where (1): Operation Cost
(2): Profit
(3): Tax
(4): Compensation Fund
(5): Insurance

Rate of (1) to (4) is elected RID's data shown at page, and (5) is usually 1.5%.

Rate of overhead for construction cost of Nong khon Kaen area and Thung Sai Yart area is calculated respectively as follows;

Description	Rate of Nong K. K.	Rate of Thung S. Y.
- Construction cost of materials and labours	40 million Baht	172 million Baht
(1) Operation cost	4.3%	3.5%
(2) Profit	7.5%	6.5%
(3) Tax	3.4%	3.4%
(4) Compensation fund	4.1%	4.1%
(5) Insurance	1.5%	1.5%
- Rate of overhead	23 %	21 %

No.	Amount of Material & Labour Cost	Operation Cost	Profit	Tax	Tax and Compensation Fund in Specified Province
(1)	(2)	(3) %	(4) %	(5) %	(6)
1.	not over 50	10	18.5	3.40	4.10
2.	50-100	8	17.5	3.40	4.10
3.	100-300	6.5	16	3.40	4.10
4.	300-500	6.5	13	3.40	4.10
5.	500-800	6.5	12	3.40	4.10
6.	800-1,000	6.5	11	3.40	4.10
7.	1,000-2,000	6	10.5	3.40	4.10
8.	2,000-5,000	6	9.5	3.40	4.10
9.	5,000-10,000	6	8.5	3.40	4.10
10.	10,000-20,000	5	8.5	3.40	4.10
11.	20,000-40,000	5	7.5	3.40	4.10
12.	40,000-60,000	4.3	7.5	3.40	4.10
13.	60,000-100,000	4	7	3.40	4.10
14.	100,000 up	3.5	6.6	3.40	4.10

Note: RID's Data as of October 1987

B-5-8 Annual Administrative Cost

1. Nong Khon Kaen

The cost of the temporary staff for the administration and miscellaneous is estimated as follows;

Description	No. of Personnel	Salary Per month (Baht)	Amount (Baht)
1. Supporting Staff			
Secretary	1	3,600	3,600
Draft-man	1	3,700	3,700
Clerk	1	4,000	4,000
Accountant	1	5,000	5,000
Assistant Officer	2	5,000	10,000
Total			26,300
2. Miscellaneous (20% of Remuneration)			4,700
Grand Total			31,000 Baht/month

2. Thung Sai Yart

The scale of the construction is larger than one of Nong Khon Kaen, so the number of staff is made more.

Description	No. of Personnel	Salary Per Month (Baht)	Amount (Baht)
1. Supporting Staff			
Secretary	1	3,600	3,600
Draft-man	2	3,700	7,400
Clerk	2	4,000	8,000
Accountant	1	5,000	5,000
Assistant Officer	3	5,000	15,000
Total			39,000
2. Miscellaneous (20% of Remuneration)			8,000
Grand Total			47,000 Baht/month

B-5-9 Annual O & M Cost of Agricultural Infrastructure

(Unit: '000 Baht)

1. Operation Cost

(1) Salaries and wages

Description	No. of Personnel	Salary Per Annum	Amount
Secretary	2	36	72
Clerk	2	40	80

Accountant	2	50	100
Typist	2	50	100
Driver	4	40	160
Assistant	4	36	144
Total			656

(2) Equipments

a) Repair and maintenance

Description	Quantity	Unit Cost	Amount	Remarks	
				Repair	Maintenance
Pick-up Truck 4 x 4	2	36	72	0.50	0.10
Pick-up 4 x 4	2	30	30	0.50	0.10
Motor-cycle 125 cc	2	1	2	0.50	0.10
Spare parts (10%)	LS		13		
Tools (5%)	LS	-	6	-	-
Sub-total			153		

$$\text{Unit Cost} = \frac{\text{Purchase Price}}{\text{Life Year}} \times \left\{ \text{Rate of Repair Cost} + \text{Rate of Maintenance Cost} \right\}$$

b) Fuel and oil

Diesel oil = 6.4 Baht/lit

Working

Description	Consumption lit/day	Days	Unit	Amount
Pick-up Truck	15	150	2	29
Pick-up	12	200	2	31
Motor cycle	8	200	2	20
Sub-total				233
Total				160

2. Maintenance Cost

20% of salaries and wages is appropriated for administration.

656 x 20% = 131

Therefore, annual O & M cost of agricultural infrastructure is estimated as follows;

Grand-total	1,020

B-5-10 Annual O & M Cost of Rural Infrastructure

(Unit: '000 Baht)

(1) Domestic Water Supply

1. Operation Cost

(a) Salaries and wages

Description	No. of Personnel	Salary Per Annum	Amount
Clerk	1	40	40
Accountant	1	50	50
Operator	1	50	50
Driver	1	40	40
Total			180

(b) Equipments

i) Repair and maintenance

Description	Quantity	Unit Cost	Amount
Pick-up Truck 4 x 4	1	36	36
Motor-cycle 125 cc	1	1	1
Spare parts (10%)	LS	-	4
Tools	LS		4
Sub-total			45

ii) Fuel and oil

Diesel oil = 6.4 Baht/lit

Working

Description	Consumption lit/day	Days	Unit	Amount
Pick-up Truck	15	150	1	15
Motor cycle	8	200	1	10
Sub-total				25
Total				70

(c) Materials

0.5% of construction cost is appropriated.

Nong Khon Kaen	217 x 0.5%	=	1
Thung Sai Yart (1)	2,973 x 0.5%	=	15
Thung Sai Yart (2)	2,832 x 0.5%	=	14
Total			30

(d) Electric charge

i) Pump working hours per day
- Average working hours per day
  Nong Khon Kaen 74 cu.m/15 cu.m/hr = 5.0 hr
  Thung Sai Yart(1) 129 cu.m/15 cu.m/hr = 8.6 hr
  Thung Sai Yart(2) 113 cu.m/15 cu.m/hr = 7.6 hr

- Working hours per day
  Nong Khon Kaen 5.0 hr x 365 days = 1,825 hr
  Thung Sai Yart(1) 8.6 hr x 365 days = 3,139 hr
  Thung Sai Yart(2) 7.6 hr x 365 days = 2,774 hr

ii) Electric consumption
- Nong Khon kaen
  Deep well pump 2.2 kw + High service pump 2.2 kw
  (2.2 kw + 2.2 kw) x 1,825 hr = 8,030 kwh
- Thung Sai Yart (1)
  Deep well pump 3.7 kw + High service pump 2.2 kw
  (3.7 kw + 2.2 kw) x 3,139 hr = 18,520 kwh
- Nong Khon kaen
  Deep well pump 3.7 kw + High service pump 2.2 kw
  (3.7 kw + 2.2 kw) x 2,774 hr = 16,367 kwh

iii) Electric charge per year
  Unit charge: 1.17 Baht/kwh
- Nong Khon Kaen: 8,030 kwh x 1.17 = 9,395 Bahts
- Thung Sai Yart (1): 18,520 kwh x 1.17 = 21,668 Bahts
- Thung Sai Yart (2): 16,367 kwh x 1.17 = 19,149 Bahts
  Total 50,212 Bahts

2. Maintenance Cost

20% of salaries and wages is appropriated for administration.

180 x 20%	=	36
Total of Domestic Water Supply		366

(2) Rural Infrastructure

O & M cost of rural electrification is not accounted because O & M shall be carried out by PEA.

(3) Meeting Facilities

1. Nong Khon Kaen

(a) Multi-purpose hall

i) Electric charge
① Annual electric use hours
  7 hr/day x 250 days = 1,750 hr

② Annual electric use amount
20 kw x 1,750 hr = 35,000kwh

③ Annual electric use charge
35,000kwh x 1.82 Baht/kwh = 64

ii) Domestic water charge
Annual charge 1,000 Baht x 12 months = 12

iii) Administration = 30

Total 106

2. Thung Sai Yart

(a) Multi-purpose hall

the same as Nong Khon Kaen 106

(b) Meeting hall

i) Electric charge
① Annual electric use hours
7 hr/day x 100 days = 700 hr

② Annual electric use amount
10 kw x 700 hr = 7,000 kwh

③ Annual electric use charge
7,000 kwh x 1.82 Baht/kwh x 4 house = 52

ii) Domestic water charge
Annual charge
500 Baht/month x 12 months x 4 house = 24

iii) Administration = 48

Sub-total 124

Total 230

Total of Meeting Facilities 336

Therefore, annual O & M cost of rural infrastructure is estimated as follows;

Grand Total 366 + 336 = 230

B-5-11 Annual O & M Cost of Post-harvest Facilities

(Unit: '000 Baht)

1. Operation Cost

(1) Salaries and wages

Description	No. of Personnel	Salary Per Annum	Amount
Secretary	1	36	36
Clerk	1	40	40
Accountant	1	50	50
Typist	1	50	50
Driver	1	40	40
Assistant	1	36	36
Total			252

(2) Equipments

a) Repair and maintenance

Description	Quantity	Unit Cost	Amount
Pick-up Truck 4 x 4	1	36	36
Motor-cycle 125 cc	1	1	1
Spare parts (10%)	LS	-	4
Tools	LS	-	4
Sub-total			45

b) Fuel and oil

Diesel oil = 6.4 Baht/lit

Working

Description	Consumption lit/day	Days	Unit	Amount
Pick-up Truck	15	150	1	15
Motor cycle	8	200	1	10
Sub-total				25
Total				70

(3) Electric and water charge

1) Electric charge per house

① Annual electric use hours
2 hr/day x 250 days = 500 hr

② Annual electric use amount
5 kw x 500 hr = 2,500kwh

③ Annual electric use charge
2,500 kwh x 1.17 Baht/kwh = 3

2) Domestic water charge per house

Annual charge
250 Baht/month x 12 months = 3

3) Administration	=	3
Sum per house		9
Sub-total by 14 houses		126

2. Maintenance Cost

20% of salaries and wages is appropriated for administration.

252 x 20%	=	50
Grand-total		498

B-5-12 Estimation of Number of Multi-purpose Storage

(1) Qualification

- The capacity of storage is 100 ton per house.
- The shipping is four times per month.

(2) Amount of crop products on the peak term

- Nong Khon Kaen

Rice	4,400 ton	from October to December

- Thung Sai Yart

Rice	10,000 ton	from October to December
Soybean	4,000 ton	from September to next March

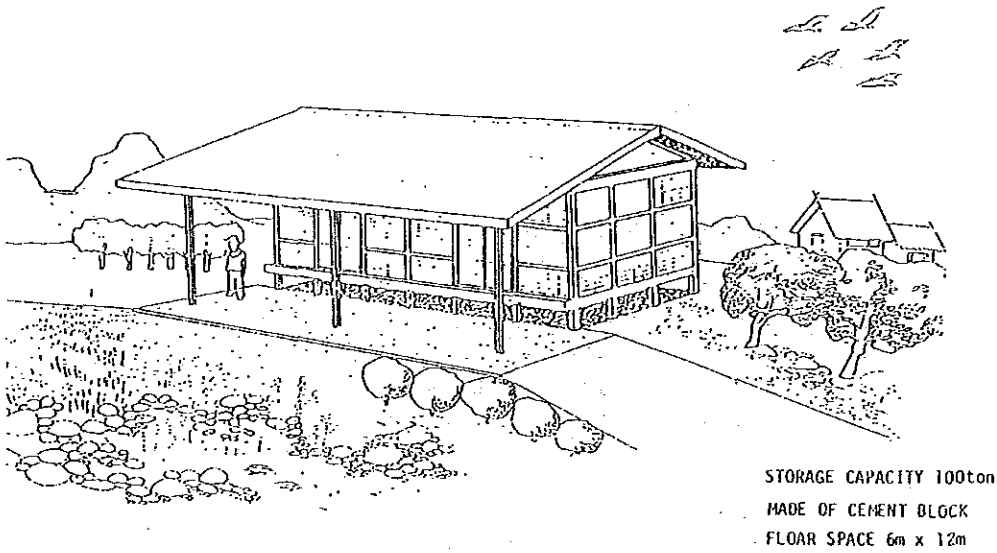
(3) Proposed number of house

- Nong Khon Kaen

4,400 ton/3 months/4 times/100 ton = 3.7 → 4 house

- Thung Sai Yart

10,000 ton/3 months/4 times/100 ton
+ 4,000 ton/7 months/4 times/100 ton = 9.8 → 10 house



STORAGE CAPACITY 100ton
MADE OF CEMENT BLOCK
FLOAR SPACE 6m x 12m

B-5-13 Supply of Construction Materials and Equipment

1) There are several borrow-pit of sand and laterite and quarry around project area, and the amount of production of them is considered enough for the project construction.

2) It is available to use the excavated soils in the project area for embankment material of road and dike construction.

3) As for concrete product, there is a batching plant in Sukhothai, and the amount of production of about 35 m^3/hr is enough for the project.
There are two big concrete product factories in Sukhothai, which are producing RC pipe, brick, electric pole and pile, complying with the Thai industry standard.

4) Steel bar and gate product are available in Sukhothai. However, in case that many quantitiy of products are needed, they shall be procured in Bangkok.

5) As for the supply of labours for construction, it is easily to obtain them in the dry season nearby the study areas.

6) As for the construction equipments, there are several companies which have many kind and number of them around Sukhothai and Phitsanulok.

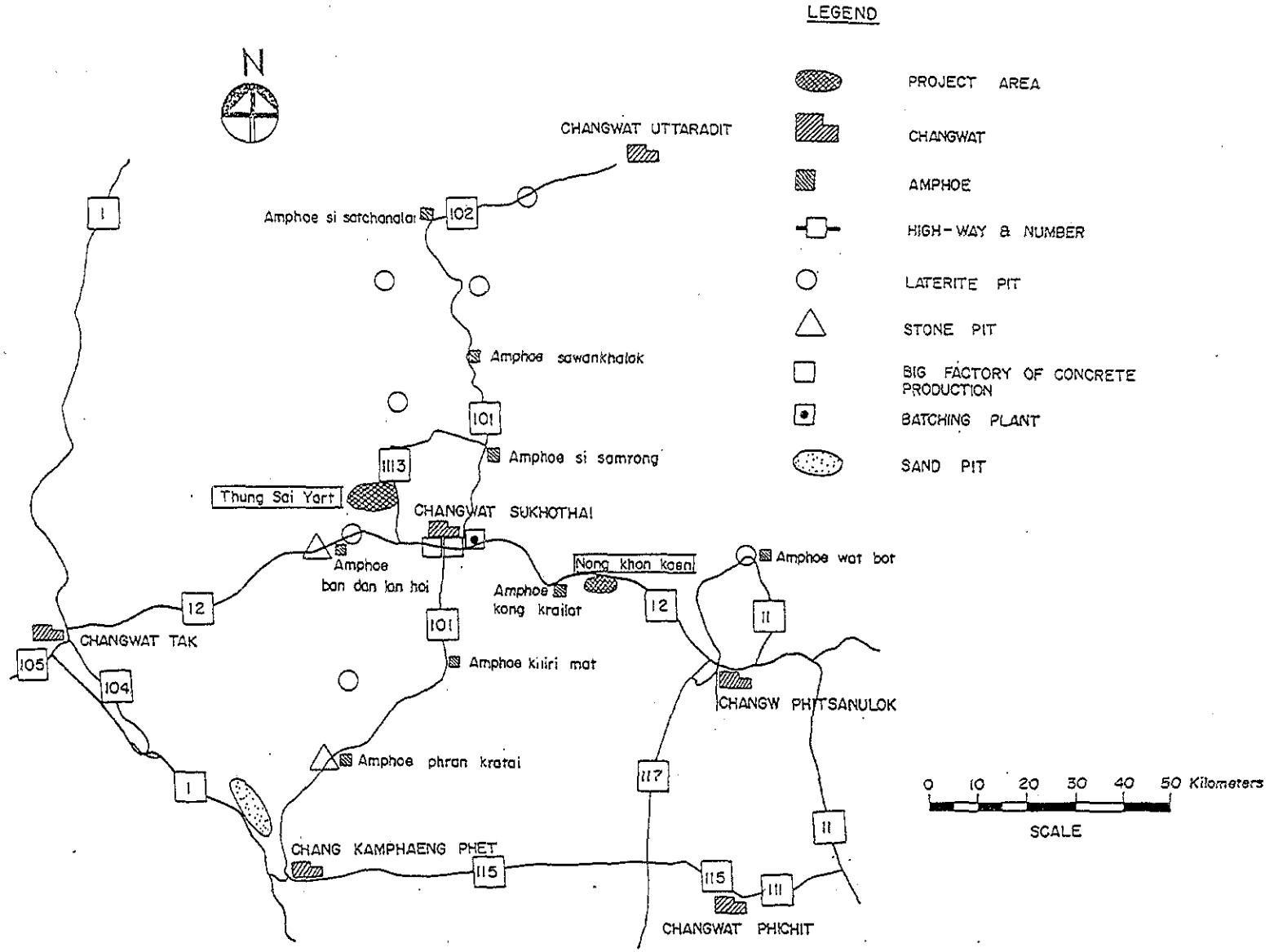


Figure B-5-6 LOCATION MAP OF CONSTRUCTION MATERIALS

Appendix C Agro-Socio-Economic Aspect

Appendix C-1 SOIL AND LAND USE

C-1-1 Typical Profile of Soil Series

Horizon	Depth (cm)	Description
Chiang Rai Series (Cr)		
Ap	0-10	Light brownish gray (10RY6/2) dry, grayish brown (10YR5/2) moist, silt loam with common fine distinct dark brown (7.5YR4/4) mottlings along root channels; weak fine to medium crump structure, and fine subangular blocky; hard, briable, slightly plastic; common fine vesicular and interstitial pores; many fine roots; strongly acid (pH 5.5); abrupt and smooth boundary.
A2g	0-19	Gray (10YR6/1) dry, bray (10YR5/1) moist, clay loam with many fine distinct strong brown (7.5YR 5/6) mottlings; weak to moderate fine subangular blocky and medium crumb structure; very hard, firm, sticky, slightly plastic; few fine interstitial and common fine tubular pores; few fine roots; medium acid (pH 6.0); clear and smooth boundary.
B21tg	19-42	Grayish brown (10YR5/2) dry, light gray (10YR7/ 1) moist, clay loam with common fine distict strong brown (7.5YR5/8), and many fine prominent red (2.5YR4/8) mottlings; moderate coarse and medium subangular blocky; very hard, firm, sticky and plastic; broken moderately thick clay coating on ped faces and along pores; few fine tubular pores, common fine interstitial pores; very few fine roots; very strongly acid (pH 5.0) clear and smooth boundary.
B22tg	42-60	Gray to light brownish gray (10YR6/1-6/2) clay with many medium prominent red (10R4/8) mottling; strong coarse and medium subangular and angular blocky; very hard, very firm, sticky and plastic; continuous thick clay coating on ped faces; few fine tubular and common fine interstitial pores; few small Mn nodules; very few very fine roots; very strongly acid (pH 5.0); clear and wavy boundary.
B23tg	68-100	Light gray to ligh brownish gra (10YR7/2-6/2); clay with medium prominent red (10R4/8), and few fine distinct strong brown (7.5YR5/8) mottlings; strong medium and coarse angular blocky; very firm, sticky, plastic; continuous thick clay on ped faces; few fine interstitial pores; very few small hard rounded Mn-nodules; strong acid (pH 5.5).
Nakhon Pathom Series (Np)		
A1	0-6/8	Brown (10YR5/3); silty loam; slightly sticky; slightly plastic; weak coarse subangular; common fine roots; common medium tubular and vesicular pores; abrupt, wavy boundary; pH 5.5.
B21t	6/8-15/17	Pale brown (10YR6/3); silty loam; many medium and coarse dark brown (7.5YR4/4) mottles; sticky and plastic; strong fine subangular blocky; thin broken clay coating on ped faces and pores; many medium interstitial common fine and medium vesicular pores; few fine roots; clear wavy boundary; pH 5.5.

Horizon	Depth (cm)	Description
B22t	15/17-33	Dark yellowish brown (10YR4/4); silty clay loam; few fine strong brown (7.5YR5/8) mottles; moderate medium subangular blocky; sticky and plastic, very hard; thin continuous clay coatings on ped faces and in pores; common medium and fine interstitial and tubular pores; grandual, smooth boundary; pH 6.5.
B23t	33-44	Yellowish brown (10YR5/4); silty clay; common fine reddish yellow (7.5YR5/8) mottles; sticky and plastic, very hard; thin continuous clay coating on ped faces and in pores; common medium tubular and many medium vesicular pores; pH 7.

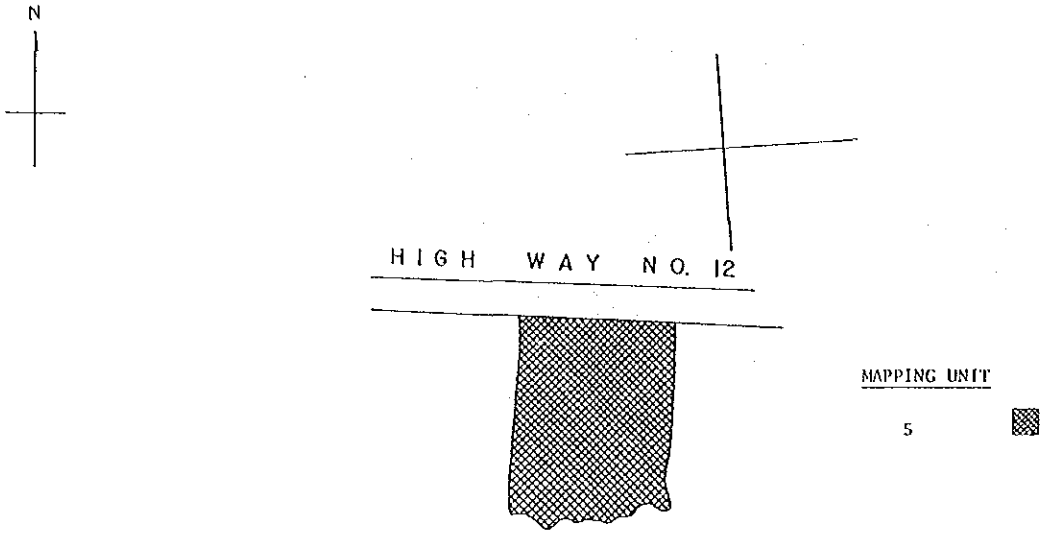
Kamphaeng Saen Series (Ks)

Ap	0-12	Brown (7.5YR4/4); silt loam moderate fine to medium subangular blocky structure; slightly sticky, slightly plastic, slightly hard when dry, firm when moist; common fine and medium roots; diffuse smooth boundary; neutral pH 7.
B21t	12-36	Brown (7.5YR4/4); silty clay loam; moderate fine to medium subangular blocky structure, slightly sticky, slightly plastic, firm when moist, slightly hard when dry, thin patchy clay coatings on ped faces and in pores; few very fine roots; diffuse, smooth boundary; neutral pH 7.
B22t	36-78	Brown (7.5YR4/4); silty clay loam to silty clay; weak fine to medium subangular blocky structure; sticky and plastic; firm when moist; slightly hard when dry; patchy thin clay coating on ped faces and in pores; very few very fine roots; diffuse, smooth boundary; moderately alkaline pH 8.
C	78-120	Brown (7.5YR4/4); silty clay; few fine faint strong brown (7.5YR5/8) mottles; weak fine to medium subangular blocky structure; sticky and plastic when wet, hard when dry; patchy thin clay coating on ped faces and in pores; moderately alkaline pH 8.

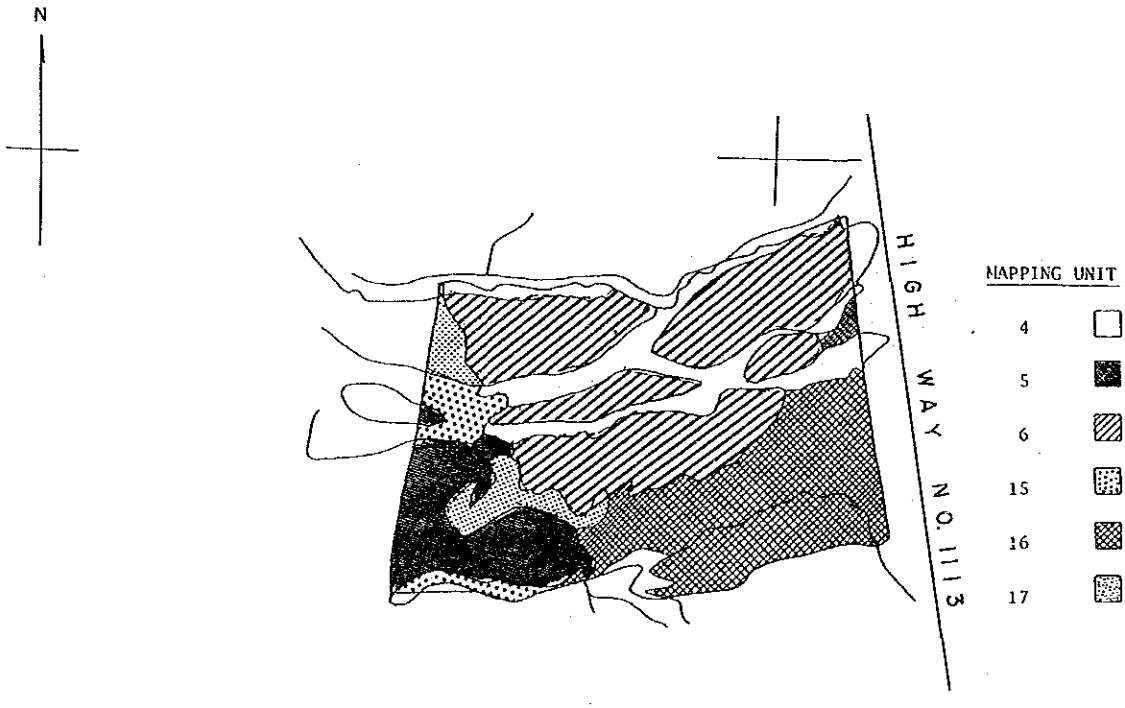
Saraburi Series (Sb)

Apg	0-13	Gray (10YR5/1) dry, dark gray (10YR4/1) moist clay loam to clay; common fine distinct strong brown (7.5YR5/6) mottlings along root channels; weak fine subangular blocky; extremely hard, very sticky, plastic; common fine vesicular pores; many roots; medium acid pH 6 abrupt and smooth boundary.
ABg	13-36	Dark gray (10YR4/1); clay with many fine faint dark brown (7.5YR4/4) mottlings; weak to moderate coarse and medium subangular and angular blocky; extremely hard, very firm; sticky, plastic; patchy thin cutans along pores; common fine interstitial and few fine tubular pores; common small slightly hard iron nodules; few very fine roots; slightly acid (pH 6.5); clear and smooth boundary.

Horizon	Depth (cm)	Description
B2tg	36-77	Gray (10YR5/1) clay with fine distinct yellowish brown (10YR5/4) and many medium faint dark brown (7.5YR4/4) mottlings; moderate coarse and medium subangular and angular blocky; very hard very firm, sticky, plastic; broken thin cutan on ped faces; few fine tubular and interstitial pores; very few very fine roots; slightly acid (pH 6.5); gradual and wavy boundary.
B3t	77-105	Dark grayish brown (2.5Y4/2) clay with many medium distinct light olive brown (2.5Y5/6) and few fine distinct yellowish brown (10YR5/4) mottlings; moderate coarse and medium subangular blocky; very firm, sticky and plastic; broken thin cutan on ped faces and patchy thin cutan in pores; few fine tubular and interstitial pores; very few small hard rounded ironstone; very fine roots; neutral (pH 7).



Mapping unit of land suitability classified by Land Development Department under Nong Khon Kaen Study Area (Scale 1:100,000)



Mapping unit of land suitability classified by Land Development Department under Thung Sai Yart Study Area (Scale 1:100,000)

C-1-2 Detailed Explanation on Mapping Unit (DLD)

Mapping Unit No. 4

Soils in this group are deep soil and texture is silt loam. The drainage is good to somewhat good. The land is intermittently inundated for a short period during the rainy season. Fertility of the soils is medium. The land is quite level, however, with 0-1% slope and the altitude is less than 60 m. Since the land is usually saturated certain fruit trees suffer from such high water content of soil.

