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CHAPTER D-1 AGRICULTURAL BACKGROUND OF CAMBODIA

D-1.1 Agricultural Development Policy

D-1.1.1 Agriculture in Cambodian Economy

Cambodia is an agriculture country, and agriculture is the mainstay of Cambodia's economy. Approximately 84 % of total population and 90 % of the poor live in rural area, with agricultural activities as their main sources of income. About 80 % of labor force is engaging in agricultural sector. The agricultural sector occupied 40 % of GDP in 1999 as shown in table below.

Gross Domestic Product (GDP) and Agriculture

(Unit: Riel billion)

Year	1996	1997	1998	1999	2000 p*
GDP	8,325	9,149 (9.9%)	10,543 (15.2%)	11,646 (10.5%)	11,923 (2.4%)
Agriculture	3,471	3,857 (11.1%)	4,414 (14.4%)	4,704 (6.6%)	4,201 (-9.8%)
Crops	1,965	2,063 (5.0%)	2,386 (15.6%)	2,478 (-0.3%)	2,327 (-6.1%)
Paddy	1,171	1,269 (8.3%)	1,505 (18.6%)	1,553 (-3.2%)	1,312 (-15.5%)
Livestock	551	569 (3.3%)	683 (19.9%)	836 (17.0%)	738 (-11.7%)
Fisheries	555	592 (6.7%)	726 (22.7%)	933 (28.5%)	828 (-5.9%)
Forestry	400	633 (58.3%)	619 (-2.1%)	456 (-30.5%)	297 (-34.8)
Industry sector	1,212	1,460 (20.4%)	1,814 (24.3%)	2,140 (18.0%)	2,708 (26.6%)
Service sector	3,221	3,419 (6.1%)	3,861 (12.9%)	4,307 (11.6%)	4,495 (4.4%)
Growth rate of real GDP	(-0.7%)	(5.8%)	(2.5%)	(4.8%)	(-2.7%)
Per capita GDP (1,000 Riel)	754	786 (4.2%)	859 (9.2%)	920 (7.1%)	920 (0.0%)
Official exchange rate (Riel/US$)	2,640	2,991	3,774	3,814	3,859

Note: Figures are shown at current prices.
( ) shows growth rate to the previous year.
Figures in 2000 are preliminary estimates.
P*: preliminary estimation

Source: National Accounts of Cambodia (1993 - 2000), National Institute of Statistics, 2001.

The GDP growth rate of agriculture sector has lagged behind the industry. The real GDP of agriculture had grown at 2.5 % per year during the period 1996 to 1999, the comparative rate for the total GDP was 4.3 %, and that for the industry sector was 17.0 %.

Within the agricultural sector, agriculture (crops), livestock, fisheries and forestry sub-sectors accounted for the distributions of 52 %, 18 %, 21 % and 9 %,

respectively. Paddy product in the crops occupied nearly one third of the agriculture's GDP.

Under the situations as mentioned above, rural and agricultural development is given the highest priority in the national development for food security, poverty alleviation and foreign earnings through exportation of agricultural products.

D-1.1.2 Five Year Socioeconomic Development Plan (SEDP)

The First Five Year Socioeconomic Development Plan (SEDP-1) was inaugurated in 1996 for a period of 1996 to 2000. SEDP-1 aimed at i) poverty reduction, ii) developing of productive base of economy, iii) domestic self-reliance, iv) capacity building, and v) cooperation with regional countries. RGC (Royal Government of Cambodia) is preparing the Second Five Year Socioeconomic Development Plan (SEDP-2) and has presented draft SEDP-2 for discussion among institutions and organizations concerned at March 2001. Objectives of SEDP-2 are;

- To alleviate poverty,
- To restructure government administration,
- To reform national economic system and develop market oriented economy,
- To invest infrastructure, particularly rural road,
- To develop human resources,
- To extend health, education and social services, and
- To use natural resources based on the sustainable environment.

D-1.1.3