Mapping Unit No. 5

Soils are deep and usually fine texture. As a consequence, drainage is quite poor to poor and the land is usually flooded for 3-4 months during the rainy season. Soil fertility is medium. The land is flat having slope of 0-1% and is elevated at less than 60 m from mean sea level.

Mapping Unit No. 6

In this group, the soils are deep with fine soil texture. Soil drainage is poor and inundation occurs for 3-4 months during the rainy season. The soil fertility is low. The land is flat, 0-1% slope with the altitude of less than 60 m. The main constraint of this soil is due to its low soil fertility.

Mapping Unit No. 15

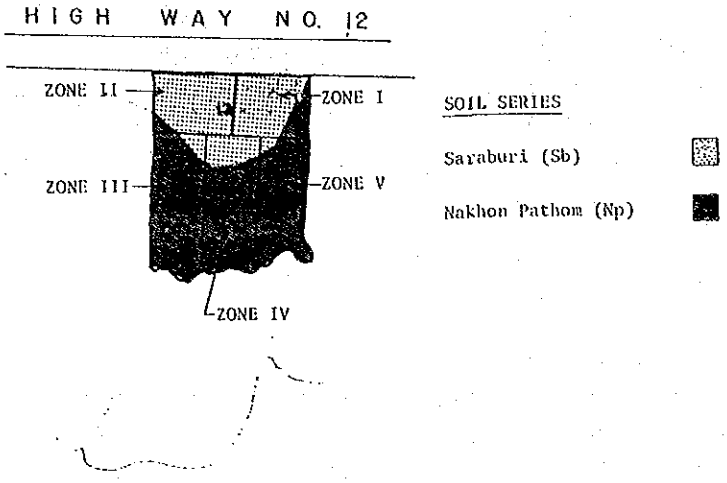
Soils in this group are deep soil and the texture is silt loam. Drainage of the soils is somewhat good with medium soil fertility. The land is quite level and the slope of the land is 0-1% and is elevated to 60-100 m.

Mapping Unit No. 16

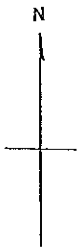
In this group, soils are deep and fine in texture. Consequently, the drainage is quite poor to poor and the land is inundated for 3-4 months during the rainy season. The soil fertility is medium. Land is flat with 0-1% slope and its altitude is 60-100 m.

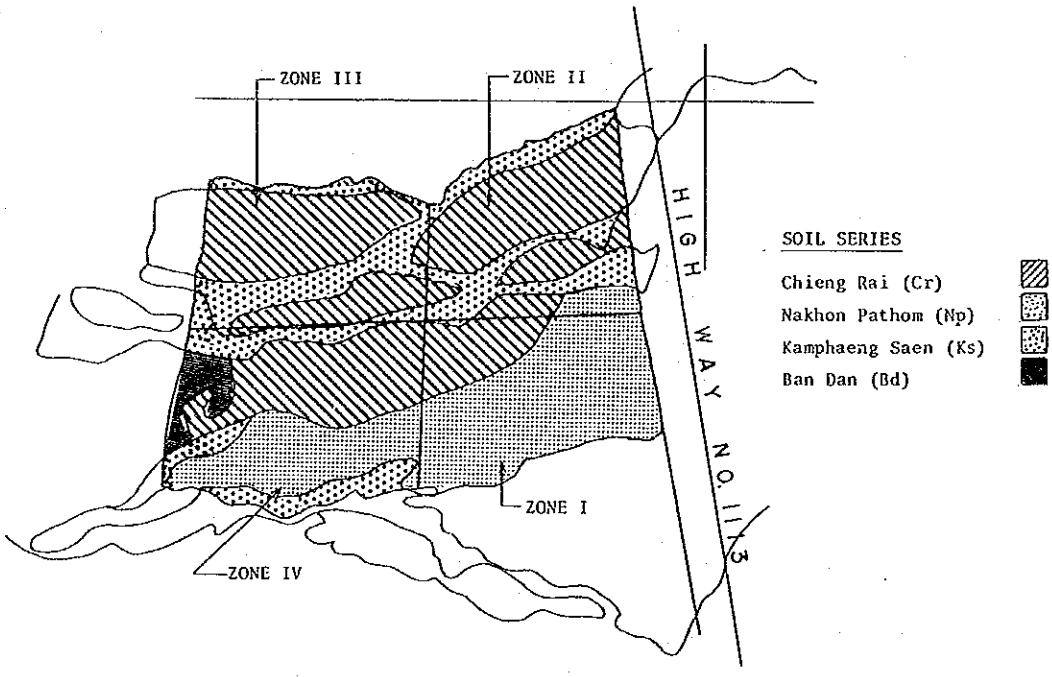
Mapping Unit No. 17

Soils are deep and the texture is fine. Drainage of soil is poor and land is usually flooded for 3-4 months during the rainy season. Fertility of soils is poor. Land is leveling with a slope of 0-1% and the altitude is about 60-100m. Limitation of the soils in this group is due to its poor fertility.



Major soil series and their distribution in Nong Khon Kaen
(Scale 1:100,000)





Major soil series and their distribution in Thung Sai Yart Study Area
(Scale 1:100,000)

C-1-3 Residual Soil Moisture

Determination of Soil Moisture Content : Irrigation Block in Thung Sai Yart

1. Materials and Methods

Soil moisture content, indicates the amount of moisture in soil, can be determined and expressed by several methods. For this study, it will be expressed as percentage of soil dry weight. Determinations of the soil moisture content, as percent of soil dry weight, are as follows :

1. put soil samples in moisture can and weight, the weight obtained is the weight of wet soil + tare.

2. dry the samples, in hot-air oven, at 100-110 C for 12-15 hours or until soil dry weight is constant. Before weighing soil samples, they should be put in the dessicator, let them cool down to constant temperature and, then, weight the samples, the weight obtained is the weight of dry soil + tare.

3. clean moisture can and weight (tare).

4. soil moisture content, % by weight (% Odw), can be calculated from

$$\% \text{ Odw} = \frac{\text{(weight of wet soil + tare)} - \text{(weight of dry soil + tare)}}{\text{(weight of dry soil + tare)} - \text{(tare)}} \times 100$$

$$= \frac{\text{weight of wet soil} - 1}{\text{weight of dry soil}} \times 100$$

For the irrigation block of Thung Sai Yart as indicated in Figure C-1-1, soil moisture content, after rice was harvested, was accomplished by sampling soil at 3depths; 30, 50 and 75 cm with covered normal root zone of annual crops. This was done on the 7th, 14th, 21st and 28th December, 1989. However, soil moisture content did not indicate the amount of moisture that could be used by crops. In order to knowing the amount of moisture available to crops, both the amount of moisture at field

capacity (FC) and permanent wilting point (PWP) must be determined.

Moisture at FC is the maximum amount of moisture that can be retained by a soil. It indicates the upper limit of available moisture-content range of a soil. Moisture at FC is estimated as amount of water retained by a soil after that soil is applied with a suction of 1/3 atmosphere. Estimation of moisture at FC of a soil is done by air drying the soil sample and sieving through sieve of 2 mm pore size. Then the soil is saturated with water and applied with 1/3 atmosphere suction. After no water drips of the soil, moisture content at this condition is said to be equivalent to moisture at FC of the soil.

The permanent wilting point indicates the amount of moisture at which growing plant permanently wilts. Even if the ambient atmosphere is saturated with water vapor (100% Relative Humidity) for 15 hours, the plant cannot recover from wilting. The PWP is the lower limit of available moisture-content range. The PWP is estimated by the same procedure as the moisture at FC but the suction of 15 atmosphere is applied to soil.

After the FC and PWP are estimated, the available moisture content (AMCO) of a soil at any moment can be determined. The AMCO is the difference between moisture content (MC) at any moment and the PWP.

$$AMCO = MC - PWP$$

As soil moisture content increases and reaches the FC, the soil is reached a stage where AMCO is maximum. Moisture content exceeds FC, which is called superfluous moisture, is unavailable to crops. The difference between the FC and PWP of a soil is the available moisture capacity (AMCA) of that soil which indicates the maximum amount of moisture that can be held by that soil.

$$AMCA = FC - PWP$$

2. Results and Discussions

The results showed that fine-texture soil holds more water than coarse-texture soil. However, it does not tell anything about AMCA. Table C-1-1 indicated that the AMCA of all soil samples were in the range of 6.392 to 14.391 % by weight. These AMCA's are retained in pores of

0.2-10 u in size. Soils having greater amount of these pore size can retain greater amount of AMCA. Coarse-texture soil contains pore size greater than 10 u, thus, water loss is great and retain less amount of water than fine-texture soil which possesses greater amount of pore size smaller than 0.2 u. Nevertheless, water retained in pore size smaller than 0.2 u is not available to plant as it is retained by energy greater than the ability of plant to absorb it.

Table C-1-2 and Figure C-1-2 illustrated that MC and AMCO's of soil samples, at 30 cm deep, taken at the first week were greater than those soil samples taken at the later weeks. Reduction of MC and AMCO during the 4-week period was apparent. Especially, the last sampling date (December 28) where MC's were more or less close to the PWP values. That is the AMCO of soil is close to zero, for example, block TSYE-2 which the MC was lower than the PWP. For this block, after rice harvesting, there was neither rainfall nor irrigation. Thus, evaporation was greater than water replenishment. For block TSYM-1, the AMCO was originally low and changes in AMCO with time was quite small. This was because rice, in this block, was harvested and the block was left idle for a long time. Changes of AMCO at50 and 75 cm deep were small except for block TSYW-3, at 50 cm deep, of the last sampling date, where AMCO reduction was great.

3. Conclusion

Soils which had greater MC's, at any point in time, than another soils might have lesser AMCO's as the AMCO was depended upon the amount of pores with 0.2-10u in size. Given the MC and AMCO during the period of interest, one can predict that, after rice is harvested, how long the crop of concern would have sufficient amount of water for crop growth. From this test, it revealed that during the month of December, soils contained adequate amount of moisture for crop. Water shortage would result if soils are not irrigated. Generally, the AMCO at any time should not be lesser than 50% of the AMCA. Wherever AMCO is about 50% AMCA, the soil should be irrigated until the FC is reached. If AMCO is greater than 100% AMCA, drainage is needed.

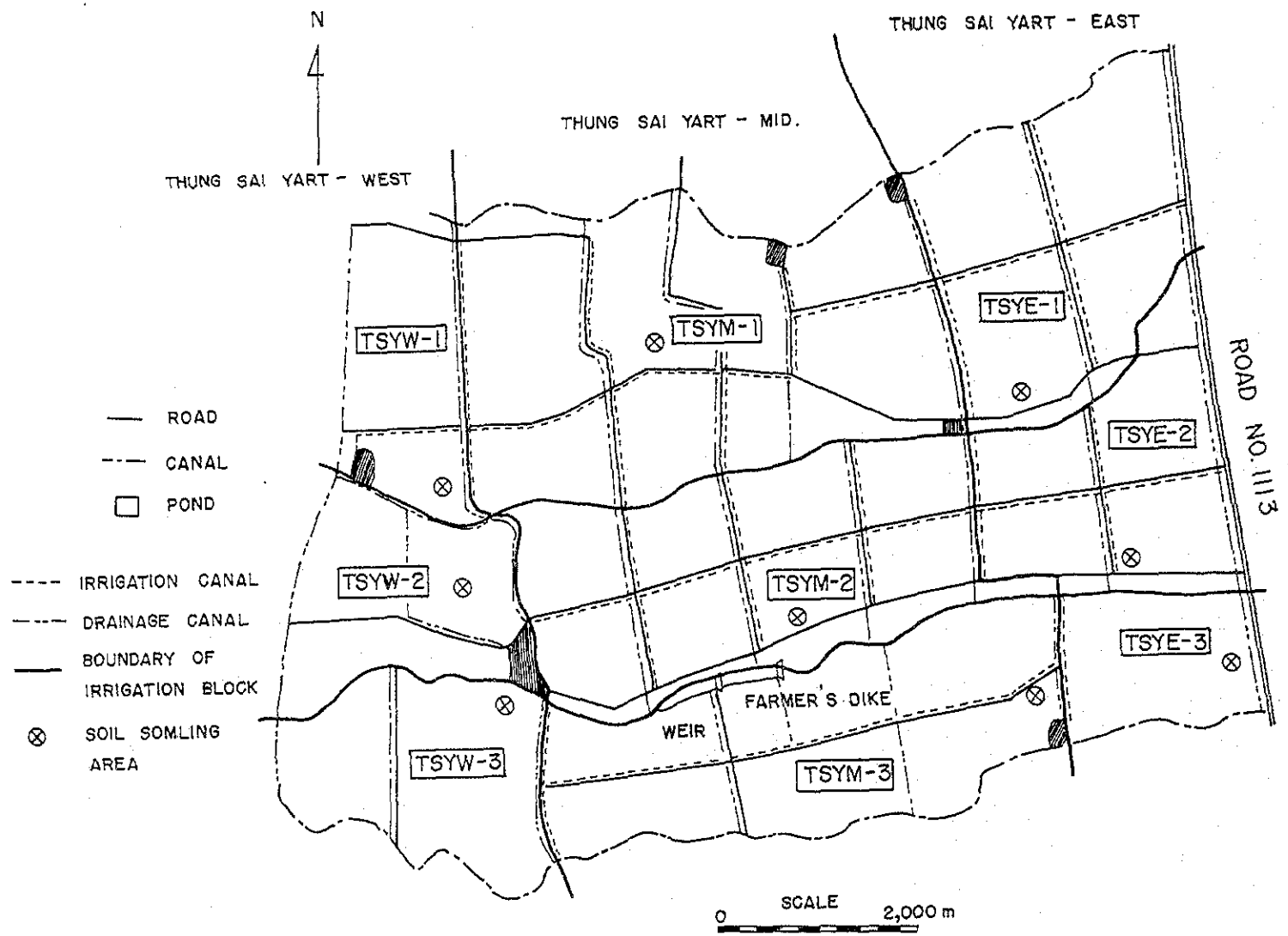


Figure C-1-1 IRRIGATION BLOCK IN THUNG SAI YART

Table C-1-1 Field capacity, permanent wilting point and available moistu capacity (% by weight) of soils, in Thung Sai Yart ALRP, at different depths.

Block No.	Depth (cm)	FC	PWP	AMCA
TSYE-1	30	28.431	17.891	10.540
	50	28.957	17.181	11.776
	75	29.660	17.241	12.419
TSYE-2	30	17.780	9.161	8.619
	50	17.976	8.396	9.580
	75	28.938	14.547	14.391
TSYE-3	30	33.083	20.023	13.060
	50	33.996	20.714	13.282
	75	33.601	19.943	13.658
TSYM-1	30	27.736	14.872	12.864
	50	27.138	15.848	11.290
	75	26.993	15.304	11.689
TSYM-2	30	22.960	14.118	8.842
	50	31.719	18.121	13.598
	75	35.157	21.682	13.475
TSYM-3	30	31.121	18.669	12.452
	50	33.099	20.646	12.453
	75	33.697	20.365	13.332
TSYW-1	30	20.021	12.780	7.241
	50	24.964	16.433	8.531
	75	37.728	24.975	12.753
TSYW-2	30	16.354	7.163	9.191
	50	20.357	11.861	8.496
	75	13.756	7.364	6.392
TSYW-3	30	32.801	22.650	10.151
	50	36.643	23.204	13.439
	75	30.417	18.643	11.774

Note : FC : Field Capacity
PWP : Permanent Wilting Point
AMCA : Available Moisture Capacity

Table C-1-2 Moisture content and available moisture content (% by weight) of soils, in Thung Sai Yart ALRP

Block No.	Depth (cm)	7 Dec.		14 Dec.		21 Dec.		28 Dec.	
		MC	AMCO	MC	AMCO	MC	AMCO	MC	AMCO
TSYE-1	30	21.102	3.211	20.418	2.527	19.809	1.918	19.622	1.731
	50	18.471	1.290	18.350	1.169	18.365	1.184	18.224	1.043
	75	20.887	3.646	20.891	3.650	20.729	3.488	19.399	2.158
TSYE-2	30	10.776	1.615	10.467	1.306	10.260	1.099	8.640	-0.521
	50	13.606	5.210	13.463	5.067	13.394	4.998	11.918	3.522
	75	19.288	4.741	19.403	4.856	19.332	4.785	19.371	4.824
TSYE-3	30	25.776	5.753	23.951	3.928	23.079	3.056	22.249	2.226
	50	24.886	4.152	24.303	3.589	24.258	3.544	24.025	3.311
	75	24.645	4.702	24.588	4.645	24.624	4.681	24.466	4.523
TSYM-1	30	15.859	0.987	15.562	0.690	15.406	0.534	15.384	0.512
	50	17.437	1.589	17.058	1.210	17.389	1.541	16.936	1.088
	75	19.043	3.739	18.740	3.436	18.738	3.434	17.860	2.556
TSYM-2	30	19.868	5.750	19.641	5.523	18.005	3.887	16.033	1.915
	50	23.637	5.516	23.688	5.567	23.351	5.230	22.611	4.490
	75	26.996	5.314	26.865	5.183	27.039	5.357	27.043	5.361
TSYM-3	30	20.768	2.099	20.261	1.592	20.088	1.419	19.030	0.361
	50	24.534	3.888	24.352	3.706	24.117	3.471	21.924	1.278
	75	21.927	1.562	21.875	1.510	21.737	1.372	21.586	1.221
TSYW-1	30	17.141	4.361	14.554	1.774	14.465	1.685	12.921	0.141
	50	15.531	-0.902	10.277	-6.156	10.004	-6.429	10.270	-6.163
	75	28.669	3.694	28.172	3.197	28.102	3.127	27.858	2.883
TSYW-2	30	14.790	7.627	13.223	6.060	13.146	5.983	12.339	5.176
	50	14.681	2.820	14.393	2.532	14.362	2.501	14.246	2.385
	75	8.908	1.544	8.872	1.508	8.895	1.531	8.916	1.522
TSYW-3	30	29.183	6.533	28.847	6.197	28.560	5.910	24.135	1.485
	50	32.166	8.962	31.957	8.753	31.831	8.627	27.952	4.748
	75	28.732	10.086	28.627	9.984	28.718	10.075	28.144	9.501

Note : Dec. : December
MC : Moisture Content
AMCO : Available Moisture Content

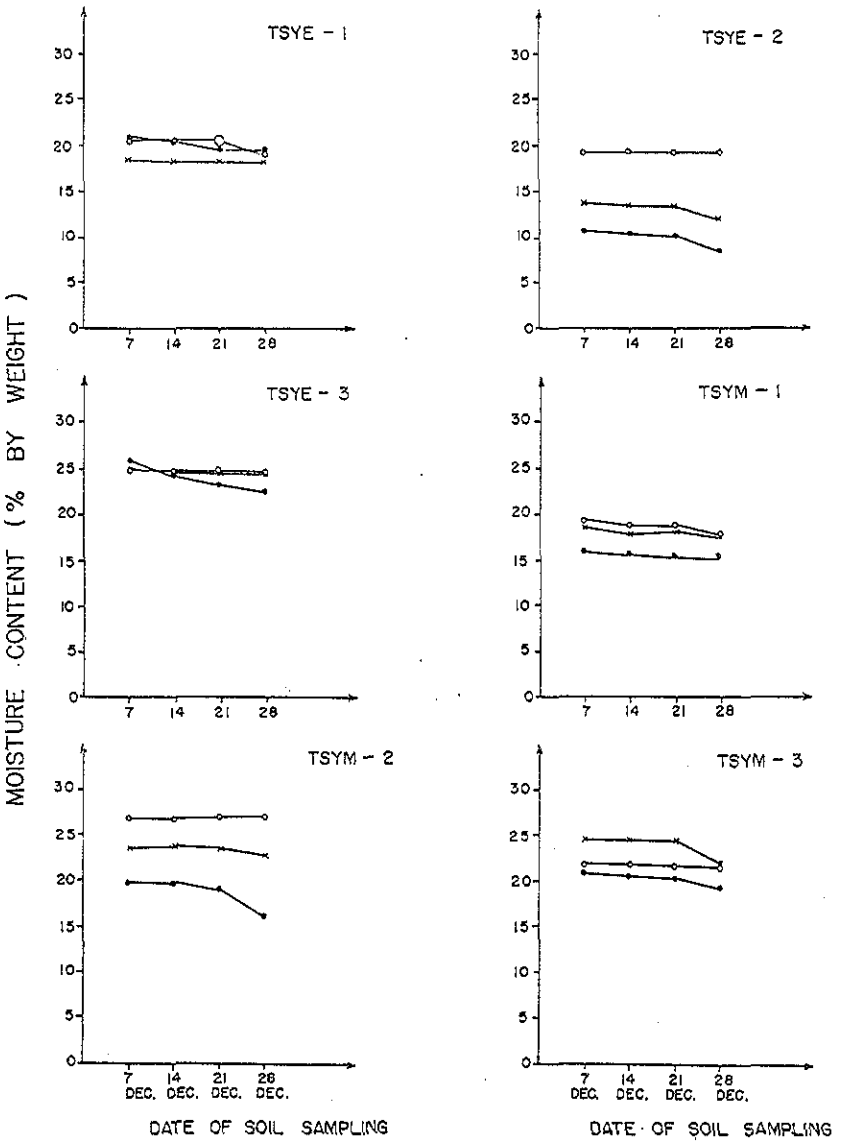
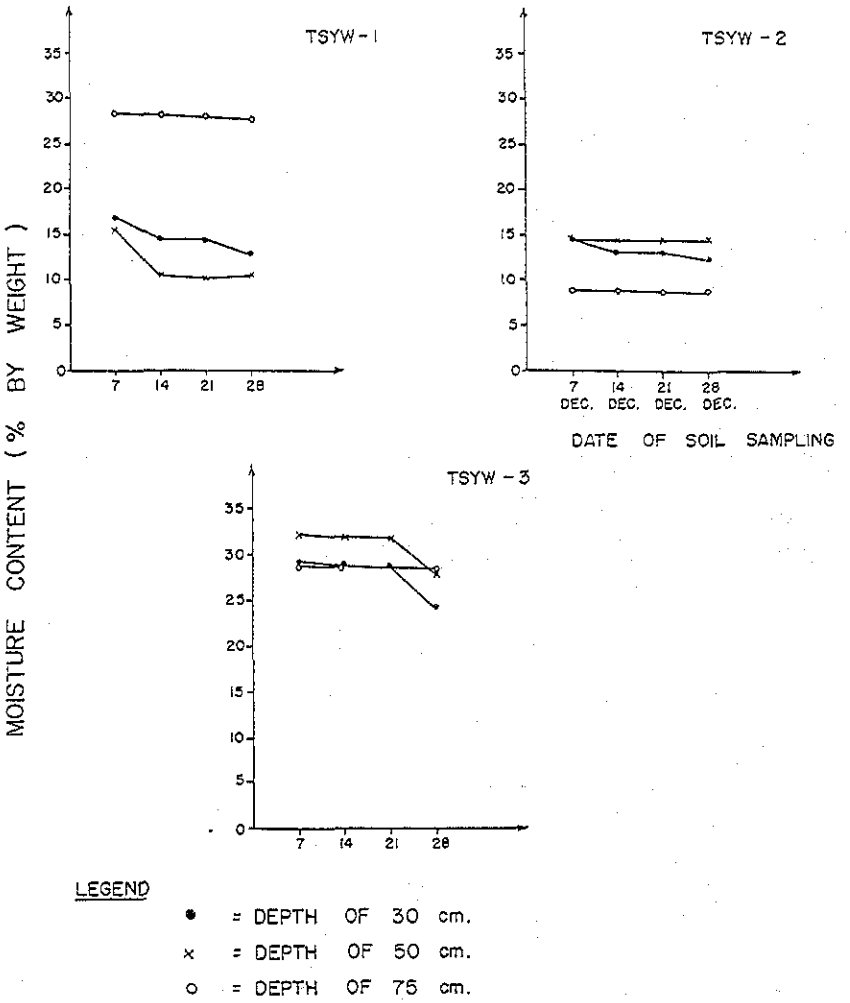


Figure C-1-2 RELATIONSHIPS BETWEEN SOIL MOISTURE CONTENT AND DATE OF SOIL SAMPLING



RELATIONSHIPS BETWEEN SOIL MOISTURE CONTENT AND DATE OF SOIL SAMPLING

Appendix C-2 AGRONOMY AND FARMING PLAN

C-2-1 Present Paddy Rice Cultivation Method

Item \ Cropping	Wet Season			Dry Season
	Transplanting	Dry Broadcasting	Wet Broadcasting	Wet Broadcasting
1 Varieties	(Local Implement varieties) (Nong Khon Kean Area) Leuang Pathew Leuang On Maepad	(Thung Sai Yart Area) Khao Dauk Mali 105 Khao Tah Haeng 17 Maepad Leuang Pathew	(High Yield Varieties) RD 7 RD 23 RD 25	
2 Nursery bed and Transplanting or Broadcasting	Seed bed area 500m² per hectare (Seeds 40 kg) Sowing in mid of May to end of July Transplanting at ran dam, 3~4 plants/hill	Cleaning / Bund Mending Plowing Breaking Sowing 75 kg per hectare Sowing in last of May through last of July	- do - Breaking after Harrowing Final Harrowing / Leveling Sowing - do -	
3 Basal application and Top dressing	Non fertilizer or few application Non Top dressing or few with Urea		Nitrogenphosphate Compound fertilizers 16-20-0 or 16-16-8 put on 200 kg per-hectare Top dressing with Urea 50 kg per-hectare at at 2 time	- do - put on 250 kg per hectare - do - with Area 75 kg per hectare at 2 time
4 Weed Control	Start of weeding by handing or 24~D at 25 day after transplanting		Herbicide application (Land up) before plowing -do- at 45 day after sowing	
5 Pest Control	Insecticides Furadan (2F) 0.5l			
6 Drainage	Cutting low and high plants hill - Drying in -Paddy fild threshing Machinery		at 20 day before harvesting	
7 Harvesting	Cutting high plants hill-Drying in paddy field - threshing Machinery		Cutting low and high plants hill - Drying in Paddy fild - threshing Machinery	

C-2-2 Present Agricultural Mechanization

Study Area / Village \ Number of Machinery		Small farm Tractor		Farm Tractor	Pump
		5-15 PH	16-25 PH	60-85 PH	
Nong Khon Kaen	Bung Krob (40)	28	-	-	28
	Mai Suk Kasem 1 (65)	30	-	2	30
	Mai Suk Kasem 2 (110)	36	5	3	36
	Na Taew (72)	60	-	-	40
	Mae Pho Thong (27)	18	3	-	18
Subtotal	(314)	172	8	5	152
Thung Sai Yart	Wang Thong Daeng (116)	68	-	-	-
	Sai Yart (131)	77	-	-	-
	Roa Rang Ngam (94)	52	-	-	-
	Sam Nak (107)	56	-	-	-
	Lan Du (67)	46	-	-	-
	Klong Saket (38)	28	-	-	-
Subtotal	(553)	327	-	-	-

Note : ( ) are Household in a Village

C-2-3 Present number of livestock

Study Area / Village \ Livestock		Cow	Buffalo	Pig	Chicken	Duck
Nong Khon Kaen	Bung Krob (40)	15	2	12	150	25
	Mai Suk Kasem 1 (65)	82	-	112	250	50
	Mai Suk Kasem 2 (110)	100	-	50	350	250
	Na Taew (72)	10	7	40	150	50
	Mai Pho Thong (27)	10	-	-	120	-
Subtotal	(314)	217	9	214	1,020	375
Thung Sai Yart	Wang Thong Daeng (116)	143	35	77	2,331	123
	Sai Yart (131)	99	11	75	1,763	93
	Roa Rang Ngam (94)	66	-	65	1,033	54
	Sam Nak (107)	70	-	60	1,066	56
	Lan Du (67)	145	18	80	2,321	210
	Klong Saket (38)	56	38	34	72	321
Subtotal	(553)	579	102	391	8,586	857

Note : ( ) are Household in a Village

C-2-4 Paddy & Mungbean Habitual Cropping & Annual Human Labor Requirement

(Unit; Man-day/ha)

Operation	Crops: Paddy Trans-planting	Paddy Broad-casting	Mungbean	Paddy T.P (%)	Paddy B.C (%)	Mungbean (%)
1. Nussery	0.8	-	-	1	-	-
2. Land preparation	1.9	1.5	6.5	3	4	16
3. Sowing (Broadcasting)	-	1.2	4.0	-	3	10
4. Planting	24.0	-	-	42	-	-
5. Fertilizer dressing	0.5	3.0	-	1	7	-
6. Pest control	0.4	2.4	1.0	1	6	3
7. Weeding	2.0	1.9	4.0	3	5	10
8. Watering	5.6	7.6	-	10	18	-
9. Other care	0.2	0.1	2.0	0	0	5
10. Harvesting	20.1	21.3	19.3	35	52	48
11. Others	2.4	2.1	3.0	4	5	8
Total	57.9	41.1	39.8	100	100	100

C-2-5 Paddy Crop Damaged by Causes

(% of Crops Area)

Damage	Area: Thung Sai Yart Small Farms	Thung Sai Yart Large Farms	Nong Khon Kaen Small Farms	Nong Khon Kaen Large Farms
1. Diseases	70	56	0	0
2. Worms	0	6	0	0
3. Insects	8	0	0	19
4. Anzmal (Rats)	0	0	0	9
5. Weeds	0	0	0	0
6. Floods	2	20	0	13
7. Droughts	20	18	100	59
8. Burning	0	0	0	0
9. Others	0	0	0	0
Total	100	100	100	100

C-2-6 Paddy Rice Production and Sold Precedes

Rice Crop Disposition by Farm Averages

Area	Farms Size	Production Total (kg)	Consumer (%)	Seed (%)	For Sold (%)	Wage and Rent (%)
Thnng Sai Yart	Small Farms	3731.2	43.0	6.3	48.7	2.0
	Large Farms	5953.3	33.1	6.8	52.7	7.3
Nong Khon Kean	Small Farms	8363.1 (200.0)	8.9	5.5	85.7 (100)	0
	Large Farms	19382.0	1.6	4.6	93.8	0

Note: ( ) is a Sweet Corn

Rice Total Proceeds and Sold Proceeds

Area	Farms Size	Total Proceeds(Baht)	Consumer (Baht)	Seed (Baht)	For Sold (Baht)	Wage and Rent (Baht)
Thnng Sai Yart	Small Farms	13,805	5,936	870	6,723	277
	Large Farms	22,027	7,291	1,498	11,608	1608
Nong Khon Kean	Small Farms	30,943 (496)	2,754	1,702	26,518 (496)	0
	Large Farms	71,713	1,147	3,299	67,267	0

Note: Rice Price~3.7Baht/kg
( ) Maize Price ~2.48Baht/kg

C-2-7 Crop Selection

S	Crop	Growing period	Soil adapt-ability	Maintenance of soil	Farm labour	Market-ability
I	Soybean	1	1	1	1	1
	Mungbean	1	1	1	1	1
	Groundnut	2	2	1	1	1
II	Vegetables Leaf V.	2	2	2	2	2
	Fruit V.	2	2	2	3	1
	Fruit tree Pomelo		1		2	1
	Mango		1		2	1
III	Field corn	2	1	3		1
	Sesame	1	2	2		1
	Vegetables Root V.	2	2～3	2	2	2
	Fruit tree Jackfruit		1		1	1
	Sugarapple		1		2	1
	Lemon		1		3	1
	Tamarind		1		2	1

Note; S is stage of screening work,
I , II and III are initial, second and third stages of screening process.

Condition of selection is as follows.

Condition	1	2	3
Growing period	Less than 100 days	More than 130 days	—
Soil adaptability	Good condition in whole study area	Good condition in some part of Nong Khon Kaen and west of Thung Sai Yart	—
Maintenance of soil fertility	Good	Normal	Decline
Farm labour(ha)	0-60 man-days	60-150 man-days	150-200 man-days
Marketability	Profitable	Profitable depend on condition	—

Leaf V is cabbage, chinese cabbage, etc. Root V is radish, carot, onion.
Fruit V is water melon, cucumber tomato, chilly, green pea.

C-2-8 Characteristics of Paddy Rice Native Varieties (Cropping in Study Area)

Item	Grain	Type	Combination Designation	Height (cm.)	Maturity (day)	Dormancy (day)	Characteristics	
							Advantages	Disadvantages
Khas Dank a Mali 105	long gain	NG	NV	140	P.S.V. Nov. 20	56	- drought resistant - aromatic and good eating quality - good eating quality - tolerant to acid suffole soils - salt tolerant	- surceptible to brown spot and bacterial leaf light
Khas Tah Haeng 17	long gain	NG	NV	150	P.S.V. Nov. 20	35	- moderately resistant to gallmidge - good eating quality - high yield	- susceptible to rice blast, yellow orange leaf virus, and brown plant hopper
Leuang Pathew 123	long gain	NG	NV	150	P.S.V. Nov. 20	35	- moderately sensitive to brown spot - good eating quality	- susceptible to rice blast, yellow orange leaf virus, and brown plant hopper
Leuang on	long gain	NG	NV	150	P.S.V. Nov. 20	35	- good eating quality - moderately susceptible to bacterial leaf blight	- susceptible to brown plant hopper and blast
Maepad	long gain	NG	NV	150	Nov. 28	35	- good eating quality - drought tolerant	- susceptible to brown spot and bacterial leaf blight

Notes: NG - non glutinous varieties
NV - native varieties
P.S.V. - photo-sensitivity

C-2-9 Characteristics of RD Varieties

Name	Grain Type	Combination & Designation	Released Year	Height (cm.)	Maturity (day)	Dormancy (day)	Characteristics	
							Advantages	Disadvantages
RD 1	non-glutinous	LT/IR 8 (BKN 56-1-2)	1969	115	130	21	- good plant type, stiff straw, wide adaptability, high responsive to fertilizer - non-sensitive to photoperiod - high yield - moderately resistant to Brown Spot and Green Leaf Hopper - clear grain and good milling quality	- susceptible to Blast, Yellow Orange leaf Virus, Bacterial Blight, Ragged Stunt, Gall Midge and Brown Plant Hopper - not well grown in early vegetative stage - sensitive to Bacterial Blight at high nitrogen fertilizer level - rather poor eating quality
RD 2	glutinous	GP 15/T(N)1 (IR 253-4-1-2-1)	1969	115	130	28	- non-sensitive to photoperiod - short height, wide adaptability - high yield - resistant to Brown Spot; moderately resistant to Green Leaf Hopper	- susceptible to Blast, Ragged Stunt, Bacterial Blight, Brown Plant Hopper and Gall Midge - fair eating quality
RD 3	non-glutinous	LT/IR 8 (BKN 12-2-2)	1969	100	128	21	- non-sensitive to photoperiod - good plant type, short height, wide adaptability, high responsive to fertilizer - high yield - can be grown in poor soil fertility - covered panicle for preventing from bird damage - resistant to Green Leaf Hopper	- susceptible to Blast, Bacterial Blight, Brown Spot, Ragged Stunt and Gall Midge - rather poor eating quality
RD 4	glutinous	17-1(LT/IR 8) *W 1252// RD 2 * sister line of RD 1 (BKN 6805-22-13)	1973	107	127	28	- non-sensitive to photoperiod - stiff straw, its plant type is better than MN 62 M - high yield - resistant to Gall Midge and Brown Plant Hopper - its grain is longer than MN 62 M	- very poor eating quality - susceptible to Blast, Bacterial Blight and Ragged Stunt - 20% sterility - should not be grown if there is no outbreak of Gall Midge

Name	Grain Type	Combination & Designation	Released Year	Height (cm.)	Maturity (day)	Dormancy (day)	Characteristics	
							Advantages	Disadvantages
RD 5	non-glutinous	PN 16/Sigadis (BKN 6517-9-2-2)	1973	146	140	42	- taller than RD 1, can be grown in semi-deep water - longer growth duration than RD 1 - intermediate amylose content, very good eating quality and good milling quality - resistant to Blast and moerately resistant to Bacterial Blight	- weakly sensitive to photoperiod, hence, not suitable for Dry Season - at normal fertilizer level, may produce the same yield as RD 1, but at higher level may produce less
RD 6	glutinous	KDML 105'65-G_2U-68-254 (Mutant Rice Variety) KDML 105 irradiated in 1965 G_2=20 krad Gamma Ray U=Uranium 235	1977	154	21 Oct.	35	- same height as NSPT - wide adaptability - resistant to Brown Spot - clear aromatic grain - good eating quality	- susceptible to Bacterial Blight and Brown Plant Hopper - sensitive to photoperiod, can be grown only in Wet Season
RD 7	non-glutinous	C_4-63/GR 88// Sigadis (SPR 6726-134-2-26)	1975	108	120-130	7	- non-sensitive to photoperiod - good plant type, stiff straw, good exertion - high responsive to fertilizer - resistant to Blast and moderately resistant to Bacterial Blight - tolerant to acid sulfate soil - earlier than RD 1 for 7 days - better cooking and eating quality than RD 1	- susceptible to yellow Orange Leaf Leaf Virus, Ragged Stunt, Brown Plant Hopper and Gall Midge - should not be grown in semi-deep water
RD 8	glutinous	NSPT/IR 262 (KKN 6721-5-7-4)	1978	151	23 Oct.	21	- good plant type and tillering - a little bit shorter than NSPT - dark green leaves and erect flag leaf - more drought tolerance than NSPT - higher yield than NSPT especially in drought conditions - long slender grain, good cooking and eating quality - resistant to Brown Spot	- sensitive to photoperiod

Name	Grain Type	Combination & Designation	Released Year	Height (cm.)	Maturity (day)	Dormancy (day)	Characteristics	
							Advantages	Disadvantages
RD 9	non-glutinous	CNT 3176/w 1256// RD 2 (BKN 6809-74-40)	1975	120	115-125	35	- non-sensitive to photoperiod - good plant type, stiff straw - earlier than RD 1 - high responsive at low fertilizer level - resistant to Ragged Stunt in natural condition; moderately resistant to Brown Plant Hopper, Green Leaf hopper and Gall Midge	- susceptible to Bacterial Blight - rather poor eating quality
RD 10	glutinous	RD 1'69 NF_1U-G6-6 (Mutant Rice Variety) RD 1 irradiated in 1969 NF_1=1.5 Krad Fast Neutrons U=Uranium 235	1981	100-105	130	25	- non-sensitive to photoperiod - good plant type, short height - moderately resistant to Blast - long slender grain and good eating quality	- susceptible to Brown Spot and Ragged Stunt
RD 11	non-glutinous	IR 661/KDML 105 (WP 153)	1977	110	135	28	- non-sensitive to photoperiod - good plant type, stiff straw - high responsive to fertilizer - moderately resistant to Brown Spot	- susceptible to Bacterial Blight, Ragged Stunt and Brown Plant Hopper - rather poor eating quality
RD 13	non-glutinous	NPY 132/PS 39 (BKN 6402-352)	1978	160	26 Jan.	21	- very well exerted panicle - higher yield than NPY 132 - suitable for Nakhon Si Thammarat, Phattalung, Songkhla and Pattani in Wet Season - medium grain, good cooking and eating quality - resistant to Blast and Brown Spot	- sensitive to photoperiod
RD 15	non-glutinous	KDML 105'65 G_1U-45 (Mutant Rice Variety) KDM 105 irradiated in 1965 G_1=15 Krad Gamma Ray U=Uranium 235	1978	130	10 Oct.	42-49	- higher yield than KDML 105 - better drought resistant - resistant to Brown Spot - long clear grain and good eating quality like KDML 105	- sensitive to photoperiod

Name	Grain Type	Combination & Designation	Released Year	Height (cm.)	Maturity (day)	Dormancy (day)	Characteristics	
							Advantages	Disadvantages
RD 17	non-glutinous	IR 262/PG 56 (BKN 6986-66-2)	1979	130	140	35-42	- high yield - tolerant to deep water - withstand submergence for 7 days - moderately resistant to drought condition - moderately resistant to Bacterial Blight - good for nonirrigated area	- susceptible to Brown Plant Hopper - non-sensitive to photoperiod not recommended for Dry Season - fair cooking quality
RD 19	non-glutinous	IR 262/PG 56 (BKN 6986-147-2)	1979	130	15 Nov.	28-35	- tolerant to deep water - withstand submergence for 7 days - moderately resistant to Bacterial Blight and Brown Spot - should be grown in Wet Season in Central Region - good elongation ability by fertilizer application - good kneeing ability	- susceptible to Brown Plant Hopper - sensitive to photoperiod - slightly chalky grain, suitable for parboiled rice
RD 21	non-glutinous	KDML 105/NM 5-4// IR 26 (SPR 7419-86-2-5)	1981	100-125	120-130	28	- non-sensitive to photoperiod - resistant to Brown Plant Hopper; resistant to bacterial Blight and Ragged Stunt in natural condition - good grain and good eating quality	- susceptible to Yellow Orange Leaf Virus
RD 23	non-glutinous	RD 7/IR 32//RD 1 (SPRLR 76002-168 -1-1)	1981	115-120	120-130	35	- non-sensitive to photoperiod - moderately resistant to Brown Plant Hopper and Green Leaf Hopper; resistant to Bacterial Blight and Ragged Stunt in natural condition - good grain and good eating quality	- susceptible to Yellow Orange Leaf Virus

Name	Grain Type	Combination & Designation	Released Year	Height (cm.)	Maturity (day)	Dormancy (day)	Characteristics	
							Advantages	Disadvantages
RD 25	non-glutinous	KDML 105/IR 2061//1981 KDML 105/IR 26 (BKN 75091-CNT-B_3 -RST-40-2-2)		90-100	110-120	21	- non-sensitive to photoperiod - short height - very resistant to Ragged Stunt and Brown Plant Hopper, moderately resistant to Stem Borer	- susceptible to Yellow Orange Leaf Virus - very slightly chalky grain
RD 27	non-glutinous	KTO/KTH 17 (BKN 6113-79)	1981	160-170	early Nov.		- moderately resistant to Sheath Rot and Sheath Blight; resistant to Ragged Stunt in natural condition - good eating quality	- sensitive to photoperiod - susceptible to yellow Orange Leaf Virus and Brown Plant Hopper

Note:
RD - Rice Department
LT - Leuang Tawng (Dry Season)
GP 15 - Gam Pai 15
MN 62 M - Moey Nawng 62 M
PN 16 - Puang nahk 16
GR 88 - Gow Ruang 88
KDML 105 - Khao Dawk Mali 105
NSPT - Niaw San Pah Tawng
PG 56 - Pin Gaew 56
NPY 132 - Nahng Prayah 132
PS 39 - Pak Sian 39
NM S-4 - Nahng Mon S-4
KTD - Khao Tah Oo
KTH 17 - Khao Tah Haeng 17
IR - rice variety from IRRI
T(N)1 - Taichung Native 1, rice variety from Taiwan
W - rice variety from India
Sigadis - rice variety from Indonesia
C_4-63 - rice variety from the Philippines
BKN - Bangkhen Rice Experiment Station
SPR - Suphanburi Rice Experiment Station
KKN - Khon Kaen Rice Experiment Station
CNT - Chainat Rice Experiment Station
LR - Lowland Rice

C-2-10 Labour Requirement

(1) Paddy

Operation	Transplanting		Wet Broadcasting	
	Man-day	Small Tractor (10PS) (hr)	Man-day	Small Tractor (10PS) (hr)
1. Nursery-bedding (Sub-total)	1.7	4		
• Land Preparation Sowing	0.7	4	-	-
• Care of Seedings	1.0	-	-	-
2. Land Preparation (Sub-total)	6.1	41	6.1	41
• Cleaning/Bund Mending	2.0	-	2.0	-
• Plowing (1 Time)	1.9	15	1.9	15
• Breaking/Harrowing(2 Time)	1.4	14	1.4	14
• Final Harrowing/Leveling	0.8	12	0.8	12
3. Planting (Sub-total)	25.0		1.0*	
• Pulling/Deliver Seedling	5.0	-	1.0*	-
• Furrowing/Planting/Thinning	20.0	-		-
4. Fertilizing (Sub-total)	2.0		2.0	
• Basal Fertilizers	1.0	-	1.0	-
• Top-dressing	1.0	-	1.0	-
5. Pest Control	1.0		1.0	
6. Weed Control	2.4		2.4	
7. Irrigation/Drainage	5.0		6.0	
8. Harvesting (Sub-total)	20.5	8	20.5	12.0
• Reaping/Plucking/Bunding	16.0		16.0	
• Hanting/Piling	2.5	4	2.5	8
• Drying	-	-	-	-
• Threshing Winnowing	2.0	4	2.0	4
9. Sacking/Piling/Delivery	2.7	4	2.7	4
10. Total	66.4	57	41.7	57

Note: * broadcasting by hand

(2) Soybean

Operation	Man-day	Small Tractor (10PS) (hr)
1. Land Preparation (Sub-total)	6.1	23.8
• Cleaning/Bund Mending	2.0	
• Plowing	1.9	11.4
• Breaking/Harrowing	1.4	8.4
• Final Harrowing/Leveling	0.8	4.0
2. Planting (Sub-total)	4.5	10.5
• Pulling/Deliver Seedling	3.0	10.5
• Furrowing/Ridge	1.5	-
3. Fertilizing (Sub-total)	1.0	
• Basal Fertilizers	1.0	-
• Top-dressing		-
4. Pest Control	1.0	
5. Cultivation/Weeding	1.0	
6. Irrigation/Drainage	2.0	
7. Harvesting (Sub-total)	19.3	
• Reaping/Plucking/Bunding	11.5	-
• Hanting/Piling	1.5	-
• Threshing Winnowing	6.3	-
8. Sacking/Piling/Delivery	2.7	1.0
9. Total	37.6	35.3

C-2-11 Proposed Labour Requirement

(1) Nong Khon Kaen Area

(Unit: Man-day/ha)

Block	Crop	Area (ha)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
North Area	Paddy(HYV)	1	-	-	-	-	3.8	7.5	2.0	4.8	7.3	15.7	0.6		41.7
	Soybean	1	4.0	14.5	3.0	-	-	-	-	-	-	8.5	6.1	1.5	37.6
	Vegetables(a)	1x2	6.4	41.3	46.0	67.5	50.0	18.8	6.4	41.3	46.0	67.5	50.0	18.8	460.0
	Vegetables(b)	1	18.8	10.0	41.0	41.2	-	-	-	-	-	-	-	31.3	142.1
South Area	Paddy(HYV)	1	-	-	-	-	-	-	7.2	4.3	1.1	3.7	12.7	12.7	41.7
	Soybean	1	2.1	4.9	7.9	14.2	-	-	-	-	-	-	-	8.5	37.6
	Tree Crops(young tree)	1	2.4	5.6	6.0	6.3	2.9	3.7	7.2	4.3	2.9	3.6	4.2	2.9	52.0
	Tree Crops (bearing tree)	1	6.0	14.0	15.0	30.0	12.0	15.0	12.0	18.0	12.0	15.0	18.0	12.0	185.0
North Area	Paddy	420	-	-	-	-	1,600	3,150	840	2,020	3,070	6,600	260	-	17,540
	Soybean	240	960	9,920	720	-	-	-	-	-	-	2,040	1,470	360	15,470
	Vegetables(a)	30x2	200	1,240	1,380	2,030	1,500	570	200	1,240	1,380	2,030	1,500	570	13,840
	Vegetables(b)	30	570	300	1,230	1,240	-	-	-	-	-	-	-	940	4,280
	Sub-total	750	1,730	11,460	3,330	3,270	3,100	3,720	1,040	3,260	4,450	10,670	3,230	1,870	51,130
South Area	Paddy	480	-	-	-	-	-	-	3,460	2,070	530	1,780	6,100	6,100	20,040
	Soybean	70	150	350	560	1,000	-	-	-	-	-	-	-	600	2,660
	Tree Crops(young tree)	40	(100)	(230)	(240)	(260)	(120)	(150)	(290)	(180)	(120)	(150)	(170)	(120)	(2,130)
	Tree Crops (bearing tree)		240	560	600	1,200	480	600	480	720	480	600	720	480	7,160
	Sub-total	590	390	910	1,160	2,200	480	600	3,940	2,790	1,010	2,380	6,820	7,180	29,860
	Total	1,340	2,120	12,370	4,490	5,470	3,580	4,320	4,980	6,050	5,460	13,050	10,050	9,050	80,990

(2) Middle and East Blocks of Thung Sai Yart Area

(Unit: Man-day/ha)

Block	Crop	Area (ha)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Middle	Paddy(HYV)	1	-	-	-	-	1.6	10.2	20.8	7.4	3.4	12.5	10.5	-	66.4
	Paddy(LV)	1	2.3	-	-	-	-	2.8	4.2	9.7	14.9	7.4	6.4	16.5	64.2
	Soybean	1	3.1	12.3	5.8	-	-	-	-	-	-	-	6.3	10.1	37.6
East (1)	Paddy(HYV)	1	-	-	-	-	-	6.5	14.9	12.0	5.3	3.5	24.2	-	66.4
	Paddy(LV)	1	1.5	-	-	-	-	-	6.1	13.4	9.2	10.8	13.2	7.7	64.2
	Soybean	1	1.5	14.0	5.7	-	-	-	-	-	-	-	5.9	10.5	37.6
	Tree Crops(Young)	1	2.4	5.6	6.0	6.3	2.9	3.7	7.2	4.3	2.9	3.6	4.2	2.9	52.0
	Tree Crops(Bearing)	1	6.0	14.0	15.0	30.0	12.0	15.0	12.0	18.0	12.0	15.0	18.0	12.0	179.0
East (2)	Paddy(LIV)	1	-	-	-	-	-	-	0.4	17.8	15.2	7.1	5.4	20.5	66.4
	Paddy(LV)	1	1.5	-	-	-	-	-	0.4	18.1	13.5	8.6	5.0	19.3	66.4
	Soybean	1	1.2	3.1	14.8	-	-	-	-	-	-	-	-	18.5	37.6
Middle	Paddy(HYV)	1,400	-	-	-	-	2,240	14,280	29,120	10,360	4,760	17,500	14,700	-	92,960
	Paddy(LV)	1,200	2,760	-	-	-	-	3,360	5,040	11,640	17,880	8,880	7,680	19,800	77,040
	Soybean	380	1,180	4,680	2,210	-	-	-	-	-	-	-	2,400	3,840	14,310
East (1)	Paddy(HYV)	340	-	-	-	-	-	2,180	5,070	4,080	1,810	1,190	8,230	-	22,560
	Paddy(LV)	310	470	-	-	-	-	-	1,890	4,160	2,860	3,350	4,100	2,390	19,220
	Soybean	60	90	840	340	-	-	-	-	-	-	-	360	630	2,260
	Tree Crops(Young)	40	(100)	(230)	(240)	(260)	(120)	(150)	(290)	(180)	(120)	(150)	(170)	(120)	(2,130)
	Tree Crops(Bearing)	-	240	560	600	1,200	480	600	480	720	480	600	720	480	7,160
East (2)	Paddy(LIV)	380	-	-	-	-	-	-	160	6,780	5,780	2,700	2,060	7,790	25,270
	Paddy(LV)	310	470	-	-	-	-	-	130	5,610	4,190	2,670	1,550	5,990	20,610
	Soybean	100	120	310	1,480	-	-	-	-	-	-	-	-	1,850	3,760
	Total		5,330	6,390	4,630	1,200	2,720	20,420	41,890	43,350	37,760	36,890	41,800	42,770	285,150

(3) West Block of Thung Sai Yart Area

(Unit: Man-day/ha)

Block	Crop	Area (ha)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
West Area	Paddy(HYV)	1	-	-	-	-	-	5.6	28.7	3.7	3.2	23.2	-	-	66.4
	Paddy(LV)	1	-	-	-	-	-	1.1	14.5	21.4	2.5	5.2	19.5	-	64.2
	Soybean	1	1.3	8.1	-	-	-	-	-	-	-	6.1	9.5	2.6	37.6
	Paddy(LIV)	440	-	-	-	-	-	2,470	12,630	1,630	1,410	10,210	-	-	28,350
	Paddy(LV)	380	-	-	-	-	-	420	5,510	8,140	950	1,980	7,410	2,090	26,500
	Soybean	120	1,360	980	-	-	-	-	-	-	-	740	1,140	320	4,540
	Total	940	1,360	980	-	-	-	2,890	18,140	9,770	2,360	12,930	8,550	2,410	59,390

C-2-12 Holding Number of Farm Labour Force in Study Area

(Unit: man-day)

Items	Nong Khon Kaen	Amp. Mung	Amp. B.D.L.H
1. Number of land certificate (L.C) Holder (Farmer)	365 (69)	655 (141)	316 (70)
2. Number of farm manager	327 + (69) = 396	586 + (139) = 716	297 + (66) = 363
3. Number of farm labor force per family	Man; 1.5 Female; 1.8 x 0.7 } 2.76	Man; 1.4 Female; 1.5 x 0.7 } 2.45	2.45
4. Farm labor days per monthly (25 days)	69	61	61
5. Number of monthly total farm labor force	22,563 + (4,761) = 27,324	35,746 + (7,930) = 43,676	18,117 + (4,026) = 22,143
6. Number of total annual farm labor force	270,756 + (57,132) = 327,888	428,952 + (95,160) = 524,112	217,404 + (48,312) = 265,716

Note: ( ) is outside study area.

C-2-13 Land Preparation and Sowing for Soybean Using by Small Tractor

Item/Area		Nong Khon Kaen	Thung Sai Yart-West	Thung Sai Yart-Mid	Thung Sai Yart-East
1. Operation time by tractor(hr/ha)		34.3	34.3	34.3	34.3
2. Cropping area	(ha)	310	120	380	160
3. Operation days	(days)	45	19	38	30
4. Operation total time	(hr)	315	133	266	210
5. Operation area by one tractor(4)÷(1)	(ha)	9.1	3.8	7.7	6.1
6. Using number of tractor (2)÷(5)		31	32	50	26

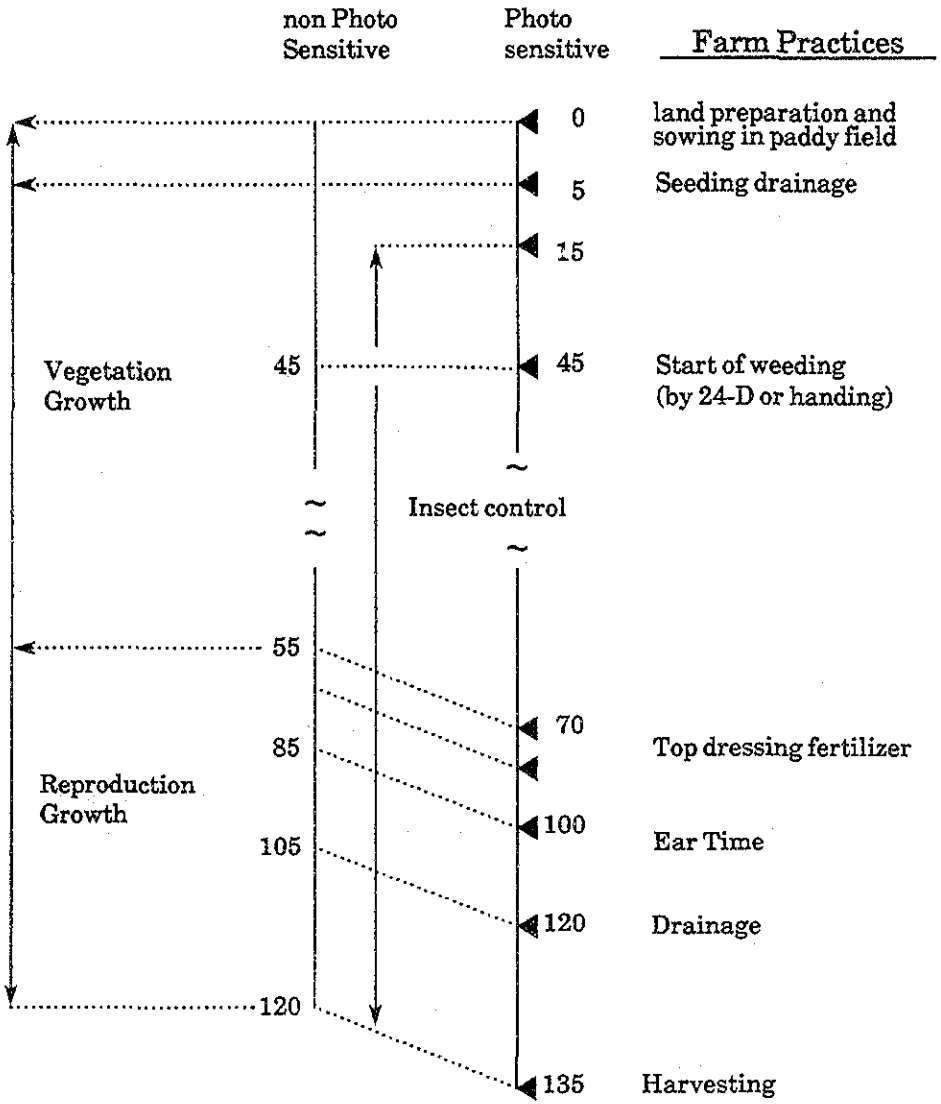
Note: --- can be using small tractor by water irrigation

C-2-14 Soybean Prominent Characteristics

Item / Recommended varieties	Plant characteristics: Growth type	Plant height (cm)	Color of flower	Day to flowering (days)	Day to maturity (days)	No. pods/plant (pods)	Prominent seed: Degree of dehiscence	Hilum of color	Seed weight g/100 seeds
Chiang Mai 60 (7508-50-10 x Williams) (1987)	determinate	61	white	35	97	-	-	brown	14.5
Nakhonsawan 1 (OCB) (1985)	determinate	50	purple	29	75	-	-	light brown	18.6
Sukhothai 1 (Shin Shin x SRF400) (1987)	indeterminate	108	purple	29	96	-	low	as yellow as rice straw	17.2
SJ 1 (UT-Sah)	indeterminate	82	purple	35	100	41.7	high	black	13.7
SJ 2 (Pakchong)	determinate	67	purple	40	95	49.6	low	red	12.2
SJ 4 (1976)	determinate	65	purple	37	95	60.2	low	brown	15.2
SJ 5 (Tainung 4 x SJ 2) (1980)	determinate	63	purple	35	95	38	moderate	light brown	14.1

Item / Recommended varieties	Grain yeild (kg/ha): rainy season	dry season	average throughout the year	chemical compositions of seed: fat (%)	protein (%)	Remarks
Chiang Mai 60 (7508-50-10 x Williams) (1987)	-	-	153	20.0	43.8	- CM60 has fewer branches but greater pod members and responds more to low fertilizer rate than SJ5.
Nakhonsawan 1 (OCB) (1985)	193	126	-	21.3	39.4	- It a very early maturing cultivar with high yield. The cultivar can be planted so as to reduce the risk of climatic uncertainty.
Sukhothai 1 (Shin Shin x SRF400) (1987)	183	127	-	23.2	34.4	- The cultivar is susceptible to purple stain disease. But it is resistance to bacterial pustule and yellow mosaic virus.
SJ 1 (UT-Sah)	166	143	158	18.5	34.9	- It is very susceptable to rust, especially during the rainy season.
SJ 2 (Pakchong)	150	165	155	21.0	34.7	- It can be planted both in the rainy and dry season because pods do not dehise easily.
SJ 4 (1976)	194	188	193	19.0	37.8	- to rust and purple, moderately resistant to downy mildow but susceptible to bacterial pustule and soybean mosaic virus
SJ 5 (Tainung 4 x SJ 2) (1980)	-	-	193	18.7	41.8	- it was more resistant to soybean mosaic virus than but resisted to anthracnase and rust at at similar extent to SJ 4

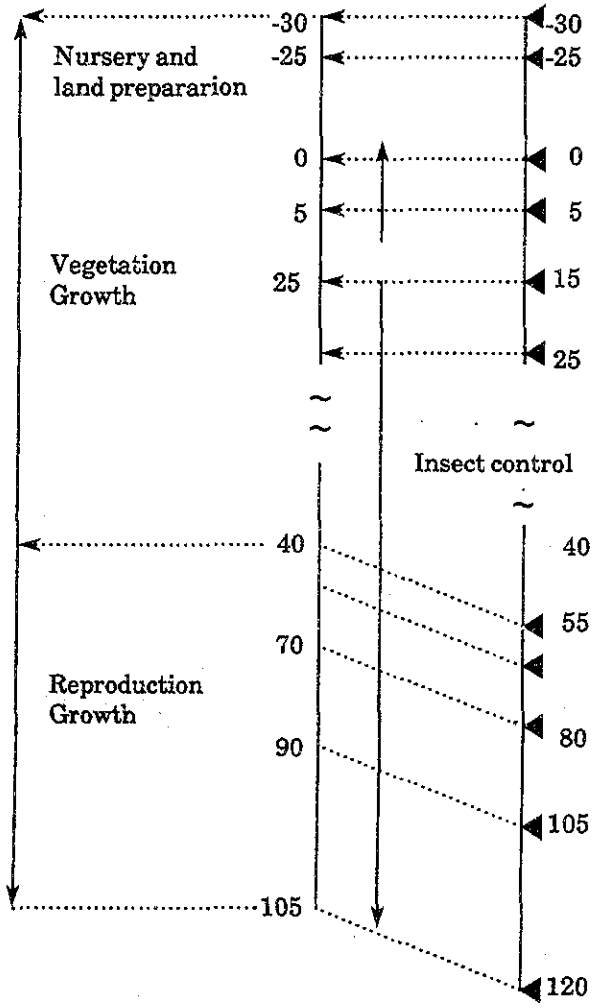
C-2-15 Cropping Calender – Wet Season Rice Wet broadcasting



Farm Practices	(non photo) Farm Inputs (ha)	(Photo) Farm Inputs (ha)
land preparation and sowing in paddy field	· Seeds 75kg/ha	· - do -
Seeding drainage	· Fungicides for Seed tratment, Ditane M-45 any other	· - do -
	· Basal application 16-20-0~200~250kg or 16-16-8~250	· Basal application 16-20-0~125kg K_2O~40kg
	· Insecticides eg Furadan (2F, 0.5ℓ)	· Insecticides eg Furadan (2F, 0.5ℓ)
Start of weeding (by 24-D or handing)	· Herbicides eg 24-D	· Herbicides eg 24-D
	· Top dressing with Urea 30~50kg	· Top dressing with Urea 40~45kg
	· (Total of Chamical fertiliger) N50, P 50, K 20 kg	

· Remark ; ①Recommended Varieties
non photo sensitive RD7, RD23 etc
Photosensitive RD6, Khao dowk Mali105
Khoatah Haeng 17, etc
②Recomendetion Herbicides

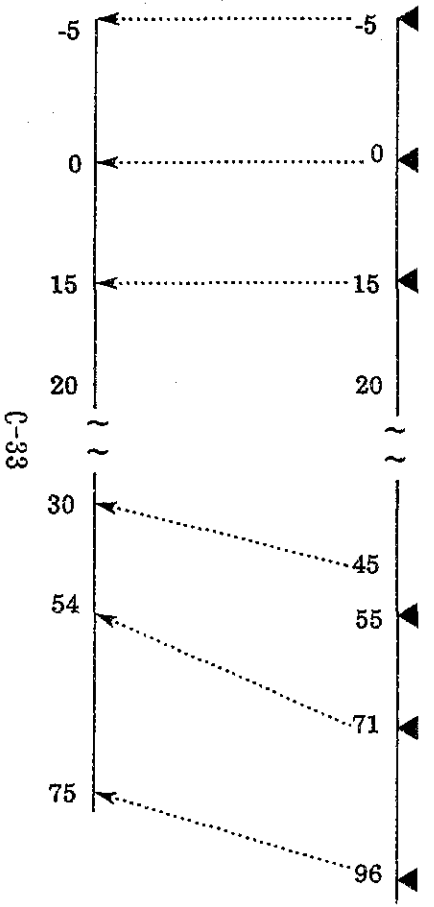
Cropping Calender – Wet Season Rice Transplanting



Farm Practices	(non photo) Farm Inputs (ha)	(Photo) Farm Inputs (ha)
start land preparation of Seed bed	· Seeds bed area 500m²/ha	· - do -
sowing in the Seed bed	· Seed's 40kg	· - do -
	· Fertilizer (16-20-0) 30kg/500m²	· - do -
	· Fungicides for Seed treatment Ditane M-45 any other 1.5kg	· - do -
Trans planting (25×25cm,3~4plants/hill)	· Basal application 16-20-0. or 16~16-8. 250~300kg	· Basal application 16-20-0~125kg K_2O~40kg
Herbicide application (not more than water, don't drain)	· Herbicides eg Benchiocaue shimetorin 30kg	· Herbicides eg Hednal 25kg
	· Insecticides eg Furadan (2F, 0.5ℓ)	· Insecticides rg - do - (2F, 0.5ℓ)
Start of weeding (by Handing or 24-D)	· Top dressing with Urea 75~100kg (Total of Chemical fertiliger) N50~65, P 50, K0~20 kg	· Top dressing festilizer Urea~20~25kg (Total of Chemical fertiliger) N30, P 25, K24 kg
Top dressing fertilizer		
Ear Time		
Drainage		
Harvesting		

· Remark ; ① Recommended Varieties
non photo sensitive RD7, RD23 etc
Photosensitive RD6, Khao dowk Mali105
Khoatah Haeng 17, etc

Cropping Calender – Soybean



Farm practices

startof land preparation
fertilizer can be broadcast, and then
covered by harrowing before planting

Dibbing Seed (50×20)
(3~4 Seeds per hole)
planting them rather
shallow 2~5cm deep in moist soil

Thinning /off-burying, Hilling-up/weeding
Weeding by post-emergency

After opening flower
- Insect control
- Irrigation water

Harvesting

Farm Inputs per Hectare

- Basal fertilizer :
  3-9-6, 120 kg

- Seed 50 kg
- Insecticides
  eq. Furadan 3G 18kg
  (Pre-planting application)
  eq. palathion EC 0.5ℓ
- Monocrotophos 3.0 ℓ
- Herbicide
  eq. Onecide+Flex 1.0 ℓ

- Remark ; ① Recommended Varieties
  eq 75day Type ~ Nakhon Sawan No.1 (SW. 1)
  96day Type ~Sukhothai No.1 (SK. 1)

② Soil requirement CL - Soil PH more than 6.0

C-2-16 Cropping Guide of Vegetables

(1) Leaf Vegetables

(unit: per Hectare)

Item	Cabbage	Cauliflower
1. Optimum Soil		
• Major Soil Series	Saraburi (Nong Khon Kaen)	-do-
2. Size of Seedling		
• Sowing time	• Jul. to Aug. (wet) or Jan. to Feb. (dry)	-do-
• Transplanting Time	• 3～5 leaf stage	
• Seed rate	• 1～1.25kg	
• Nusery area	• 1,000～2,000㎡	
3. Land Preparation		
• Land leveling	• 2 times of harrowing	-do-
• Plowing	• deep plowing 20～30cm	
• Ridging		
4. Fertilizers Inputs	(Before Planting) (Head formation)	(Before Sowing) (Flower-bud Stage)
• Ammonium sulfate	300kg 300kg	350kg 200～300kg
• Super phosphate	200kg -	400kg -
• Potassium sulfate	100kg -	- -
• Manure	20ton -	15～20ton -
5. Diseases and Insect Pest Control	Daiholtan wp 4.0kg Rannet wp 2.0kg	Deptelex wsp 5.0kg Marason Emul 2,000cc
6. Spacing in the Field	180 × 45cm with 2 lines	-do-
7. Irrigation Interval	• 10 days (First Irrigation before plowing)	one week (-do-)
8. Thinning or Weeding	3～4 times	-do-
9. Harvesing Time	Nov. to Dec. (wet) or May (dry)	(wet)(dry) • 1st Harvesting-Nov. Apr. • 2nd Harvesting-Dec. May
10. Average Production	18～25ton/ha	15～25ton

(2) Fruit Vegetables

(unit: per Hectare)

Item	Water melon	Cucumber	Tomato
1. Optimum Soil	Saraburi (Sb)	-do-	-do-
2. Size of Seedling			
• Sowing time	• direct sowing	• -do-	
• Transplanting Time	-	-	• 7～8 true leaf stage
• Seed rate	• 5～20dl	• 30～50dl	
• Nusery area	-	-	• 500㎡
3. Land Preparation			
• Plowing	• Pulverization with deep plowing (20～30cm)		
• Land leveling	• 2～3 times of harrowing		
• Ridging (spacing in the field)	• 300×80cm or 180×130cm	• 180×60cm with 2 lines	• 180×45cm with 2 lines
4. Fertilizers Inputs	(Basal) (Top) kg kg	(Before Sowing) (Flower-Stage) kg kg	(Before Planting) (Full bloom stage) kg kg
• Ammonium sulfate	(N)100 7	150～200 150	200～250 200kg
• Super phosphate	(P) 20 -	300 -	250～300 -
• Potassium sulfate	(K) 13 7	- -	50～100 50～100
• Manure	20ton	10～20ton -	20～25ton -
5. Diseases and Insect Pest Control	Juneve wp 20 kg Deptelex Emul 1,000cc	Topgin M. wp 700g Daconil wp 2.0kg	kg Toriagin wp 3.0
6. Irrigation Interval	one week (First irrigation before plowing)	-do-	-do-
7. Thinning or Weeding	2 times	2 times	2 times
8. Harvesing Time	Mar. to Apr.	Mar. to Apr.	Mar. to Apr.
9. Average Production	23ton	15～25ton	23～30ton

C-2-17 Indices of Fruit Tree Cultivation

1. Selecting orchard Loaction

Citrus trees grow best and live longer on well-drained. Major cropping area is Nakhon Pathon (Np) Series, when the root can grow more deeply, and should have irrigation water available during the dry season.

2. Land Preparation

For orchard planting in flat or slightly rolling terrains, land preparation is done by plowing the field as deep as possible.

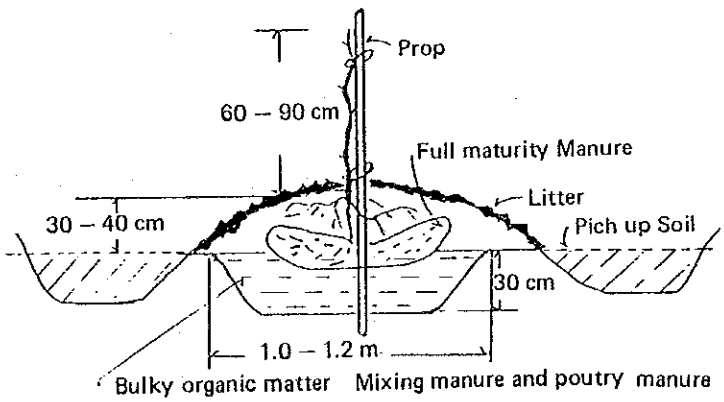
Then the field is harrowed several times until the desired soil tilth is attained. This is done before the onset of the rainy season to fully expose the soil. Then the field is laid out and stakes are set corresponding to the desired distance of planting.

3. Planting

Transplanting in the field may be done any month of the year but preferably at the onset of or during the rainy season.

Before planting, remove carefully the container that goes with the planting material. Set the plant in the hole. See to it that it is aligned with the other trees.

Fill the extra space with top soil or compost, if the latter is available. Pack the soil firmly around the root system. Watering the plants right after planting and during the first few days may be necessary if the soil has inadequate moisture.



4. Tree Spacing (Minimum Spacing)

Items	Mango	Coconut	Jack Furit	Pomelo	Lemon	Bamboo
	m m					
• recommned distance	8 x 8	7 x 7	8 x 8	8 x 8	7 x 7	7 x 7
• tree/ha	156	204	156	156	204	204

5. Suggested Application

Tree Age	Mango	Coconut	Jack Furit	Pomelo	Lemon	Bamboo
	kg/pieces	kg	kg	kg	kg	kg/ha
Field/planting	0.3	0.2	0.3	0.3	0.3	40+urea20
6 months	-	0.6	-	-	-	40+urea20
2 years	0.5	1.0	0.5	0.5	0.5	40+urea20
3 years	0.8	1.3	0.8	0.8	0.8	40+urea20
4 years	1.0	2.0	1.0	1.0	1.0	40+urea20
5 years	1.5	2.6	1.5	1.5	1.5	40+urea20
Compound-Fertilizer						
N	10	15	10	15	do	do
P	10	15	10	15	do	do
K	5	15	5	15	do	do

6. Cover Crops

The rain fall of the wet season in Thailand almost guarantees a good cover of some green manure crop whether planted or volunteer. The important thing is to turn it under or cut it down closely at the beginning of the dry season so as to conserve the soil moisture.

The cut grass should be left as a mulch on the ground. Several varieties of legumes can be used for this purpose or even a good volunteer crop of Native cover.

7. Diseases and Insect/Pest Control

The tropical condition of Thailand are favorable for insect life in the orchard and field. Most crops including citrus are affected to keep tree healthy and producing good crops of quality fruit. It is necessary to control much fruit has dropped on the ground or has been of marketable fruits.

1) Insect Attacking Citrus

- Stink Bug

Distribution; All areas

Control ; • Hand-Picking

• Severe infestations spray with EPN or Marathon

Time ; • At first appearance of insect

- Fruit Piercing Moth

  Distribution; All areas

  Control ; Some natural parasites; if severe, spray with EPN or Marathon

  Time ; • When fruit starts ripening. Repeat two weeks thereafter, and necessary spray a third time.

- Pomelo Fruit Fly

  Distribution; Severe in south

  Control ; • Repellant sprays, EPN, DDVP. Repeat once or twice during season if necessary.
  • Bagging of fruits; collect and destroy all infested fruits

  Time ; When fruit is small - 3 cm in diameter

- Leaf Miner Caterpillar

  Distribution; All areas, especially on pomelo foliage

  Control ; Spray with EPN or other DDVP

  Time ; When new leaves appear, if infestations are observed.

- Rust Mite

  Distribution; All areas

  Control ; Dust with dusting sulphur

  Time ; When fruits are small

- Citrus Aphido

  Distribution; All areas on young growth and young trees

  Control ; Spray with tobaco solution of EPN

  Time ; When aphids appear on new growth

- Mealy Bug

  Distribution; All areas (not important)

  Control ; Natural in most areas. If sever, spray with EPN, DDVP.

  Time ; When clusters of insects appear

- Leaf-Eating Caterpillars

  Distribution; All areas - on young foliage

  Control ; Spray with EPN or DDVP

  Time ; When foliage is new and tender

- Stem Borer of Citrus

  Distribution; South east

  Control ; Cut away the smaller infested branches and burn.

• Consult the Agricultural agent

- Red Ants

  Distribution; All areas

  Control ; Remove ant nests from tree and destroy. Spray or dust with EPN or other.

- Black Parlatoria Scale

  Distribution; All areas

  Control ; If the seales become injurious a two-percent light-medium oil spray. If available, may be used for control at the time the eggs are hatched out and the young scale is in mobile form.

2) Citrus Diseases

- Citrus Gummosis or Foot Rot

The first step of control is to correct the contributing conditions explained above. If the tree has been planted low the soil should be removed down to the first leteral roots and the air allowed to reach the trunk.

Even if this excavation fills with water during a rain, it will drain away and dry faster as the air reaches the tree trunk. The infected lesions on the trunk or root should be cut out with a sharp knife to the healthy bark surrounding the diseased areas.

The exposed wood tissue should be painted with a Bordeaux paint or one-percent solution of potassium permanganate.

- Citrus Canker

It is caused by a microscopic bacterium. Pomelo appear to be more resistant the disease than limes and oranges. Badly infected tree should be removed and burned to reduce the rate of spread among other trees in the orchard.

It would be well to spray with a Bordeaux spray in order to hold down severe infection on leaves and fruit.

8. Harvesting time and Production

Items		Mango	Coconut	Jack Furit	Pomelo	Lemon	Bamboo (Shoots)
Harvesting time		May	Throughout the year	Jun	Jul.	Oct.	Sep.
Average production (Bearing tree)	ton	15.6	6.0	8.0	14.0	15.0	10.0

Appendix C-3 ECONOMY AND PROJECT EVALUATION

C-3-1 RESULTS OF FARMER'S ENQUETE SURVEY

1. Constraints on Farming and Request to Project

Sub-project		Thung Sai Yart			Nong Khon Kaen		
Ranking		1st	2nd	3rd	1st	2nd	3rd
Constraints on Farming		Lack of Irrigation Water(51%)	Lack of Agr Credit (13%)	Lack of Farm Road (13%)	Lack of Irrigation Water(27%)	Lack of Agr Credit (27%)	Insect & Disease (12%)
Request to Project	Agriculture Infrastruct.	Irrigation (58%)	Farm Road (20%)	Land Leve-lling(11%)	Irrigation (56%)	Land Leve-lling(25%)	Farm Road (10%)
	Agr. Product Facility	Collecting Center (31%)	Farm Storage (14%)	Rice Mill (10%)	Drying Facility (28%)	Collecting Center (21%)	Farm Storage (19%)
	Rural Infrastruct.	Water Supply (27%)	Rural Electrifi. (20%)	Rural Road (16%)	Water Supply (19%)	Rural Drainage (16%)	Rural Road (10%)
	Rural Community	Radio System (31%)	Village Hall(28%)	Daily Market (12%)	Village Hall(40%)	Radio System (20%)	Meeting Place (11%)

2. Upland Crop Cultivation

		Thung Sai Yart		Nong Khon Kaen	
		Experienced	Expectation	Experienced	Expectation
No. of Respondent		41 (28%)	56 (39%)	21 (38%)	11 (20%)
Main Crops		Maize, Mungbean, Soybean, Fruits, Chilli	Soybean, Maize Mungbean, Fruits	Watermelon, Mungbean, Sweet Corn, Fruits	Fruits, Soybean
Constraints for Upland Farming	1st	Lack of Irrigation Water (29%)		Unsuitable Soil Condition (25%)	
	2nd	Unsuitable Soil Condition (27%)		Lack of Knowhow & Extension (23%)	
	3rd	Lack of Knowhow & Extension (23%)		Less Profitable than Paddy (11%)	

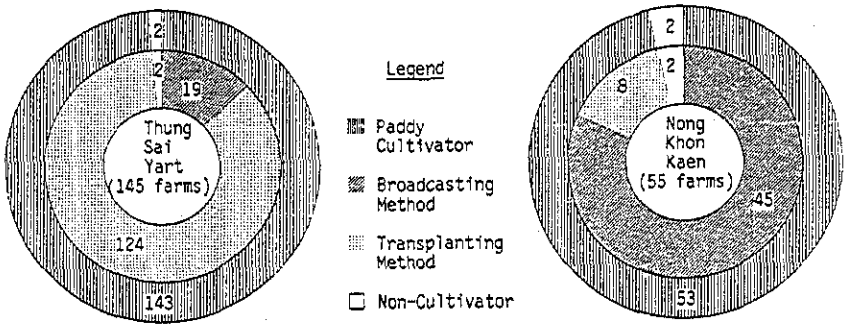
3. Contribution and Cooperation to Project

	Thung Sai Yart					Nong Khon Kaen				
	Cooperative				Not Coope-rative	Cooperative				Not Coope-rative
	Act-ive	Med-ium	Pas-sive	Sub-total		Act-ive	Med-ium	Pas-sive	Sub-total	
Submission of Own Land	21%	33%	38%	92%	2%	7%	25%	64%	96%	4%
Changing Location of and Reshaping Own Land	-	-	-	77%	23%	-	-	-	71%	29%
Bearing Project Cost	7%	22%	52%	81%	19%	-	9%	69%	78%	22%
Contribution to Project	-	-	-	97%	3%	-	-	-	98%	2%

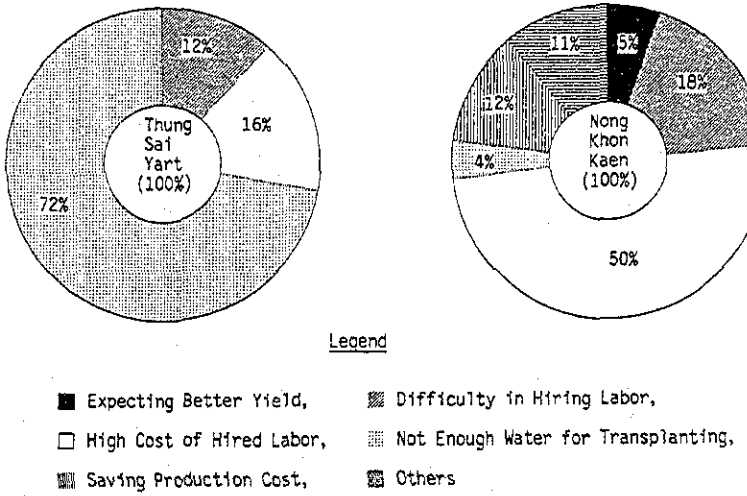
2. FARM MANAGEMENT

2-1. Paddy Cultivation

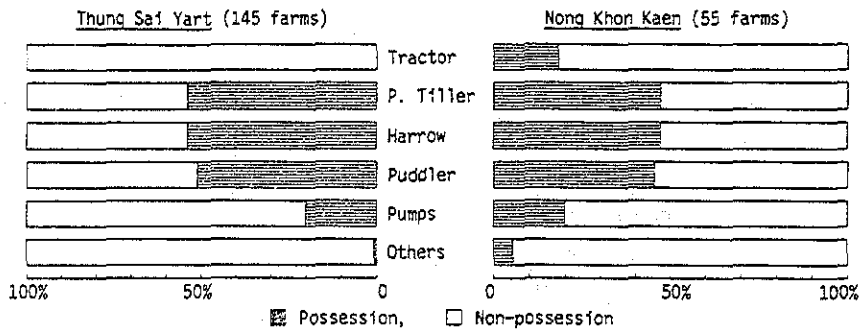
2-1-1. Paddy Cultivator and Planting Method



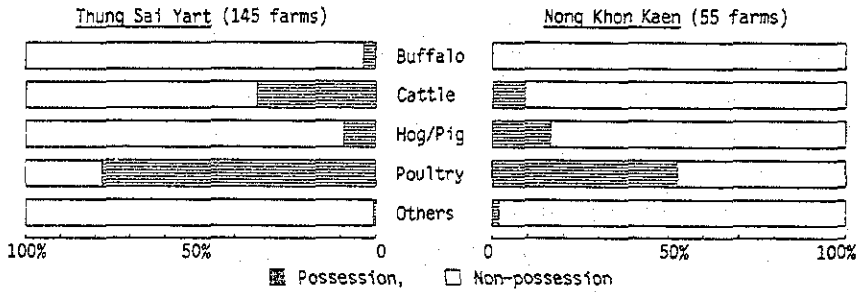
2-1-2. Reason for Broadcasting Method



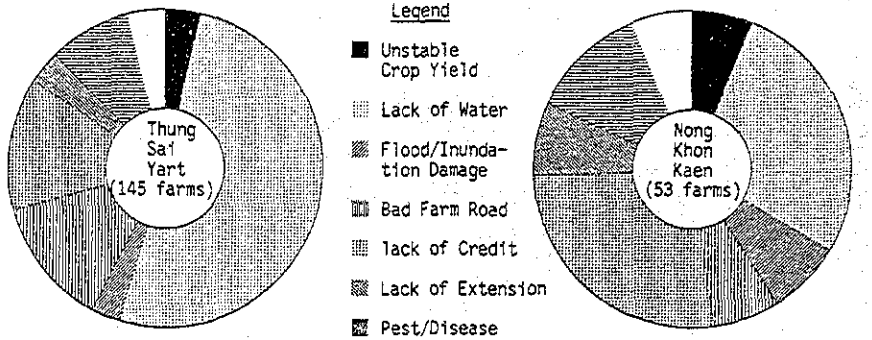
2-2. Farm Machinery



2-3. Livestock



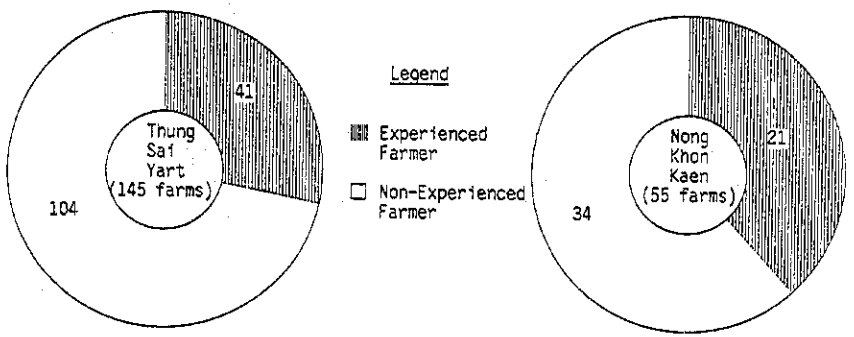
2-4. Problems on Farming Practice

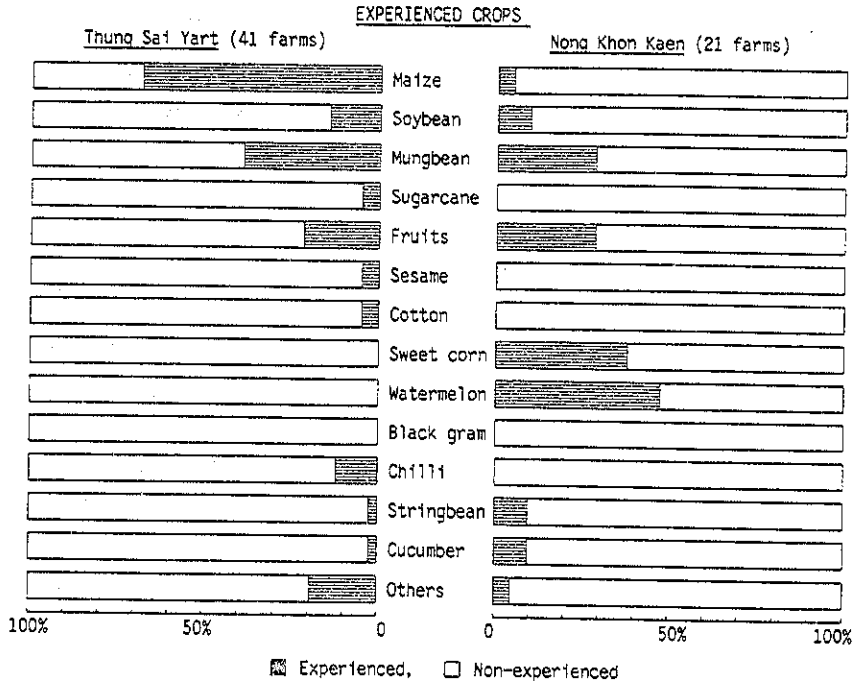


(No respondent: 2 farms)

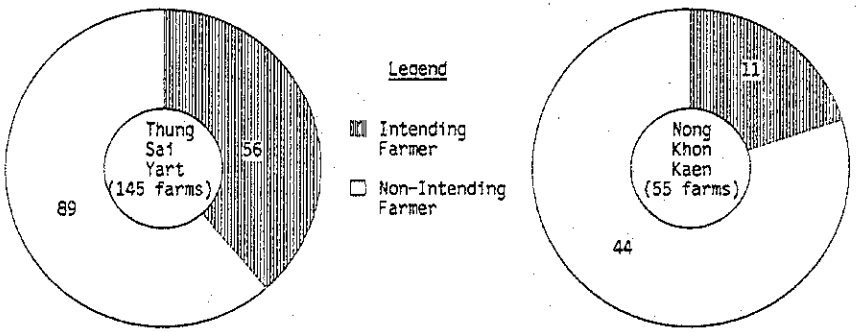
3. UPLAND CROPPING

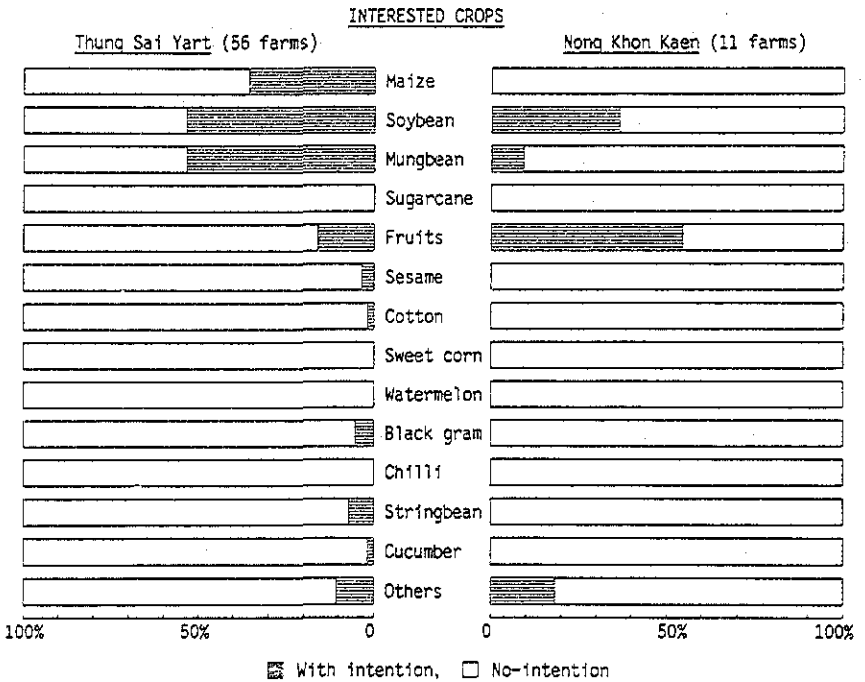
3-1. Experience of Upland Cropping





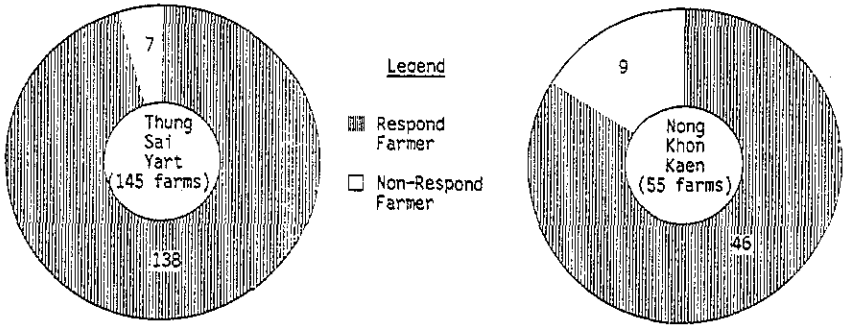
3-2. Intention for Upland Cropping



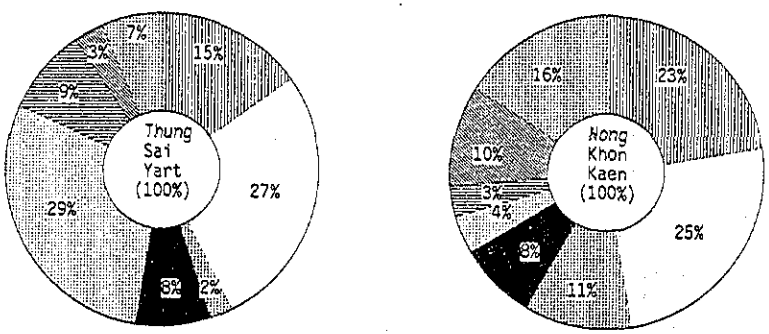


3-3. Constraints for Upland Farming

3-3-1. Number of Respond Farmer



3-3-2. Constraints for Upland Crop Cultivation

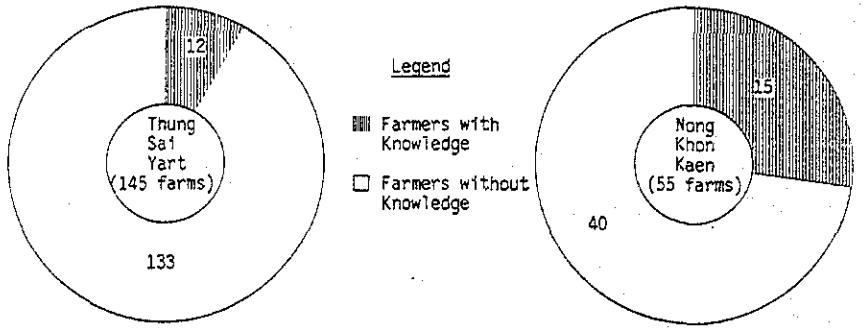


Legend

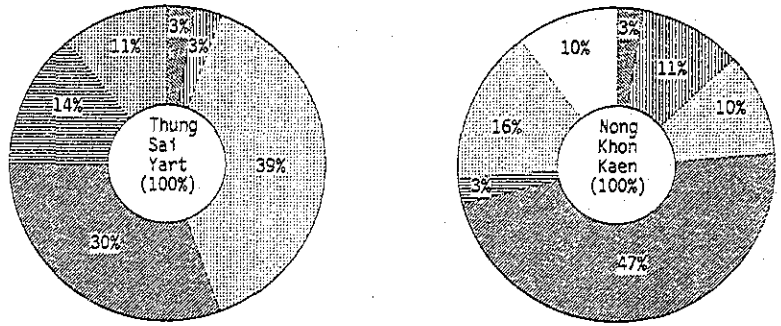
- No knowledge/No extension,
- Less profitable than paddy,
- Lack of irrigation water,
- Lack of production credit,
- Not suitable soil condition,
- More risky than paddy cropping,
- Flood/inundation,
- Others

4. LAND CONSOLIDATION

4-1. Meaning of Land Consolidation



4-2. Effect of Land Consolidation

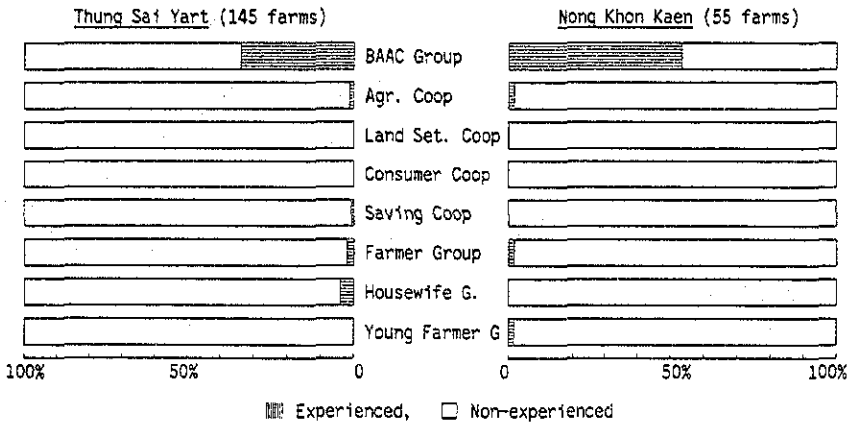


Legend

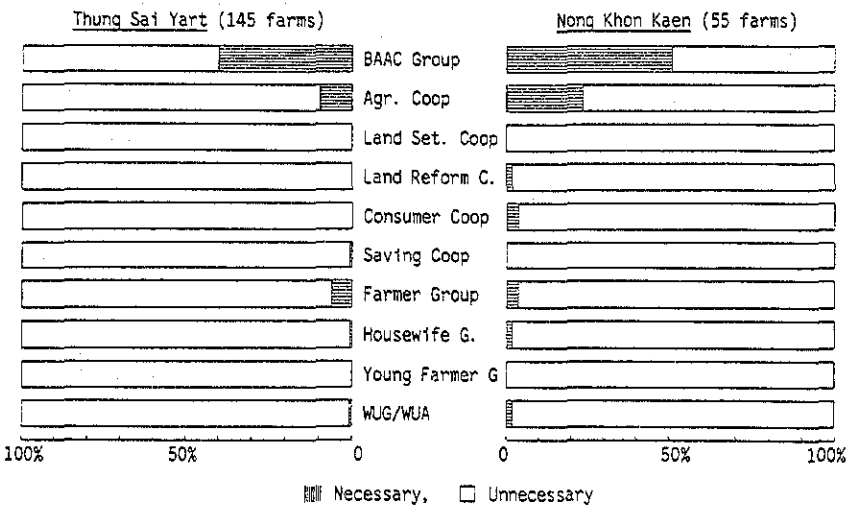
- Saving of labour,
- Increasing crop yield,
- Water become available,
- Others
- Saving of irrigation water,
- Easy water management,
- Smooth communication,

5. FARMERS ORGANIZATION

5-1. Membership of Organization

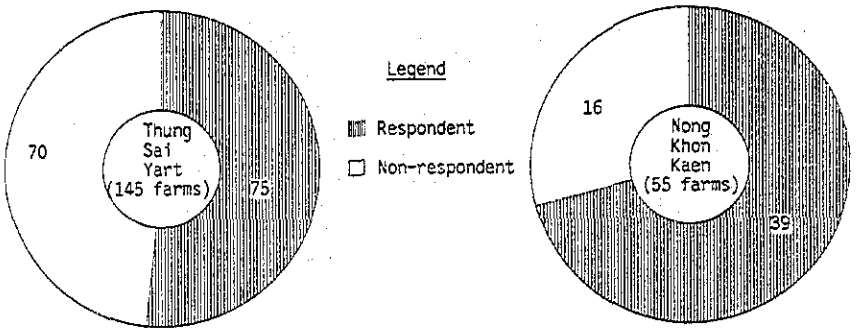


5-2. Necessity of Organization

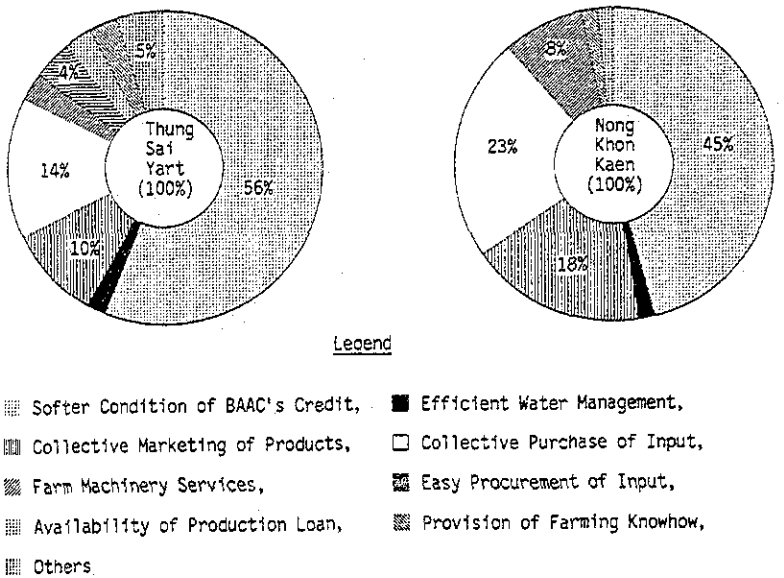


5-3. General Expectation to Farmers Organization

5-3-1. Number of Respondent Farmers

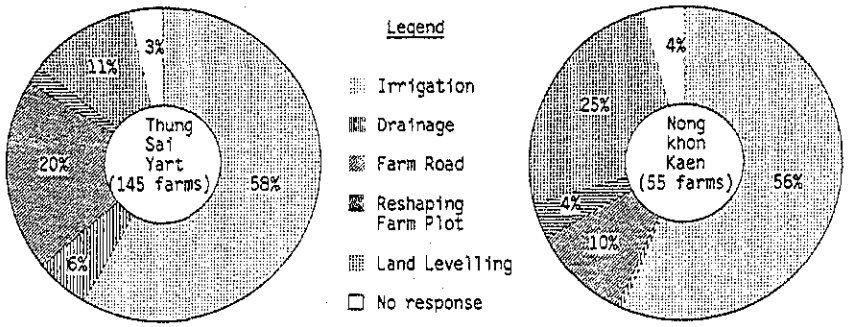


5-3-2. Expectation to Organization

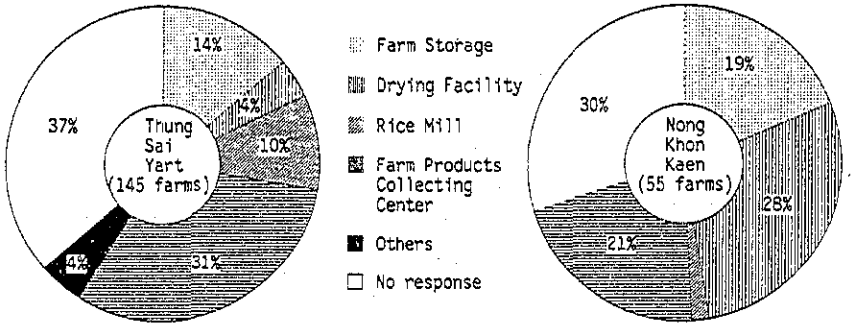


6. FARMER'S REQUEST TO THE PROJECT

6-1. Agricultural Infrastructure

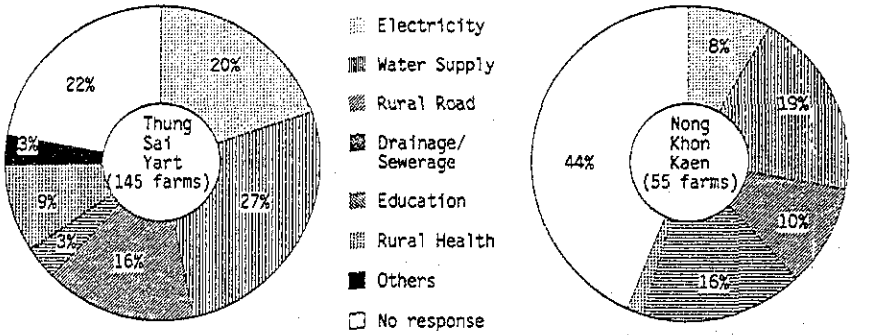


6-2. Agricultural Production Facility



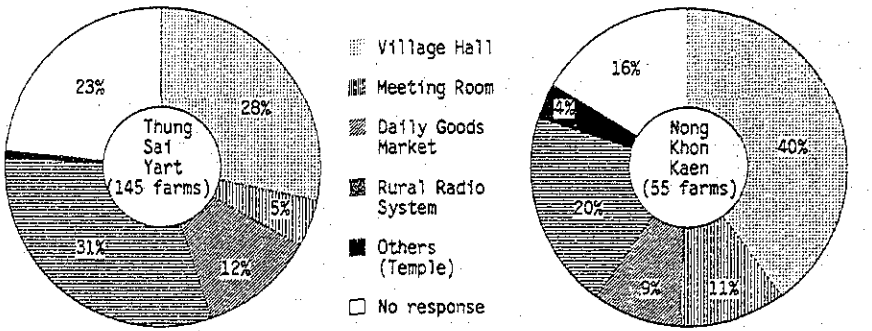
Others ■	Thung Sai Yart	Nong Khon kaen
Threshing Machine	55%	-
Agr. Input Center	20%	-
Production Transport Service	15%	-
Seed Center	10%	-
Total	100%	-

6-3. Rural Infrastructure



Others ■	Thung Sai Yart	Nong Khon kaen
Temple Rehabilitation	22%	-
Bridge	14%	-
Road Pavement	57%	-
Canal Dredging	7%	-
Total	100%	-

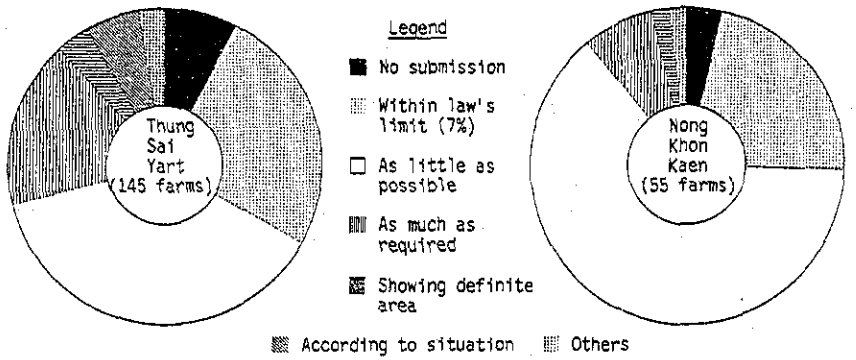
6-4. Community Development



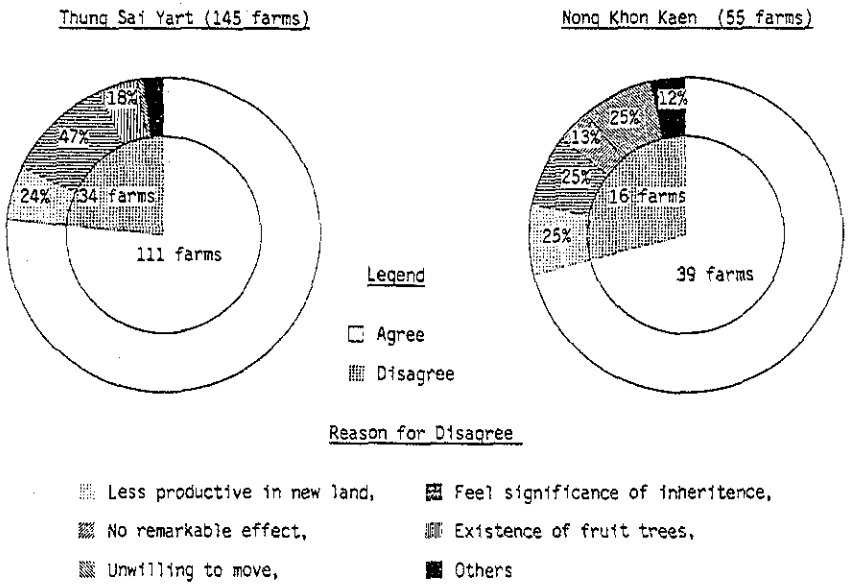
7. LAND RE-ALLOCATION AND COST RECOVERY

7-1. LAND RE-ALLOCATION

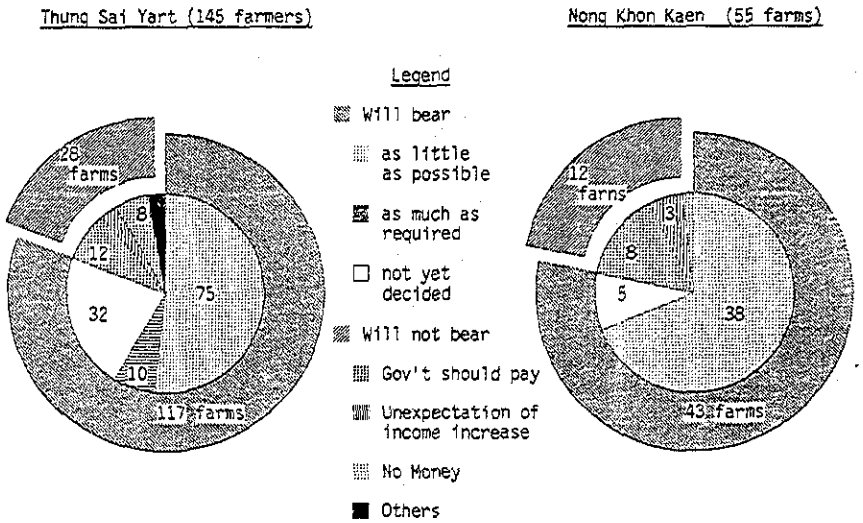
7-1-1. Submission of Farm Land for Public Use



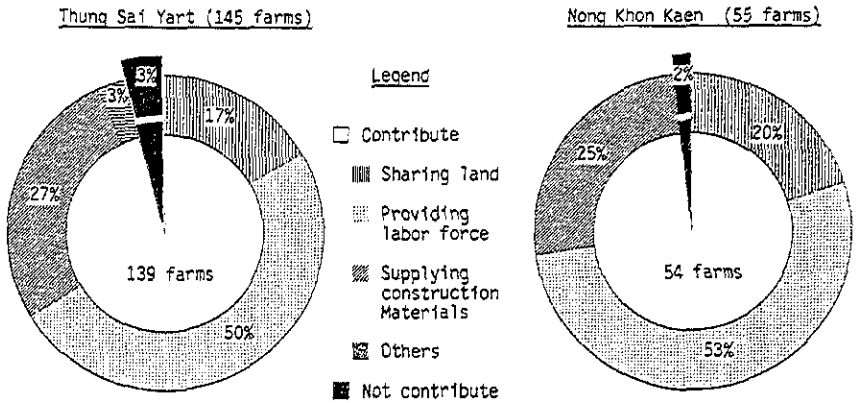
7-1-2. Change Location and Reshaping Farm Plot



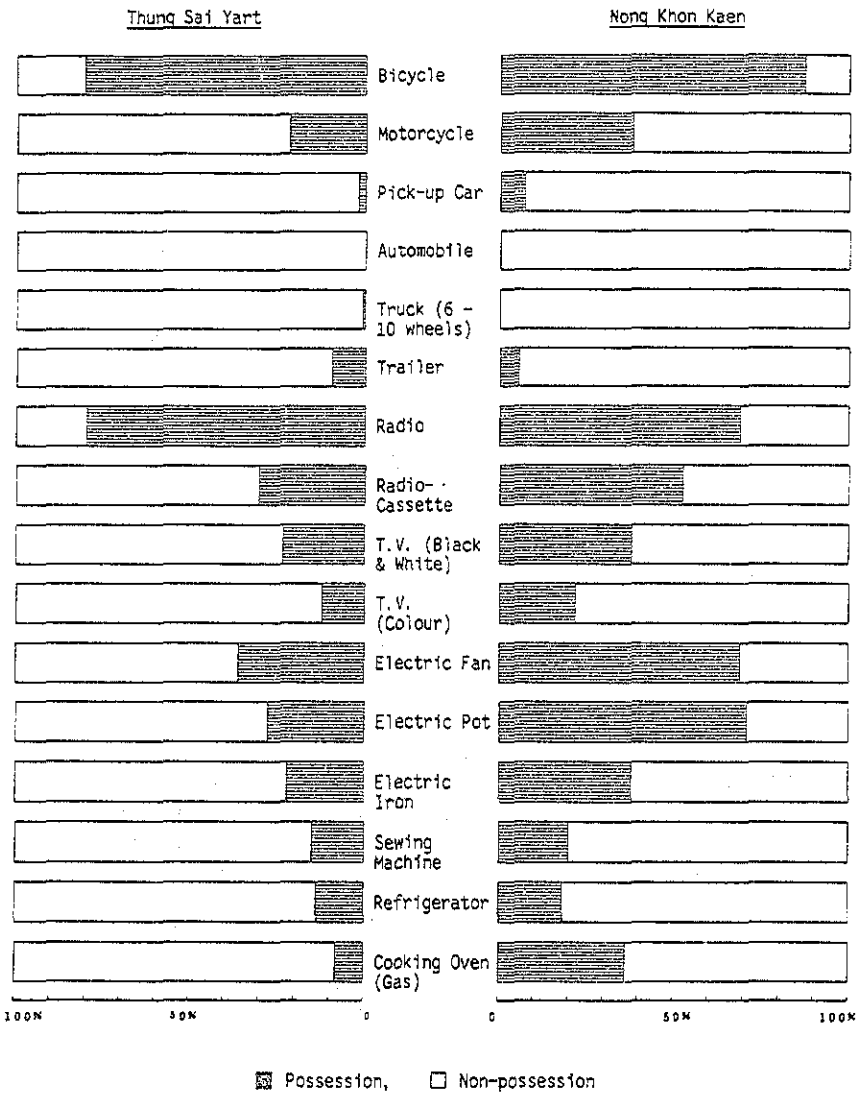
7-2. Cost Recovery For Project Cost



7-3. Farmers' Contribution to Project



8. POSSESSION OF DURABLE GOODS



C-3-2 PRICE STRUCTURE FOR AGRICULTURAL COMMODITIES

1. Paddy

	Unit (/ton)	Projected 2000 price Finan.	C.F.	Econo.	Remarks
W.B. projected price, f.o.b. Bangkok	US$	265	-	265	
- ditto -	Baht	6,760	-	6,760	
Port charges	"	200	0.80	160	
Taxes (business + municipal)	"	180	0.00	-	
Exporters margin	"	340	0.70	240	
Export duties	"	-	-	-	
Wholesale price, Bangkok	"	6,040	-	6,360	
Transport/handling/losses	"	300	0.80	240	
Wholesaler's margin		270	0.70	190	
Ex-mill price of rice	"	5,470	-	5,930	
Ex-mill price of paddy	"	3,610	-	3,910	
Miller's margin	"	200	0.80	160	
Milling tax	"	80	0.00	-	
Input price of paddy at mill	"	3,330	-	3,750	
Middleman's margin	"	190	0.70	130	
Farmgate price of paddy	"	3,140	-	3,620	

2. Soybean

	Unit (/ton)	Projected 2000 price Finan.	C.F.	Econo.	Remarks
W.B. projected price, c.i.f. Europe	US$	240	-	240	
W.B. projected price, c.i.f. Bangkok	US$	300	-	300	
- ditto -	Baht	7,650	-	7,650	
Import duties	"	(4,590)	0.00	0	
Business tax	"	210	0.00	0	
Port handling charges	"	200	0.80	160	
Transport to oil mill	"	150	0.88	130	
Importer's margin	"	380	0.70	270	
Wholesale price in Bangkok	"	8,590	-	8,210	
Quality adjustment	"	7,730	-	7,390	
Transport/handling to Bangkok	"	300	0.88	260	
Marketing costs	"	500	0.88	440	
Local merchant margin	"	350	0.70	250	
Farmgate price	"	6,580	-	6,440	

Note: C.F.: Conversion Factor

On the basis of 1990 constant prices

3. Fertilizers

	Unit (/ton)	Urea (N, 46%)	T.S.P. (P_2O_5, 45%)	Potassium Chloride (K_2O, 60%)
1. World Bank's Projected 2000 price	US$	207	233	120
2. Freight and Insurance	"	70	70	70
3. CIF price at Bangkok port	"	277	303	190
Converted to Thai Baht	Baht	7,060	7,730	4,850
Financial Price				
4. Port handling charges	Baht	200	200	200
5. Tax (Business + Municipal)	"	190	210	130
6. Transport (Port - Sukhothai)	"	120	120	120
7. Transport (Wholesale Market -.Farmgate)	"	40	40	40
8. Farmgate price	"	7,610	8,300	5,340
(Nutrient price)	"	(16,500)	(18,400)	(8,900)
Economic Price				
4. Port handling charges (C.F.: 0.80)	Baht	160	160	160
5. Tax (Business + Municipal) (C.F.: 0.00)	"	-	-	-
6. Transport (Port - Sukhothai) (C.F.: 0.80)	"	100	100	100
7. Transport (Wholesale Market - Farmgate) (C.F.: 0.80)	"	30	30	30
8. Farmgate price	"	7,350	8,020	5,140
(Nutrient price)	"	(16,000)	(17,800)	(8,600)

Note: All figures are rounded
C.F.: Conversion Factor

C-3-3 Economic Benefit (Crop)

(a) Incremental Crop N.P.V.[1]

(1) Nong Khon Kaen

	Unit	Paddy			Mungbean	Soybean	Vegetables		Total
Without Project		(L.V.)	(Wet-HYV)	(Dry-HYV)			(Leaf)	(Fruit)	
G.P.V.	Baht/ha	7,964	11,946	16,652	8,000	-	-	34,500	-
P.C.	"	4,001	6,141	11,116	3,069	-	-	21,255	-
N.P.V.	"	3,963	5,805	5,536	4,931	-	-	13,245	-
Cropped Area	ha	469	556	141[2]	24	-	-	5	1,195
Total N.P.V.	Baht 1,000	1,859	3,228	781	118	-	-	66	6,052
With Project									
G.P.V.	Baht/ha	-	17,738	-	-	11,592	36,000	34,500	-
P.C.	"	-	6,559	-	-	8,422	25,777	21,255	-
N.P.V.	"	-	11,179	-	-	3,170	10,223	13,245	-
Cropped Area	ha	-	900	-	-	310	60	30	1,300
Total N.P.V.	Baht 1,000	-	10,061	-	-	983	613	397	12,054
Incremental N.P.V.	Baht 1,000	-1,859	6,833	-781	-118	983	613	331	6,002

(2) Thung Sai Yart

	Unit	Paddy				Mungbean	Soybean	Total
Without Project		(LV-1)	(LV-2)	(LIV)	(HYV)			
G.P.V.	Baht/ha	3,620	-	3,620	-	9,600	-	-
P.C.	"	2,897	-	2,897	-	2,242	-	-
N.P.V.	"	723	-	723	-	7,358	-	-
Cropped Area	ha	3,935	-	1,986	-	44	-	5,065
Total N.P.V.	Baht 1,000	2,845	-	785	-	324	-	3,954
With Project								
G.P.V.	Baht/ha	4,344	9,050	12,308	15,204	-	11,592	-
P.C.	"	2,859	5,276	5,959	6,702	-	5,139	-
N.P.V.	"	1,485	3,774	6,349	8,502	-	6,453	-
Cropped Area	ha	1,890	310	380	2,180	-	660	5,420
Total N.P.V.	Baht 1,000	2,807	1,170	2,413	18,534	-	4,259	29,183
Incremental N.P.V.	Baht 1,000	-38	1,170	1,401	18,534	-324	4,259	25,229

Note: [1] N.P.V. of fruits is calculated separately.
[2] The cropped area is calculated on the basis of proper pumping amount by existing shallow wells.
G.P.V.: Gross Production Value (crop yield x price), P.C.: Production Cost, N.P.V.: Net Production Value (GPV-PC)

(b) Summary of Economic Production Cost

(Unit: Baht/ha)

(1)Nong Khon Kaen

Crop	Seed	Fertilizer	Agr. Chemicals	Agr. Machinery	Farm Labor	Miscellaneous	Total
Without Project							
Paddy (Wet-TP-LV)	160	-	-	1,850	1,800	191	4,001
Paddy (Wet-BC-HYV)	300	1,496	200	2,008	1,835	292	6,141
Paddy (Dry-BC-HYV)	300	1,496	200	6,746	1,845	529	11,116
Mungbean	250	-	100	863	1,710	146	3,069
Vegetable (Dry-Fruit)	4,000	1,140	600	6,093	6,390	1,932	21,255
With Project							
Paddy (Wet-BC-HYV)	160	1,846	400	1,811	1,890	312	6,559
Soybean (Dry)	350	1,004	400	4,062	2,205	401	8,422
Vegetable (Dry-Fruit)	4,000	1,140	600	6,093	6,390	1,932	21,255
Vegetable (Dry+Wet-Leaf)	3,800	2,973	400	5,911	10,350	2,343	25,777

(2)Thung Sai Yart

Crop	Seed	Fertilizer	Agr. Chemicals	Agr. Machinery	Farm Labor	Miscellaneous	Total
Without Project							
Paddy (Wet-TP-LV & LIV)	160	-	-	569	2,030	138	2,897
Mungbean	250	-	100	455	1,330	107	2,242
With Project							
Paddy (Wet-TP-LV(1))	160	-	-	533	2,030	136	2,859
Paddy (Wet-TP-LV(2))	160	320	300	2,005	2,240	251	5,276
Paddy (Wet-TP-LIV)	160	1,081	400	1,689	2,345	284	5,959
Paddy (Wet-TP-HYV)	160	1,873	400	1,605	2,345	313	6,702
Soybean (Dry)	400	1,004	400	1,375	1,715	245	5,139

Note: Wet: Wet season cropping, Dry: Dry season cropping
TP: Transplanting, BC: Broadcasting

C-3-4 Economic Cost of Crop Production

(Without Project)

Subproject: Nong Khon Kaen

Crop: Paddy (T.P.)

Season: Wet , Variety: L.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	4.0	160	
2 Fertilizer					
N (Nutrient Basis)	Kg	-	16.0	-	
P (")	Kg	-	17.8	-	
K (")	Kg	-	8.6	-	
Sub-total	-	-	-	-	
3 Agr. Chemicals					
Fungicide	time	-	100.0	-	
Pesticide	"	-	100.0	-	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	-	
4 Agr. Machinery					
Hand Tractor	Hour	40	13.0	520	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	0.6	120.0	72	"
Pump (Shallow Well)	Hour	58	13.0	754	"
Pump (Low-lift)	Hour	42	12.0	504	"
Sub-total	-	-	-	1,850	
5 Farm Labor	manday	40	45.0	1,800	
6 Total (1 - 5)	-	-	-	3,810	
7 Other Miscellaneous	L.S.	-	-	191	(5% of 6)
8 Grand Total	-	-	-	4,001	

Crop Yield: 2,200 Kg/ha G.P.V.: 7,964 Baht/ha

Unit Price: 3.62 Baht/Kg P.C.: 4,001 Baht/ha

N.P.V.: 3,963 Baht/ha

Economic Cost of Crop Production

(Without Project)

Subproject: Nong Khon Kaen

Crop: Paddy (B.C.)

Season: Wet , Variety: H.Y.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	75	4.0	300	
2 Fertilizer					
N (Nutrient Basis)	Kg	49	16.0	784	
P (")	Kg	40	17.8	712	
K (")	Kg	-	8.6	-	
Sub-total	-	-	-	1,496	
3 Agr. Chemicals					
Fungicide	time	-	100.0	-	
Pesticide	"	1	100.0	100	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	200	
4 Agr. Machinery					
Hand Tractor	Hour	50	13.0	650	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	0.83	120.0	100	"
Pump (Shallow Well)	Hour	58	13.0	754	"
Pump (Low-lift)	Hour	42	12.0	504	"
Sub-total	-	-	-	2,008	
5 Farm Labor	manday	41	45.0	1,835	
6 Total (1 - 5)	-	-	-	5,849	
7 Other Miscellaneous	L.S.	-	-	292	(5% of 6)
8 Grand Total	-	-	-	6,141	

Crop Yield: 3,300 Kg/ha G.P.V.: 11,946 Baht/ha

Unit Price: 3.62 Baht/Kg P.C.: 6,141 Baht/ha

N.P.V.: 5,805 Baht/ha

Economic Cost of Crop Production

(Without Project)

Subproject: Nong Khon Kaen

Crop: Paddy (B.C.)

Season: Dry , Variety: H.Y.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	75	4.0	300	
2 Fertilizer					
N (Nutrient Basis)	Kg	49	16.0	784	
P (")	Kg	40	17.8	712	
K (")	Kg	-	8.6	-	
Sub-total	-	-	-	1,496	
3 Agr. Chemicals					
Fungicide	time	1	100.0	100	
Pesticide	"	1	100.0	100	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	200	
4 Agr. Machinery					
Hand Tractor	Hour	50	13.0	650	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	1.2	120.0	144	"
Pump (Shallow Well)	Hour	450	13.0	5,850	"
Pump (Low-lift)	Hour	8.5	12.0	102	"
Sub-total	-	-	-	6,746	
5 Farm Labor	manday	41	45.0	1,845	
6 Total (1 - 5)	-	-	-	10,587	
7 Other Miscellaneous	L.S.	-	-	529	(5% of 6)
8 Grand Total	-	-	-	11,116	

Crop Yield: 4,600 Kg/ha
Unit Price: 3.62 Baht/Kg

G.P.V.: 16,652 Baht/ha
P.C.: 11,116 Baht/ha
N.P.V.: 5,536 Baht/ha

Economic Cost of Crop Production

(Without Project)

Subproject: Nong Khon Kaen

Crop: Mungbean

Season: Dry

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	25	10.0	250	
2 Fertilizer					
N (Nutrient Basis)	Kg	-	16.0	-	
P (")	Kg	-	17.8	-	
K (")	Kg	-	8.6	-	
Sub-total	-	-	-	-	
3 Agr. Chemicals					
Fungicide	time	1	100.0	100	
Pesticide	"	-	100.0	-	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	100	
4 Agr. Machinery					
Hand Tractor	Hour	35	13.0	455	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	-	120.0	-	"
Pump (Shallow Well)	Hour	12	13.0	156	"
Pump (Low-lift)	Hour	21	12.0	252	"
Sub-total	-	-	-	863	
5 Farm Labor	manday	38	45.0	1,710	
6 Total (1 - 5)	-	-	-	2,923	
7 Other Miscellaneous	L.S.	-	-	146	(5% of 6)
8 Grand Total	-	-	-	3,069	

Crop Yield: 1,000 Kg/ha
Unit Price: 8.00 Baht/Kg

G.P.V.: 8,000 Baht/ha
P.C.: 3,069 Baht/ha
N.P.V.: 4,931 Baht/ha

Economic Cost of Crop Production

(With Project)

Subproject: Nong Khon Kaen

Crop: Paddy (B.C.)

Season: Wet , Variety: H.Y.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	75	4.0	160	
2 Fertilizer					
N (Nutrient Basis)	Kg	49	16.0	784	
P (")	Kg	50	17.8	890	
K (")	Kg	20	8.6	172	
Sub-total	-	-	-	1,846	
3 Agr. Chemicals					
Fungicide	time	2	100.0	200	
Pesticide	"	1	100.0	100	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	57	13.0	741	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	1.3	120.0	156	"
Pump (Shallow Well)	Hour	26	13.0	338	"
Pump (Low-lift)	Hour	48	12.0	576	"
Sub-total	-	-	-	1,811	
5 Farm Labor	manday	42	35.0	1,890	
6 Total (1 - 5)	-	-	-	6,247	
7 Other Miscellaneous	L.S.	-	-	312	(5% of 6)
8 Grand Total	-	-	-	6,559	

Crop Yield: 4,900 Kg/ha

Unit Price: 3.62 Baht/Kg

G.P.V.: 17,738 Baht/ha

P.C.: 6,559 Baht/ha

N.P.V.: 11,179 Baht/ha

Economic Cost of Crop Production

(With Project)

Subproject: Nong Khon Kaen

Crop: Soybean

Season: Dry (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	50	7.0	350	
2 Fertilizer					
N (Nutrient Basis)	Kg	24	16.0	384	
P (")	Kg	30	17.8	534	
K (")	Kg	10	8.6	86	
Sub-total	-	-	-	1,004	
3 Agr. Chemicals					
Fungicide	time	1	100.0	100	
Pesticide	"	2	100.0	200	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	43	13.0	559	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	0.5	120.0	60	"
Pump (Shallow Well)	Hour	251	13.0	3,263	"
Pump (Low-lift)	Hour	15	12.0	180	"
Sub-total	-	-	-	4,062	
5 Farm Labor	manday	49	45.0	2,205	
6 Total (1 - 5)	-	-	-	8,021	
7 Other Miscellaneous	L.S.	-	-	401	(5% of 6)
8 Grand Total	-	-	-	8,422	

Crop Yield: 1,800 Kg/ha

Unit Price: 6.44 Baht/Kg

G.P.V.: 11,592 Baht/ha

P.C.: 8,422 Baht/ha

N.P.V.: 3,170 Baht/ha

Economic Cost of Crop Production

(With Project)

Subproject: Nong Khon Kaen

Crop: Vegetables (Cabbage)

Season: Wet & Dry (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	dl	19	200.0	3,800	
2 Fertilizer					
N (Nutrient Basis)	Kg	126	16.0	2,016	
P (")	Kg	32	17.8	570	
K (")	Kg	45	8.6	387	
Sub-total	-	-	-	2,973	
3 Agr. Chemicals					
Fungicide	time	2	100.0	200	
Pesticide	"	2	100.0	200	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	51	13.0	663	incl. fuel
Medium-size Tractor	Hour	9	220.0	1,980	"
Thresher (4 tons/hr)	Hour	-	120.0	-	"
Pump (Shallow Well)	Hour	232	13.0	3,016	"
Pump (Low-lift)	Hour	21	12.0	252	"
Sub-total	-	-	-	5,911	
5 Farm Labor	manday	230	45.0	10,350	
6 Total (1 - 5)	-	-	-	23,434	
7 Other Miscellaneous	L.S.	-	-	2,343	(10% of 6)
8 Grand Total	-	-	-	25,777	

Crop Yield: 18,000 Kg/ha

Unit Price: 2.00 Baht/Kg

G.P.V.: 36,000 Baht/ha

P.C.: 25,777 Baht/ha

N.P.V.: 10,223 Baht/ha

Economic Cost of Crop Production

(With Project)

Subproject: Nong Khon Kaen

Crop: Vegetables (Watermelon)

Season: Dry (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	dl	20	200.0	4,000	
2 Fertilizer					
N (Nutrient Basis)	Kg	107	16.0	1,712	
P (")	Kg	20	17.8	356	
K (")	Kg	20	8.6	172	
Sub-total	-	-	-	2,240	
3 Agr. Chemicals					
Fungicide	time	3	100.0	300	
Pesticide	"	3	100.0	300	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	600	
4 Agr. Machinery					
Hand Tractor	Hour	65	13.0	845	incl. fuel
Medium-size Tractor	Hour	9	220.0	1,980	"
Thresher (4 tons/hr)	Hour	-	120.0	-	"
Pump (Shallow Well)	Hour	232	13.0	3,016	"
Pump (Low-lift)	Hour	21	12.0	252	"
Sub-total	-	-	-	6,093	
5 Farm Labor	manday	142	45.0	6,390	
6 Total (1 - 5)	-	-	-	19,323	
7 Other Miscellaneous	L.S.	-	-	1,932	(10% of 6)
8 Grand Total	-	-	-	21,255	

Crop Yield: 23,000 Kg/ha

Unit Price: 1.50 Baht/Kg

G.P.V.: 34,500 Baht/ha

P.C.: 21,255 Baht/ha

N.P.V.: 13,245 Baht/ha

Economic Cost of Crop Production

(Without Project)

Subproject: Thung Sai Yart

Crop: Paddy (T.P.)

Season: Wet , Variety: L.V. & L.I.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	4.0	160	
2 Fertilizer					
N (Nutrient Basis)	Kg	-	16.0	-	
P (")	Kg	-	17.8	-	
K (")	Kg	-	8.6	-	
Sub-total	-	-	-	-	
3 Agr. Chemicals					
Fungicide	time	-	100.0	-	
Pesticide	"	-	100.0	-	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	-	
4 Agr. Machinery					
Hand Tractor	Hour	41	13.0	533	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	0.3	120.0	36	"
Pump (Shallow Well)	Hour	-	13.0	-	"
Pump (Low-lift)	Hour	-	12.0	-	"
Sub-total	-	-	-	569	
5 Farm Labor	manday	58	35.0	2,030	
6 Total (1 - 5)	-	-	-	2,759	
7 Other Miscellaneous	L.S.	-	-	138	(5% of 6)
8 Grand Total	-	-	-	2,897	

Crop Yield: 1,000 Kg/ha G.P.V.: 3,620 Baht/ha

Unit Price: 3.62 Baht/Kg P.C.: 2,897 Baht/ha

N.P.V.: 723 Baht/ha

Economic Cost of Crop Production

(Without Project)

Subproject: Thung Sai Yart

Crop: Mungbean

Season: Wet (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	25	10.0	250	
2 Fertilizer					
N (Nutrient Basis)	Kg	-	16.0	-	
P (")	Kg	-	17.8	-	
K (")	Kg	-	8.6	-	
Sub-total	-	-	-	-	
3 Agr. Chemicals					
Fungicide	time	1	100.0	100	
Pesticide	"	-	100.0	-	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	-	
4 Agr. Machinery					
Hand Tractor	Hour	35	13.0	455	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	-	120.0	-	"
Pump (Shallow Well)	Hour	-	13.0	-	"
Pump (Low-lift)	Hour	-	12.0	-	"
Sub-total	-	-	-	455	
5 Farm Labor	manday	38	35.0	1,330	
6 Total (1 - 5)	-	-	-	2,135	
7 Other Miscellaneous	L.S.	-	-	107	(5% of 6)
8 Grand Total	-	-	-	2,242	

Crop Yield: 1,200 Kg/ha G.P.V.: 8,000 Baht/ha

Unit Price: 8.00 Baht/Kg P.C.: 2,242 Baht/ha

N.P.V.: 7,358 Baht/ha

Economic Cost of Crop Production

(With Project)

Subproject: Thung Sai Yart

Crop: Paddy (T.P.)

Season: Wet , Variety: L.V. (1) (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	4.0	160	
2 Fertilizer					
N (Nutrient Basis)	Kg	-	16.0	-	
P (")	Kg	-	17.8	-	
K (")	Kg	-	8.6	-	
Sub-total	-	-	-	-	
3 Agr. Chemicals					
Fungicide	time	-	100.0	-	
Pesticide	"	-	100.0	-	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	-	
4 Agr. Machinery					
Hand Tractor	Hour	41	13.0	533	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	-	120.0	-	"
Pump (Shallow Well)	Hour	-	13.0	-	"
Pump (Low-lift)	Hour	-	12.0	-	"
Sub-total	-	-	-	533	
5 Farm Labor	manday	58	35.0	2,030	
6 Total (1 - 5)	-	-	-	2,723	
7 Other Miscellaneous	L.S.	-	-	136	(5% of 6)
8 Grand Total	-	-	-	2,859	

Crop Yield: 1,200 Kg/ha G.P.V.: 4,344 Baht/ha

Unit Price: 3.62 Baht/Kg P.C.: 2,859 Baht/ha

N.P.V.: 1,485 Baht/ha

Economic Cost of Crop Production

(With Project)

Subproject: Thung Sai Yart

Crop: Paddy (T.P.)

Season: Wet , Variety: L.V. (2) (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	4.0	160	
2 Fertilizer					
N (Nutrient Basis)	Kg	20	16.0	320	
P (")	Kg	-	17.8	-	
K (")	Kg	-	8.6	-	
Sub-total	-	-	-	320	
3 Agr. Chemicals					
Fungicide	time	2	100.0	200	
Pesticide	"	1	100.0	100	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	300	
4 Agr. Machinery					
Hand Tractor	Hour	57	13.0	741	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	0.63	120.0	76	"
Pump (Shallow Well)	Hour	-	13.0	-	"
Pump (Low-lift)	Hour	99	12.0	1,188	"
Sub-total	-	-	-	2,005	
5 Farm Labor	manday	64	35.0	2,240	
6 Total (1 - 5)	-	-	-	5,025	
7 Other Miscellaneous	L.S.	-	-	251	(5% of 6)
8 Grand Total	-	-	-	5,276	

Crop Yield: 2,500 Kg/ha G.P.V.: 9,050 Baht/ha

Unit Price: 3.62 Baht/Kg P.C.: 5,276 Baht/ha

N.P.V.: 3,774 Baht/ha

Economic Cost of Crop Production

(With Project)

Subproject: Thung Sai Yart

Crop: Paddy (T.P.)

Season: Wet , Variety: L.I.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	4.0	160	
2 Fertilizer					
N (Nutrient Basis)	Kg	29	16.0	464	
P (")	Kg	25	17.8	445	
K (")	Kg	20	8.6	172	
Sub-total	-	-	-	1,081	
3 Agr. Chemicals					
Fungicide	time	2	100.0	200	
Pesticide	"	1	100.0	100	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	57	13.0	741	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	0.9	120.0	108	"
Pump (Shallow Well)	Hour	-	13.0	-	"
Pump (Low-lift)	Hour	70	12.0	840	"
Sub-total	-	-	-	1,689	
5 Farm Labor	manday	67	35.0	2,345	
6 Total (1 - 5)	-	-	-	5,675	
7 Other Miscellaneous	L.S.	-	-	284	(5% of 6)
8 Grand Total	-	-	-	5,959	

Crop Yield: 3,400 Kg/ha G.P.V.: 12,308 Baht/ha

Unit Price: 3.62 Baht/Kg P.C.: 5,959 Baht/ha

N.P.V.: 6,349 Baht/ha

Economic Cost of Crop Production

(With Project)

Subproject: Thung Sai Yart

Crop: Paddy (T.P.)

Season: Wet , Variety: H.Y.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	4.0	160	
2 Fertilizer					
N (Nutrient Basis)	Kg	48	16.0	768	
P (")	Kg	50	17.8	890	
K (")	Kg	25	8.6	215	
Sub-total	-	-	-	1,873	
3 Agr. Chemicals					
Fungicide	time	2	100.0	200	
Pesticide	"	1	100.0	100	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	57	13.0	741	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	1.2	120.0	126	"
Pump (Shallow Well)	Hour	-	13.0	-	"
Pump (Low-lift)	Hour	62	12.0	744	"
Sub-total	-	-	-	1,605	
5 Farm Labor	manday	67	35.0	2,345	
6 Total (1 - 5)	-	-	-	6,389	
7 Other Miscellaneous	L.S.	-	-	313	(5% of 6)
8 Grand Total	-	-	-	6,702	

Crop Yield: 4,200 Kg/ha G.P.V.: 15,204 Baht/ha

Unit Price: 3.62 Baht/Kg P.C.: 6,702 Baht/ha

N.P.V.: 8,502 Baht/ha

Economic Cost of Crop Production

(With Project)

Subproject: Thung Sai Yart

Crop: Soybean

Season: Dry

(Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	50	8.0	400	
2 Fertilizer					
N (Nutrient Basis)	Kg	24	16.0	384	
P (")	Kg	30	17.8	534	
K (")	Kg	10	8.6	86	
Sub-total	-	-	-	1,004	
3 Agr. Chemicals					
Fungicide	time	1	100.0	100	
Pesticide	"	2	100.0	200	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	43	13.0	559	incl. fuel
Medium-size Tractor	Hour	-	220.0	-	"
Thresher (4 tons/hr)	Hour	0.5	120.0	60	"
Pump (Shallow Well)	Hour	-	13.0	-	"
Pump (Low-lift)	Hour	63	12.0	756	"
Sub-total	-	-	-	1,375	
5 Farm Labor	manday	49	35.0	1,715	
6 Total (1 - 5)	-	-	-	4,894	
7 Other Miscellaneous	L.S.	-	-	245	(5% of 6)
8 Grand Total	-	-	-	5,139	

Crop Yield: 1,800 Kg/ha

Unit Price: 6.44 Baht/Kg

G.P.V.: 11,592 Baht/ha

P.C.: 5,139 Baht/ha

N.P.V.: 6,453 Baht/ha

C-3-5 Financial Cost of Crop Production[1]

(Without Project)

Subproject: Nong Khon Kaen

Crop: Paddy

Season: Wet , Variety: L.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	3.5	140	
2 Fertilizer					
N (Nutrient Basis)	Kg	-	16.5	-	
P (")	Kg	-	18.4	-	
K (")	Kg	-	8.9	-	
Sub-total	-	-	-	-	
3 Agr. Chemicals					
Fungicide	time	-	100.0	-	
Pesticide	"	-	100.0	-	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	-	
4 Agr. Machinery					
Hand Tractor	Hour	40	16.0	640	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	0.6	150.0	90	"
Pump (Shallow Well)	Hour	58	18.0	1,044	"
Pump (Low-lift)	Hour	42	14.0	588	"
Sub-total	-	-	-	2,362	
5 Total (1 - 4)	-	-	-	2,502	
6 Other Miscellaneous	L.S.	-	-	125	(5% of 5)
7 Grand Total	-	-	-	2,627	

Note: [1] Not including cost of labor

Crop Yield: 2,200 Kg/ha
Unit Price: 3.14 Baht/Kg

G.P.V.: 5,908 Baht/ha
P.C.: 2,627 Baht/ha
N.P.V.: 4,281 Baht/ha

Financial Cost of Crop Production[1]

(Without Project)

Subproject: Nong Khon Kaen

Crop: Paddy

Season: Wet , Variety: H.Y.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	75	3.5	263	
2 Fertilizer					
N (Nutrient Basis)	Kg	49	16.5	809	
P (")	Kg	40	18.4	736	
K (")	Kg	-	8.9	-	
Sub-total	-	-	-	1,545	
3 Agr. Chemicals					
Fungicide	time	-	100.0	-	
Pesticide	"	1	100.0	100	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	200	
4 Agr. Machinery					
Hand Tractor	Hour	50	16.0	800	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	0.83	150.0	125	"
Pump (Shallow Well)	Hour	58	18.0	1,044	"
Pump (Low-lift)	Hour	42	14.0	588	"
Sub-total	-	-	-	2,557	
5 Total (1 - 4)	-	-	-	4,565	
6 Other Miscellaneous	L.S.	-	-	228	(5% of 5)
7 Grand Total	-	-	-	4,793	

Note: [1] Not including cost of labor

Crop Yield: 3,300 Kg/ha
Unit Price: 3.14 Baht/Kg

G.P.V.: 10,362 Baht/ha
P.C.: 4,793 Baht/ha
N.P.V.: 5,569 Baht/ha

Financial Cost of Crop Production[1]

(Without Project)

Subproject: Nong Khon Kaen

Crop: Paddy

Season: Dry , Variety: H.Y.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	75	3.5	263	
2 Fertilizer					
N (Nutrient Basis)	Kg	49	16.5	809	
P (")	Kg	40	18.4	736	
K (")	Kg	-	8.9	-	
Sub-total	-	-	-	1,545	
3 Agr. Chemicals					
Fungicide	time	1	100.0	100	
Pesticide	"	1	100.0	100	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	200	
4 Agr. Machinery					
Hand Tractor	Hour	50	16.0	800	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	1.2	150.0	180	"
Pump (Shallow Well)	Hour	450	18.0	8,100	"
Pump (Low-lift)	Hour	8.5	14.0	119	"
Sub-total	-	-	-	9,199	
5 Total (1 - 4)	-	-	-	11,207	
6 Other Miscellaneous	L.S.	-	-	560	(5% of 5)
7 Grand Total	-	-	-	11,767	

Note: [1] Not including cost of labor

Crop Yield: 4,600 Kg/ha G.P.V.: 14,444 Baht/ha

Unit Price: 3.14 Baht/Kg P.C.: 11,767 Baht/ha

N.P.V.: 2,677 Baht/ha

Financial Cost of Crop Production[1]

(Without Project)

Subproject: Nong Khon Kaen

Crop: Mungbean

Season: Dry (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	25	10.0	250	
2 Fertilizer					
N (Nutrient Basis)	Kg	-	16.5	-	
P (")	Kg	-	18.4	-	
K (")	Kg	-	8.9	-	
Sub-total	-	-	-	-	
3 Agr. Chemicals					
Fungicide	time	1	100.0	100	
Pesticide	"	-	100.0	-	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	100	
4 Agr. Machinery					
Hand Tractor	Hour	35	16.0	560	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	-	150.0	-	"
Pump (Shallow Well)	Hour	12	18.0	216	"
Pump (Low-lift)	Hour	21	14.0	294	"
Sub-total	-	-	-	1,070	
5 Total (1 - 4)	-	-	-	1,420	
6 Other Miscellaneous	L.S.	-	-	71	(5% of 5)
7 Grand Total	-	-	-	1,491	

Note: [1] Not including cost of labor

Crop Yield: 1,000 Kg/ha G.P.V.: 8,000 Baht/ha

Unit Price: 8.00 Baht/Kg P.C.: 1,491 Baht/ha

N.P.V.: 6,509 Baht/ha

Financial Cost of Crop Production[1]

(With Project)

Subproject: Nong Khon Kaen

Crop: Paddy

Season: Wet , Variety: H.Y.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	75	3.5	263	
2 Fertilizer					
N (Nutrient Basis)	Kg	49	16.5	809	
P (")	Kg	50	18.4	920	
K (")	Kg	20	8.9	178	
Sub-total	-	-	-	1,907	
3 Agr. Chemicals					
Fungicide	time	2	100.0	200	
Pesticide	"	1	100.0	100	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	57	16.0	912	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	1.3	150.0	195	"
Pump (Shallow Well)	Hour	26	18.0	468	"
Pump (Low-lift)	Hour	48	14.0	672	"
Sub-total	-	-	-	2,247	
5 Total (1 - 4)	-	-	-	4,817	
6 Other Miscellaneous	L.S.	-	-	241	(5% of 5)
7 Grand Total	-	-	-	5,058	

Note: [1] Not including cost of labor

Crop Yield: 4,900 Kg/ha G.P.V.: 15,386 Baht/ha

Unit Price: 3.14 Baht/Kg P.C.: 5,058 Baht/ha

N.P.V.: 10,328 Baht/ha

Financial Cost of Crop Production[1]

(With Project)

Subproject: Nong Khon Kaen

Crop: Soybean

Season: Dry (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	50	8.0	400	
2 Fertilizer					
N (Nutrient Basis)	Kg	24	16.5	396	
P (")	Kg	30	18.4	552	
K (")	Kg	10	8.9	89	
Sub-total	-	-	-	1,037	
3 Agr. Chemicals					
Fungicide	time	1	100.0	100	
Pesticide	"	2	100.0	200	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	43	16.0	688	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	0.5	150.0	75	"
Pump (Shallow Well)	Hour	251	18.0	4,518	"
Pump (Low-lift)	Hour	15	14.0	210	"
Sub-total	-	-	-	5,491	
5 Total (1 - 4)	-	-	-	7,328	
6 Other Miscellaneous	L.S.	-	-	366	(5% of 5)
7 Grand Total	-	-	-	7,694	

Note: [1] Not including cost of labor

Crop Yield: 1,800 Kg/ha G.P.V.: 11,844 Baht/ha

Unit Price: 6.58 Baht/Kg P.C.: 7,694 Baht/ha

N.P.V.: 4,150 Baht/ha

Financial Cost of Crop Production[1]

(With Project)

Subproject: Nong Khon Kaen

Crop: Vegetable (Leaf)

Season: Wet + Dry, (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	dl	19	200.0	3,800	
2 Fertilizer					
N (Nutrient Basis)	Kg	126	16.5	2,079	
P (")	Kg	32	18.4	589	
K (")	Kg	45	8.9	401	
Sub-total	-	-	-	3,069	
3 Agr. Chemicals					
Fungicide	time	2	100.0	200	
Pesticide	"	2	100.0	200	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	51	16.0	816	incl. fuel
Medium-size Tractor	Hour	9	300.0	2,700	"
Thresher (4 tons/hr)	Hour	-	150.0	-	"
Pump (Shallow Well)	Hour	232	18.0	4,176	"
Pump (Low-lift)	Hour	21	14.0	294	"
Sub-total	-	-	-	7,986	
5 Total (1 - 4)	-	-	-	15,255	
6 Other Miscellaneous	L.S.	-	-	1,526	(10% of 5)
7 Grand Total	-	-	-	16,781	

Note: [1] Not including cost of labor

Crop Yield: 18,000 Kg/ha
Unit Price: 2.00 Baht/Kg

G.P.V.: 36,000 Baht/ha
P.C.: 16,781 Baht/ha
N.P.V.: 19,219 Baht/ha

Financial Cost of Crop Production[1]

(With Project)

Subproject: Nong Khon Kaen

Crop: Vegetable (Fruits)

Season: Dry (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	dl	20	200.0	4,000	
2 Fertilizer					
N (Nutrient Basis)	Kg	107	16.5	1,766	
P (")	Kg	20	18.4	368	
K (")	Kg	20	8.9	178	
Sub-total	-	-	-	2,312	
3 Agr. Chemicals					
Fungicide	time	3	100.0	300	
Pesticide	"	3	100.0	300	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	600	
4 Agr. Machinery					
Hand Tractor	Hour	65	16.0	1,040	incl. fuel
Medium-size Tractor	Hour	9	300.0	2,700	"
Thresher (4 tons/hr)	Hour	-	150.0	-	"
Pump (Shallow Well)	Hour	232	18.0	4,176	"
Pump (Low-lift)	Hour	21	14.0	294	"
Sub-total	-	-	-	8,210	
5 Total (1 - 4)	-	-	-	15,122	
6 Other Miscellaneous	L.S.	-	-	1,512	(10% of 5)
7 Grand Total	-	-	-	16,634	

Note: [1] Not including cost of labor

Crop Yield: 23,000 Kg/ha
Unit Price: 1.50 Baht/Kg

G.P.V.: 34,500 Baht/ha
P.C.: 16,634 Baht/ha
N.P.V.: 17,866 Baht/ha

Financial Cost of Crop Production[1]

(Without Project)

Subproject: Thung Sai Yart

Crop: Paddy

Season: Wet , Variety: L.V., L.I.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	3.5	140	
2 Fertilizer					
N (Nutrient Basis)	Kg	-	16.5	-	
P (")	Kg	-	18.4	-	
K (")	Kg	-	8.9	-	
Sub-total	-	-	-	-	
3 Agr. Chemicals					
Fungicide	time	-	100.0	-	
Pesticide	"	-	100.0	-	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	-	
4 Agr. Machinery					
Hand Tractor	Hour	41	16.0	656	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	0.3	150.0	45	"
Pump (Shallow Well)	Hour	-	18.0	-	"
Pump (Low-lift)	Hour	-	14.0	-	"
Sub-total	-	-	-	701	
5 Total (1 - 4)	-	-	-	841	
6 Other Miscellaneous	L.S.	-	-	42	(5% of 5)
7 Grand Total	-	-	-	883	

Note: [1] Not including cost of labor

Crop Yield: 1,000 Kg/ha G.P.V.: 3,140 Baht/ha

Unit Price: 3.14 Baht/Kg P.C.: 883 Baht/ha

N.P.V.: 2,257 Baht/ha

Financial Cost of Crop Production[1]

(Without Project)

Subproject: Thung Sai Yart

Crop: Mungbean

Season: Wet (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	25	10.0	250	
2 Fertilizer					
N (Nutrient Basis)	Kg	-	16.5	-	
P (")	Kg	-	18.4	-	
K (")	Kg	-	8.9	-	
Sub-total	-	-	-	-	
3 Agr. Chemicals					
Fungicide	time	1	100.0	100	
Pesticide	"	-	100.0	-	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	100	
4 Agr. Machinery					
Hand Tractor	Hour	35	16.0	560	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	-	150.0	-	"
Pump (Shallow Well)	Hour	-	18.0	-	"
Pump (Low-lift)	Hour	-	14.0	-	"
Sub-total	-	-	-	560	
5 Total (1 - 4)	-	-	-	910	
6 Other Miscellaneous	L.S.	-	-	46	(5% of 5)
7 Grand Total	-	-	-	956	

Note: [1] Not including cost of labor

Crop Yield: 1,200 Kg/ha G.P.V.: 9,600 Baht/ha

Unit Price: 8.00 Baht/Kg P.C.: 956 Baht/ha

N.P.V.: 8,644 Baht/ha

Financial Cost of Crop Production[1]

(With Project)

Subproject: Thung Sai Yart

Crop: Paddy

Season: Wet , Variety: L.V. (1) (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	3.5	140	
2 Fertilizer					
N (Nutrient Basis)	Kg	-	16.5	-	
P (")	Kg	-	18.4	-	
K (")	Kg	-	8.9	-	
Sub-total	-	-	-	-	
3 Agr. Chemicals					
Fungicide	time	-	100.0	-	
Pesticide	"	-	100.0	-	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	-	
4 Agr. Machinery					
Hand Tractor	Hour	41	16.0	656	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	0.3	150.0	45	"
Pump (Shallow Well)	Hour	-	18.0	-	"
Pump (Low-lift)	Hour	-	14.0	-	"
Sub-total	-	-	-	701	
5 Total (1 - 4)	-	-	-	841	
6 Other Miscellaneous	L.S.	-	-	42	(5% of 5)
7 Grand Total	-	-	-	883	

Note: [1] Not including cost of labor

Crop Yield: 1,200 Kg/ha G.P.V.: 3,768 Baht/ha

Unit Price: 3.14 Baht/Kg P.C.: 883 Baht/ha

N.P.V.: 2,885 Baht/ha

Financial Cost of Crop Production[1]

(With Project)

Subproject: Thung Sai Yart

Crop: Paddy

Season: Wet , Variety: L.V. (2) (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	3.5	140	
2 Fertilizer					
N (Nutrient Basis)	Kg	20	16.5	330	
P (")	Kg	-	18.4	-	
K (")	Kg	-	8.9	-	
Sub-total	-	20	-	330	
3 Agr. Chemicals					
Fungicide	time	2	100.0	200	
Pesticide	"	1	100.0	100	
Herbicide	"	-	100.0	-	
Sub-total	-	-	-	300	
4 Agr. Machinery					
Hand Tractor	Hour	57	16.0	912	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	0.63	150.0	95	"
Pump (Shallow Well)	Hour	-	18.0	-	"
Pump (Low-lift)	Hour	99	14.0	1,386	"
Sub-total	-	-	-	2,393	
5 Total (1 - 4)	-	-	-	3,163	
6 Other Miscellaneous	L.S.	-	-	154	(5% of 5)
7 Grand Total	-	-	-	3,317	

Note: [1] Not including cost of labor

Crop Yield: 2,500 Kg/ha G.P.V.: 7,850 Baht/ha

Unit Price: 3.14 Baht/Kg P.C.: 3,317 Baht/ha

N.P.V.: 4,533 Baht/ha

Financial Cost of Crop Production[1]

(With Project)

Subproject: Thung Sai Yart

Crop: Paddy

Season: Wet , Variety: L.I.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	3.5	140	
2 Fertilizer					
N (Nutrient Basis)	Kg	29	16.5	479	
P (")	Kg	25	18.4	460	
K (")	Kg	20	8.9	178	
Sub-total	-	-	-	1,117	
3 Agr. Chemicals					
Fungicide	time	2	100.0	200	
Pesticide	"	1	100.0	100	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	57	16.0	912	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	0.9	150.0	135	"
Pump (Shallow Well)	Hour	-	18.0	-	"
Pump (Low-lift)	Hour	70	14.0	980	"
Sub-total	-	-	-	2,031	
5 Total (1 - 4)	-	-	-	3,688	
6 Other Miscellaneous	L.S.	-	-	184	(5% of 5)
7 Grand Total	-	-	-	3,872	

Note: [1] Not including cost of labor

Crop Yield: 3,400 Kg/ha G.P.V.: 10,676 Baht/ha

Unit Price: 3.14 Baht/Kg P.C.: 3,872 Baht/ha

N.P.V.: 6,804 Baht/ha

Financial Cost of Crop Production[1]

(With Project)

Subproject: Thung Sai Yart

Crop: Paddy

Season: Wet , Variety: H.Y.V. (Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	40	3.5	140	
2 Fertilizer					
N (Nutrient Basis)	Kg	48	16.5	792	
P (")	Kg	50	18.4	920	
K (")	Kg	25	8.9	223	
Sub-total	-	-	-	1,935	
3 Agr. Chemicals					
Fungicide	time	2	100.0	200	
Pesticide	"	1	100.0	100	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	57	16.0	912	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	1.0	150.0	150	"
Pump (Shallow Well)	Hour	-	18.0	-	"
Pump (Low-lift)	Hour	62	14.0	868	"
Sub-total	-	-	-	1,930	
5 Total (1 - 4)	-	-	-	4,405	
6 Other Miscellaneous	L.S.	-	-	220	(5% of 5)
7 Grand Total	-	-	-	4,625	

Note: [1] Not including cost of labor

Crop Yield: 4,000 Kg/ha G.P.V.: 12,560 Baht/ha

Unit Price: 3.14 Baht/Kg P.C.: 4,625 Baht/ha

N.P.V.: 7,935 Baht/ha

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Financial Cost of Crop Production[1]

(With Project)

Subproject: Thung Sai Yart

Crop: Soybean

Season: Dry

(Unit: per ha)

Particulars	Unit	Quantity	Unit Price (Baht)	Production Cost (Baht)	Remarks
1 Seed	Kg	50	8.0	400	
2 Fertilizer					
N (Nutrient Basis)	Kg	24	16.5	396	
P (")	Kg	30	18.4	552	
K (")	Kg	10	8.9	89	
Sub-total	-	-	-	1,037	
3 Agr. Chemicals					
Fungicide	time	1	100.0	100	
Pesticide	"	2	100.0	200	
Herbicide	"	1	100.0	100	
Sub-total	-	-	-	400	
4 Agr. Machinery					
Hand Tractor	Hour	43	16.0	688	incl. fuel
Medium-size Tractor	Hour	-	300.0	-	"
Thresher (4 tons/hr)	Hour	0.5	150.0	75	"
Pump (Shallow Well)	Hour	-	18.0	-	"
Pump (Low-lift)	Hour	63	14.0	882	"
Sub-total	-	-	-	1,645	
5 Total (1 - 4)	-	-	-	3,482	
6 Other Miscellaneous	L.S.	-	-	174	(5% of 5)
7 Grand Total	-	-	-	3,656	

Note: [1] Not including cost of labor

Crop Yield: 1,800 Kg/ha

Unit Price: 6.58 Baht/Kg

G.P.V.: 11,844 Baht/ha

P.C.: 3,656 Baht/ha

N.P.V.: 8,188 Baht/ha

C-3-6 Basis of Farm Machinery Cost

1. Two-wheel Tractor (8 Hp)

Basis of Calculation

a. Purchase price (financial): 35,000 Bahts
b. Durable life: 8 years or 8,000 hours
c. Residual value: 10% of purchase price
d. Interest on investment: 12% per year
e. Cost of spare and repairs: 60% of total investment
f. Fuel consumption at full load: 0.125 litre/hour/Hp
g. Diesel cost: 6.40 Bahts per litre
h. Cost of lubricants and filters: 10% of diesel cost
i. Average annual working hours: 1,000 hours
j. Operator cost: None (driven by owner farmer)

Hourly Cost

	Financial	C.F.	Economic
a. Depreciation [(35,000-3,500)/8,000]	3.94	0.84	3.31
b. Interest [(0.12x(0.5x35,000)/1000]	2.10	-	-
c. Spare & Repairs [(0.6x35,000)/8,000]	2.63	0.84	2.21
d. Fuel [8x0.125= 1.00 l/hr] @6.40	6.40	1.00	6.40
e. Lubricants [6.40x0.1]	0.64	1.00	0.64
f. Insurance	-	-	-
g. Operator	-	-	-
Sub-total	15.71	-	12.56
h. Other Miscellaneous	0.29	-	0.44
Total	16.00	-	13.00

2. Farm Tractor (30 Hp) with Rotary Plow

Basis of Calculation

a. Purchase price (financial): (380,000 + 149,000) Bahts
b. Durable life: 8 years or 8,000 hours
c. Residual value: 10% of purchase price
d. Interest on investment: 12% per year
e. Cost of spare and repairs: 80% of total investment
f. Fuel consumption at full load: 0.1 litre/hour/Hp
g. Diesel cost: 6.40 Bahts per litre
h. Cost of lubricants and filters: 10% of diesel cost
i. Annual insurance and shelter etc.: 1.5 %
j. Operator cost: Driver's hourly wage - 20 Bahts per hour
k. Average annual working hours: 1,000 hours

Hourly Cost

	Financial	C.F.	Economic
a. Depreciation [(529,000-52,900)/8,000]	59.51	0.84	49.99
b. Interest [(0.12x(0.5x529,000)/1,000]	31.74	-	-
c. Spare & Repairs [(0.7x529,000)/8,000]	46.29	0.84	38.88
d. Fuel [30x0.1=3.00 l/hr] @6.40	19.20	1.00	19.20
e. Lubricants [19.20x0.1]	1.92	1.00	1.92
f. Insurance, shelter [529,000x0.015/1,000]	7.94	1.00	7.94
g. Operator	20.00	1.00	20.00
Sub-total	186.60	-	137.93
h. Other Miscellaneous	13.40	-	12.07
Operating Cost	200.00	-	150.00
i. Contractors Profit	100.00	0.70	70.00
Total	300.00	-	220.00

3. Low-lift Pump

Basis of Calculation

a. Purchase price (financial): 25,000 Bahts
b. Durable life: 8 years or 8,000 hours
c. Residual value: 5% of purchase price
d. Interest on investment: 12% per year
e. Cost of spare and repairs: 55% of total investment
f. Fuel consumption at full load: 0.125 litre/hour/Hp
g. Diesel cost: 6.40 Bahts per litre
h. Cost of lubricants and filters: 10% of diesel cost
i. Average annual working hours: 1,000 hours
j. Operator cost: None (driven by farmer himself)

Hourly Cost

	Financial	C.F.	Economic
a. Depreciation [(25,000-1,250)/8,000]	2.97	0.84	2.49
b. Interest [(0.12x(0.5x25,000)/1,000]	1.50	-	-
c. Spare & Repairs [(0.55x25,000)/8,000]	1.72	0.84	1.44
d. Fuel [8x0.125= 1.00 l/hr] @6.40	6.40	1.00	6.40
e. Lubricants [6.40x0.1]	0.64	1.00	0.64
f. Insurance	-	-	-
g. Operator	-	-	-
Sub-total	13.23	-	10.97
h. Other Miscellaneous	0.77	-	1.03
Total	14.00	-	12.00

4. Shallow Well Pumping

Basis of Calculation

- Pump with Engine
  a. Purchase price (financial): 27,000 Bahts
  b. Durable life: 8 years or 8,000 hours
  c. Residual value: 5% of purchase price
  d. Interest on investment: 12% per year
  e. Cost of spare and repairs: 55% of total investment
  f. Fuel consumption at full load: 0.125 litre/hour/Hp
  g. Diesel cost: 6.40 Bahts per litre
  h. Cost of lubricants and filters: 10% of diesel cost
  i. Average annual working hours: 1,000 hours
  j. Operator cost: None (driven by farmer himself)
- Shallow Well
  a. Construction cost (financial): 35,000 Bahts
  b. Durable life: 20 years
  c. Residual value: None

Hourly Cost

	Financial	C.F.	Economic
a. Depreciation			
- Well [27,000/20/1,000]	1.75	0.88	1.54
- Pump [(27,000-1,350)/8,000]	3.21	0.84	2.70
b. Interest			
[(0.12x0.5x(35,000+27,000)/1,000]	3.72	-	-
c. Spare & Repairs [(0.55x27,000)/8,000]	1.86	0.84	1.56
d. Fuel [8x0.125= 0.64 l/hr] @6.40	6.40	1.00	6.40
e. Lubricants [6.40x0.1]	0.64	1.00	0.64
f. Insurance	-	-	-
g. Operator	-	-	-
Sub-total	17.58	-	12.84
h. Other Miscellaneous	0.42	-	0.16
Total	18.00	-	13.00

5. Thresher with Engine (10 Hp)

Basis of Calculation

a. Purchase price (financial): (83,000 + 27,000) Bahts
b. Durable life: 8 years or 4,000 hours
c. Residual value: 5% of purchase price
d. Interest on investment: 12% per year
e. Cost of spare and repairs: 100% of total investment
f. Fuel consumption at full load: 0.125 litre/hour/Hp
g. Diesel cost: 6.40 Bahts per litre
h. Cost of lubricants and filters: 10% of diesel cost
i. Average working efficiency: 85%
j. Operator cost: Two Assistants' wage - 20 Bahts per hour
k. Average annual working hours: 500 hours

Hourly Cost

	Financial	C.F.	Economic
a. Depreciation [(110,000-5,500)/4,000]	26.13	0.84	21.95
b. Interest [(0.12x(0.5x110,000)/500]	13.20	-	-
c. Spare & Repairs [(1.0x110,000)/4,000]	27.50	0.84	23.10
d. Fuel [10x0.125x1.2=1.50 l/hr] @6.40	9.60	1.00	9.60
e. Lubricants [9.60x0.1]	0.96	1.00	0.96
f. Operator	20.00	1.00	20.00
Sub-total	97.39		75.61
h. Other Miscellaneous	2.61	-	9.39
Operating Cost	100.00	-	85.00
i. Contractors Profit	50.00	0.70	35.00
Total	150.00	-	120.00

C-3-7 Annual Requirement for Production Credit

Crop	Cash Expenditure per ha					Cropped Area	Credit Requirement
	Seed (฿/ha)	Fertilizer (฿/ha)	Chemical (฿/ha)	Fuel (฿/ha)	Total (฿/ha)	(ha)	(฿1,000)
Nong Khon Kaen							
Paddy	263	1,907	400	791	3,361	900	3,025
Soybean	400	1,037	400	1,404	3,241	310	1,005
Vegetable (Fruit)	4,000	2,312	600	1,501	8,413	60	505
Vegetable (Leaf)	3,800	3,069	400	1,411	8,680	30	260
Fruits*1	-	15,000	5,000	1,300	21,300	40	852
Total	-	-	-	-		1,340	5,647
Thung Sai Yart							
Paddy (LV-1)	-	-	-	265	265	1,890	501
Paddy (LV-2)	-	330	300	1,004	1,634	310	507
Paddy (LIV)	70	1,117	400	821	2,408	380	915
Paddy (HYV)	140	1,935	400	771	3,246	2,180	7,076
Soybean	400	1,037	400	683	2,520	660	1,663
Fruits*1	-	15,000	5,000	1,300	21,300	40	852
Total	-	-	-	-		5,460	11,514
NKK + TSY	-	-	-	-	-	6,800	17,161

Note: *1 at full production stage

C-3-8 Financial Model for Economic Farm Size

Sub-project: Nong Khon Kaen - North
Cost Recovery Case: O/M Cost only

	Unit	Paddy	Soybean	Vegetab.	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	10,328	4,150	18,542	-
b. Cropping Intensity	%	100	27	7	134
c. Gross Crop Income	Bahts/ha				12,747
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	305
- Other Agr. Infra.	- " -	-	-	-	226
- Post-harvest facility	- " -	-	-	-	220
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Ingra.	- " -	-	-	-	-
- Post-harvest facility	- " -	-	-	-	-
c. Sub-total	- " -	-	-	-	751
3. Net Crop Income	- " -	-	-	-	11,996
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	9,000
b. Household Expenditure	Bahts/HH	-	-	-	28,822
c. Sub-total	Bahts/HH	-	-	-	37,822
5. Off-farm Income	Bahts/HH	-	-	-	20,606
6. Required Farm Income	Bahts/HH	-	-	-	17,216
7. Required Farm Size	ha	-	-	-	1.44

Financial Model for Economic Farm Size

Sub-project: Nong Khon Kaen - North
Cost Recovery Case: O/M Cost + Post-harvest

	Unit	Paddy	Soybean	Vegetab.	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	10,328	4,150	18,542	-
b. Cropping Intensity	%	100	27	7	134
c. Gross Crop Income	Bahts/ha				12,747
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	305
- Other Agr. Infra.	- " -	-	-	-	226
- Post-harvest facility	- " -	-	-	-	220
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Ingra.	- " -	-	-	-	-
- Post-harvest facility	- " -	-	-	-	246
c. Sub-total	- " -	-	-	-	997
3. Net Crop Income	- " -	-	-	-	11,750
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	9,000
b. Household Expenditure	Bahts/HH	-	-	-	28,822
c. Sub-total	Bahts/HH	-	-	-	37,822
5. Off-farm Income	Bahts/HH	-	-	-	20,606
6. Required Farm Income	Bahts/HH	-	-	-	17,216
7. Required Farm Size	ha	-	-	-	1.47

Financial Model for Economic Farm Size

Sub-project: Nong Khon Kaen - North

Cost Recovery Case: O/M Cost + Post-harvest + 1/2 of Agr. Infra.

	Unit	Paddy	Soybean	Vegetab.	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	10,328	4,150	18,542	-
b. Cropping Intensity	%	100	27	7	134
c. Gross Crop Income	Bahts/ha				12,747
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	305
- Other Agr. Infra.	- " -	-	-	-	226
- Post-harvest facility	- " -	-	-	-	220
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	2,236
- Other Agr. Ingra.	- " -	-	-	-	1,952
- Post-harvest facility	- " -	-	-	-	246
c. Sub-total	- " -	-	-	-	5,185
3. Net Crop Income	- " -	-	-	-	7,562
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	9,000
b. Household Expenditure	Bahts/HH	-	-	-	28,822
c. Sub-total	Bahts/HH	-	-	-	37,822
5. Off-farm Income	Bahts/HH	-	-	-	20,606
6. Required Farm Income	Bahts/HH	-	-	-	17,216
7. Required Farm Size	ha	-	-	-	2.28

Financial Model for Economic Farm Size

Sub-project: Nong Khon Kaen - North

Cost Recovery Case: O/M Cost + Post-harvest + of Agr. Infra.

	Unit	Paddy	Soybean	Vegetab.	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	10,328	4,150	18,542	-
b. Cropping Intensity	%	100	27	7	134
c. Gross Crop Income	Bahts/ha				12,747
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	305
- Other Agr. Infra.	- " -	-	-	-	226
- Post-harvest facility	- " -	-	-	-	220
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	4,472
- Other Agr. Ingra.	- " -	-	-	-	3,903
- Post-harvest facility	- " -	-	-	-	246
c. Sub-total	- " -	-	-	-	9,372
3. Net Crop Income	- " -	-	-	-	3,375
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	9,000
b. Household Expenditure	Bahts/HH	-	-	-	28,822
c. Sub-total	Bahts/HH	-	-	-	37,822
5. Off-farm Income	Bahts/HH	-	-	-	20,606
6. Required Farm Income	Bahts/HH	-	-	-	17,216
7. Required Farm Size	ha	-	-	-	5.10

Financial Model for Economic Farm Size

Sub-project: Nong Khon Kaen - South

Cost Recovery Case: O/M only

	Unit	Paddy	Soybean	Vegetab.	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	10,328	4,150	18,542	-
b. Cropping Intensity	%	100	15	-	115
c. Gross Crop Income	Bahts/ha	10,328	623	-	10,951
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	305
- Other Agr. Infra.	- " -	-	-	-	226
- Post-harvest facility	- " -	-	-	-	220
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Ingra.	- " -	-	-	-	-
- Post-harvest facility	- " -	-	-	-	-
c. Sub-total	- " -	-	-	-	751
3. Net Crop Income	- " -	-	-	-	10,200
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	7,000
b. Household Expenditure	Bahts/HH	-	-	-	28,822
c. Sub-total	Bahts/HH	-	-	-	35,822
5. Off-farm Income	Bahts/HH	-	-	-	20,606
6. Required Farm Income	Bahts/HH	-	-	-	15,216
7. Required Farm Size	ha	-	-	-	1.49

Financial Model for Economic Farm Size

Sub-project: Nong Khon Kaen - South

Cost Recovery Case: O/M cost + Post-harvest

	Unit	Paddy	Soybean	Vegetab.	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	10,328	4,150	18,542	-
b. Cropping Intensity	%	100	15	-	115
c. Gross Crop Income	Bahts/ha	10,328	623	-	10,951
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	305
- Other Agr. Infra.	- " -	-	-	-	226
- Post-harvest facility	- " -	-	-	-	220
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Ingra.	- " -	-	-	-	-
- Post-harvest facility	- " -	-	-	-	246
c. Sub-total	- " -	-	-	-	997
3. Net Crop Income	- " -	-	-	-	9,954
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	7,000
b. Household Expenditure	Bahts/HH	-	-	-	28,822
c. Sub-total	Bahts/HH	-	-	-	35,822
5. Off-farm Income	Bahts/HH	-	-	-	20,606
6. Required Farm Income	Bahts/HH	-	-	-	15,216
7. Required Farm Size	ha	-	-	-	1.53

Financial Model for Economic Farm Size

Sub-project: Nong Khon Kaen - South

Cost Recovery Case: O/M cost + Post-harvest + 1/2 of Agr. Infra.

	Unit	Paddy	Soybean	Vegetab.	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	10,328	4,150	18,542	-
b. Cropping Intensity	%	100	15	-	115
c. Gross Crop Income	Bahts/ha	10,328	623	-	10,951
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	305
- Other Agr. Infra.	- " -	-	-	-	226
- Post-harvest facility	- " -	-	-	-	220
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	2,236
- Other Agr. Ingra.	- " -	-	-	-	1,952
- Post-harvest facility	- " -	-	-	-	246
c. Sub-total	- " -	-	-	-	5,185
3. Net Crop Income	- " -	-	-	-	5,766
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	7,000
b. Household Expenditure	Bahts/HH	-	-	-	28,822
c. Sub-total	Bahts/HH	-	-	-	35,822
5. Off-farm Income	Bahts/HH	-	-	-	20,606
6. Required Farm Income	Bahts/HH	-	-	-	15,216
7. Required Farm Size	ha	-	-	-	2.64

Financial Model for Economic Farm Size

Sub-project: Nong Khon Kaen - South

Cost Recovery Case: O/M cost + Post-harvest + Agr. Infra.

	Unit	Paddy	Soybean	Vegetab.	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	10,328	4,150	18,542	-
b. Cropping Intensity	%	100	15	-	115
c. Gross Crop Income	Bahts/ha	10,328	623	-	10,951
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	305
- Other Agr. Infra.	- " -	-	-	-	226
- Post-harvest facility	- " -	-	-	-	220
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	4,472
- Other Agr. Ingra.	- " -	-	-	-	3,903
- Post-harvest facility	- " -	-	-	-	246
c. Sub-total	- " -	-	-	-	9,372
3. Net Crop Income	- " -	-	-	-	1,579
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	7,000
b. Household Expenditure	Bahts/HH	-	-	-	28,822
c. Sub-total	Bahts/HH	-	-	-	35,822
5. Off-farm Income	Bahts/HH	-	-	-	20,606
6. Required Farm Income	Bahts/HH	-	-	-	15,216
7. Required Farm Size	ha	-	-	-	9.64

Financial Model for Economic Farm Size

Sub-project: Thung Sai Yart - Rainfed

Cost Recovery Case: O/M Cost only

	Unit	Paddy-LV	Paddy-HY	Soybean	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	3,116	7,935	8,188	-
b. Cropping Intensity	%	100	-	-	100
c. Gross Crop Income	Bahts/ha	3,116	-	-	3,116
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Infra.	- " -	-	-	-	61
- Post-harvest facility	- " -	-	-	-	59
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Infra.	- " -	-	-	-	-
- Post-harvest facility	- " -	-	-	-	-
c. Sub-total	- " -	-	-	-	120
3. Net Crop Income	- " -	-	-	-	2,996
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	5,000
b. Household Expenditure	Bahts/HH	-	-	-	19,503
c. Sub-total	Bahts/HH	-	-	-	24,053
5. Off-farm Income	Bahts/HH	-	-	-	13,157
6. Required Farm Income	Bahts/HH	-	-	-	10,896
7. Required Farm Size	ha	-	-	-	3.64

Financial Model for Economic Farm Size

Sub-project: Thung Sai Yart - Rainfed

Cost Recovery Case: O/M Cost + Post-harvest

	Unit	Paddy-LV	Paddy-HY	Soybean	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	3,116	7,935	8,188	-
b. Cropping Intensity	%	100	-	-	100
c. Gross Crop Income	Bahts/ha	3,116	-	-	3,116
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Infra.	- " -	-	-	-	61
- Post-harvest facility	- " -	-	-	-	59
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Infra.	- " -	-	-	-	-
- Post-harvest facility	- " -	-	-	-	124
c. Sub-total	- " -	-	-	-	244
3. Net Crop Income	- " -	-	-	-	2,872
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	5,000
b. Household Expenditure	Bahts/HH	-	-	-	19,503
c. Sub-total	Bahts/HH	-	-	-	24,053
5. Off-farm Income	Bahts/HH	-	-	-	13,157
6. Required Farm Income	Bahts/HH	-	-	-	10,896
7. Required Farm Size	ha	-	-	-	3.79

Financial Model for Economic Farm Size

Sub-project: Thung Sai Yart - Rainfed

Cost Recovery Case: O/M Cost + Post-harvest + 1/2 of Agr. Infra.

	Unit	Paddy-LV	Paddy-HY	Soybean	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	3,116	7,935	8,188	-
b. Cropping Intensity	%	100	-	-	100
c. Gross Crop Income	Bahts/ha	3,116	-	-	3,116
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Infra.	- " -	-	-	-	61
- Post-harvest facility	- " -	-	-	-	59
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Ingra.	- " -	-	-	-	1,675
- Post-harvest facility	- " -	-	-	-	124
c. Sub-total	- " -	-	-	-	1,919
3. Net Crop Income	- " -	-	-	-	1,197
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	5,000
b. Household Expenditure	Bahts/HH	-	-	-	19,503
c. Sub-total	Bahts/HH	-	-	-	24,053
5. Off-farm Income	Bahts/HH	-	-	-	13,157
6. Required Farm Income	Bahts/HH	-	-	-	10,896
7. Required Farm Size	ha	-	-	-	9.10

Financial Model for Economic Farm Size

Sub-project: Thung Sai Yart - Rainfed

Cost Recovery Case: O/M Cost + Post-harvest + of Agr. Infra.

	Unit	Paddy-LV	Paddy-HY	Soybean	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	3,116	7,935	8,188	-
b. Cropping Intensity	%	100	-	-	100
c. Gross Crop Income	Bahts/ha	3,116	-	-	3,116
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Infra.	- " -	-	-	-	61
- Post-harvest facility	- " -	-	-	-	59
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Ingra.	- " -	-	-	-	3,350
- Post-harvest facility	- " -	-	-	-	124
c. Sub-total	- " -	-	-	-	3,594
3. Net Crop Income	- " -	-	-	-	- 478
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	5,000
b. Household Expenditure	Bahts/HH	-	-	-	19,503
c. Sub-total	Bahts/HH	-	-	-	24,053
5. Off-farm Income	Bahts/HH	-	-	-	13,157
6. Required Farm Income	Bahts/HH	-	-	-	10,896
7. Required Farm Size	ha	-	-	-	-

Financial Model for Economic Farm Size

Sub-project: Thung Sai Yart - Irrigated
Cost Recovery Case: O/M Cost only

	Unit	Paddy-LV	Paddy-HY	Soybean	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	3,116	7,935	8,188	-
b. Cropping Intensity	%	-	100	27	117
c. Gross Crop Income	Bahts/ha	-	7,935	2,211	10,146
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	82
- Other Agr. Infra.	- " -	-	-	-	61
- Post-harvest facility	- " -	-	-	-	59
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Infra.	- " -	-	-	-	-
- Post-harvest facility	- " -	-	-	-	-
c. Sub-total	- " -	-	-	-	202
3. Net Crop Income	- " -	-	-	-	9,944
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	5,000
b. Household Expenditure	Bahts/HH	-	-	-	19,503
c. Sub-total	Bahts/HH	-	-	-	24,053
5. Off-farm Income	Bahts/HH	-	-	-	13,157
6. Required Farm Income	Bahts/HH	-	-	-	10,896
7. Required Farm Size	ha	-	-	-	1.10

Financial Model for Economic Farm Size

Sub-project: Thung Sai Yart - Irrigated
Cost Recovery Case: O/M Cost + Post-harvest

	Unit	Paddy-LV	Paddy-HY	Soybean	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	3,116	7,935	8,188	-
b. Cropping Intensity	%	-	100	27	117
c. Gross Crop Income	Bahts/ha	-	7,935	2,211	10,146
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	82
- Other Agr. Infra.	- " -	-	-	-	61
- Post-harvest facility	- " -	-	-	-	59
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	-
- Other Agr. Infra.	- " -	-	-	-	-
- Post-harvest facility	- " -	-	-	-	124
c. Sub-total	- " -	-	-	-	326
3. Net Crop Income	- " -	-	-	-	9,820
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	5,000
b. Household Expenditure	Bahts/HH	-	-	-	19,503
c. Sub-total	Bahts/HH	-	-	-	24,053
5. Off-farm Income	Bahts/HH	-	-	-	13,157
6. Required Farm Income	Bahts/HH	-	-	-	10,896
7. Required Farm Size	ha	-	-	-	1.11

Financial Model for Economic Farm Size

Sub-project: Thung Sai Yart - Irrigated

Cost Recovery Case: O/M Cost + Post-harvest + 1/2 of Agr. Infra.

	Unit	Paddy-LV	Paddy-HY	Soybean	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	3,116	7,935	8,188	-
b. Cropping Intensity	%	-	100	27	117
c. Gross Crop Income	Bahts/ha	-	7,935	2,211	10,146
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	82
- Other Agr. Infra.	- " -	-	-	-	61
- Post-harvest facility	- " -	-	-	-	59
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	4,976
- Other Agr. Infra.	- " -	-	-	-	1,675
- Post-harvest facility	- " -	-	-	-	124
c. Sub-total	- " -	-	-	-	6,977
3. Net Crop Income	- " -	-	-	-	3,169
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	5,000
b. Household Expenditure	Bahts/HH	-	-	-	19,503
c. Sub-total	Bahts/HH	-	-	-	24,053
5. Off-farm Income	Bahts/HH	-	-	-	13,157
6. Required Farm Income	Bahts/HH	-	-	-	10,896
7. Required Farm Size	ha	-	-	-	3.44

Financial Model for Economic Farm Size

Sub-project: Thung Sai Yart - Irrigated

Cost Recovery Case: O/M Cost + Post-harvest + of Agr. Infra.

	Unit	Paddy-LV	Paddy-HY	Soybean	Total
Hectare Basis					
1. Gross Crop Income					
a. Crop NPV	Bahts/ha	3,116	7,935	8,188	-
b. Cropping Intensity	%	-	100	27	117
c. Gross Crop Income	Bahts/ha	-	7,935	2,211	10,146
2. Cost Recovery					
a. O/M cost					
- Irrigation	Bahts/ha	-	-	-	82
- Other Agr. Infra.	- " -	-	-	-	61
- Post-harvest facility	- " -	-	-	-	59
b. Initial Cost					
- Irrigation	Bahts/ha	-	-	-	9,951
- Other Agr. Infra.	- " -	-	-	-	3,350
- Post-harvest facility	- " -	-	-	-	124
c. Sub-total	- " -	-	-	-	13,627
3. Net Crop Income	- " -	-	-	-	- 3,481
Farm Household Basis					
4. Household Requirement					
a. Targeted Farm Surplus	Bahts/HH	-	-	-	5,000
b. Household Expenditure	Bahts/HH	-	-	-	19,503
c. Sub-total	Bahts/HH	-	-	-	24,053
5. Off-farm Income	Bahts/HH	-	-	-	13,157
6. Required Farm Income	Bahts/HH	-	-	-	10,896
7. Required Farm Size	ha	-	-	-	-

Appendix D Management Aspect

Appendix D-1 ORGANIZATION FOR PROJECT IMPLEMENTATION

The project implementation shall be basically managed and coordinated by a committee at three levels of government (See Figure 5-1 of Main Report). Members and responsibility of each committee are summarised in the following.

1. Project Executive Committee (P.E.C.)

1-1. Member

- Permanent Secretary, Ministry of Agriculture and Cooperatives (MOAC) as Chairman
- Director General, Dept. of Technical and Economic Cooperation (DTEC)
- Secretary General, National Economic and Social Development Board (NESDB)
- Permanent Secretary, Ministry of Interior (MOI)
- Project Director of ALRO (S.G.) as Secretary

1-2. Responsibility

- To formulate policy and to provide directives
- To resolve policy issues

2. Project Coordinating Committee (P.C.C.)

2-1. Member

- Project Director of ALRO as Chairman
- Director, Budget Bureau (BB)
- Director General, Dept. of Agricultural Extension (DOAE)
- Director General, Dept. of Agriculture (DA)
- Director General, Dept. of Cooperative Promotion (DCP)
- Director General, Dept. of Fishery (DOF)
- Director, Office of Agricultural Economics (OAE)
- General Manager, Bank for Agr. and Agr. Cooperatives (BAAC)
- Chairman, Provincial Waterworks Authority (PWA)
- Chairman, Provincial Electric Authority (PEA)
- Project Manager of ALRO as Secretary

2-2. Responsibility

- To coordinate project activiteis and to approve annual working programme with budget allocation
- To manage progress of project implementation and to report the result to P.E.C.

3. Project Working Committee (P.W.C.)

3-1. Member

- Project Manager of ALRO as Chairman
- Chief of Sukhothai Provincial DOAE
- Chief of Sukhothai Provincial DA
- Chief of Sukhothai Provincial DCP
- Chief of Sukhothai Provincial DOF
- Chief of Sukhothai Provincial OAE
- Chief of Sukhothai Provincial BAAC
- Chief of Sukhothai PWA
- Chief of Sukhothai PEA
- Experts for F.T.S.S.
- Consultants
- Field Project Manager of ALRO as Secretary

3-2. Responsibility

- To perform the current annual working programme
- To prepare the succeessive annual working programme with budget estimation
- To monitor progress of implementation and to report the result to P.C.C.
- For the proposed F.T.S.S.,

  (a)to give directives and guidelines

  (b)to coordinate line agencies concerned

  (c)to supervise its activities

Appendix D-2 BASIC CONCEPT OF F.T.S.S.

D-2-1 Background

As generally seen in the Study area, farmers have settled and commenced farming independently. The questionnaire survey has revealed that farmers point out lack of know how about cultivation of diversified crops as one of constraints against introducing them, and also they appeal a lack of production credit as one of constraints against general farming practices, because of restriction that farmers could not borrow an institutional credit by using his provisionally allocated land as collateral. As such, the study area has various handicap from viewpoints of farming technology and social solidarity among farmers.

For the realization of the effect arising from an integrated rural development project, it is not always sufficient to provide such hardware as agricultural and rural infrastructure. Further, ALRO is obliged to secure income of beneficial farmers after development of the hardware. In this project, it is prerequisite to place same significance as the hardware on the strengthening and enrichment of software, which includes an agricultural extension on such diversified crops as upland crops and fruits, institutional supporting services including farmers' organization, production credit, and so on.

D-2-2 Function

The proposed project is planning to increase farmers' income and to improve their living standard, through introduction of irrigated agriculture (partly) and diversified cropping, and strengthening the software component. Therefore, the proposed farmers training and strengthening station (F.T.S.S.) shall have the following major functions;

- to research and experiment diversified crops to be introduced,
- to research proper farming practices on paddy and diversified crops under irrigated condition,
- to collect and analyse marketing information for appropriate crop selection and for proper timing of selling out farm products,
- to give proper guidance and training for farmers,

- to demonstrate proper farming practices,
- to give guidance and assistance on proper method of pond fishery,
- to make institutional production credit available more easily,
- to support crop production groups for operation and management of the proposed multi-purpose storages,
- to develop/bring up farmers' leaders, and
- to assist farmers for their forming a land reform cooperative in each sub-project areas as the ultimate objective.

D-2-3 Arrangement

For smooth establishment and management of F.T.S.S., the Project Working Committee shall be fully responsible with positive participation from line agencies.

The F.T.S.S. shall be established in each sub-project area, having general layout as shown in Figure D-2-1 with the tabulated cost as Table D-2-1. ALRO shall take charge of the hardware component, while the software component shall be controlled under the Project Working Committee.

The line agencies shall dispatch the following staff to F.T.S.S. by its own budget;

One part-time officer (Provincial Deputy Chief class)
Two full-time officers (at least Grade 5 class)

These officers shall have guidance and training by the respective experts and then jointly perform their duties in F.T.S.S. during project implementation.

Basically, all facilities of F.T.S.S. including buildings shall be transfered to the land reform cooperative in each sub-project area.

D-2-4 Operation

The operation of F.T.S.S. is to be performed in the three steps;

First Step: Set-up operation (1 months)
This step shall be performed during the detailed design stage, consisting of preparation of (a)basic policy for management, (b) action programme, and (c)curricula for training course during the second step.

Second Step: Special operation (6 months)
This step shall be performed for 6 months period starting from the commencement of the construction works. Main activities of the step are (a)selection of trainee from the government offices concerned with the project, (b)guiding and training the said trainee on the basis of the curricula prepared in the first step and (c)selection of farms in which trial cultivation shall be made as a demonstration one.

Third Step: Regular operation (41 months)
This step shall be performed for 41 months until the end of project implementation, covering all function mentioned above, through collaborative efforts of the experts and the officials dispatched from the line agencies. Main activities by each agencies are summarized in the following;

Subjects	DA	DOAE	DCP	OAE	DOF	BAAC
- Irrigated agriculture	(r) (a)	(e) (t)	-	-	-	-
- Diversified cropping	(r) (d)	(e) (t)	-	(a)	-	-
- Production credit	-	(a)	-	-	-	(d) (t)
- Marketing economy	-	-	-	(d) (t)	-	(a)
- Input supply	(r)	(t)	-	-	-	(a)
- Farmers organization	-	(a)	(d) (t)	-	-	(a)
- Pond fishery	-	-	-	-	(d) (t)	-

Note: (r) Research/Experiment, (e) Extension, (t) Training/Guidance
(d) Development, (a) Assistance

Table D-2-1 Cost Estimation for F.T.S.S.

Particulars	Unit	Unit Price (฿)	Nong Khon Kaen Quantity	Nong Khon Kaen Amount (฿1,000)	Thung Sai Yart Quantity	Thung Sai Yart Amount (฿1,000)	Total Quantity	Total Amount (฿1,000)
A. HARDWARE COMPONENT								
1 Building								
- Main Office	m^2	5,000	320	1,600	320	1,600	320 x 2	3,200
- Lecturers'/Guest House	m^2	6,000	144	864	144	864	144 x 2	1,728
- Lecture Room	m^2	5,000	128	640	128	640	128 x 2	1,280
- Store & Workshop	m^2	3,000	64	192	64	192	64 x 2	384
Sub-total	-	-	-	3,296	-	3,296	-	6,592
2 Equipment and Supply								
- Agricultural Machinery	L.S.	-	1	700	1	700	1 x 2	1,400
- Micro Bus	unit	500,000	1	500	1	500	1 x 2	1,000
- Audio Visual	set	200,000	1	200	1	200	1 x 2	400
- Office Equipment	L.S.	-	1	304	1	304	1 x 2	608
Sub-total	-	-	-	1,704	-	1,704	-	3,408
3 Total	-	-	-	5,000	-	5,000	-	10,000
B. SOFTWARE COMPONENT								
1 Experts								
- Organiz'n & Credit (Foreign)	M/M	400,000	-	-	-	-	25	10,000
- Agri. Extension (Local)	M/M	120,000	-	-	-	-	48	5,760
- Agronomy (Local)	M/M	120,000	-	-	-	-	25	3,000
- Marketing (Local)	M/M	120,000	-	-	-	-	25	3,000
Sub-total	-	-	-	-	-	-	-	21,760
2 Other Miscellaneous	L.S.	-	-	-	-	-	1	2,704
3 Total	-	-	-	-	-	-	-	24,464
C. Grand Total	-	-	-	-	-	-	-	34,464

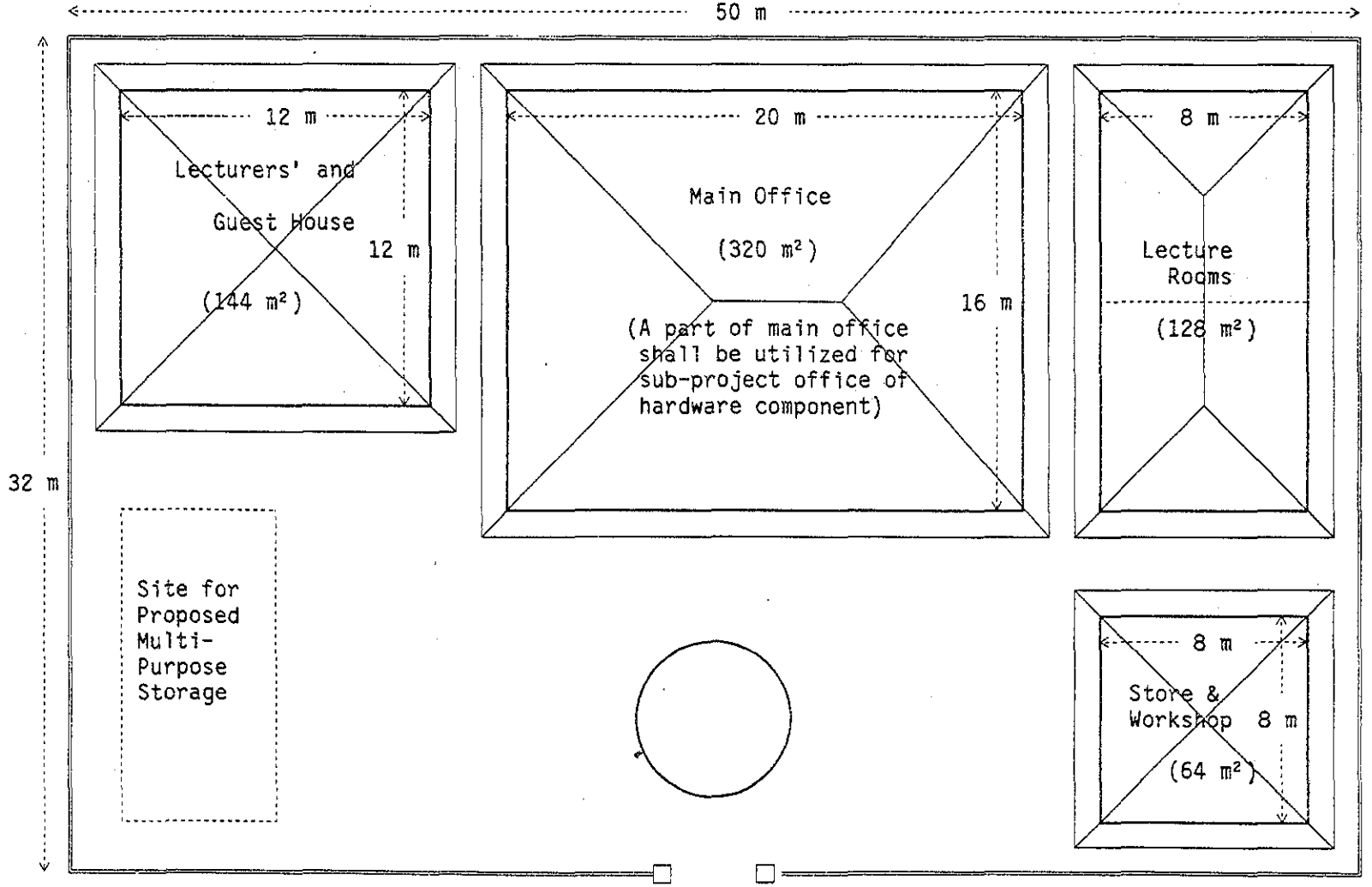

Figure D-2-1 GENERAL LAYOUT OF F.T.S.S.

Appendix D-3 BASIC CONCEPT OF MULTI-PURPOSE STORAGE

D-3-1 Function

Most of all farmers in the Study areas are forced to sell their farm products at lower prices when the supply is ample in the market, because no proper storage facility for farm products is available and they should observe conditions given by local merchants for production loans which are provided timely in spite of higher interest rate than institutional ones. From viewpoint of increasing value-added for farm products when farmers market out them, construction of multi-purpose storages is considered essential.

Accordingly, the multi-purpose storage shall have the following functions;

- to secure a certain quantity of farm products so as to obtain stronger bargaining power in the market,
- to protect quality deterioration and quantity losses of farm products, and
- to regulate shipping farm products taking into consideration current market prices.

D-3-2 Operation and Management

While construction works of the storages shall be responsible under ALRO, operation and management of them shall be basically responsible under beneficial farmers. Since most of them have no experience on the operation and management of storages, its system shall be divided into two stages; in the first stage (during project implementation), it shall be made by crop production groups with guidance and assistance of F.T.S.S. by using BAAC's experience in the paddy predging scheme, and in the second stage (after project implementation), it shall be fully responsible under a land reform cooperative which will be established during the project implementation.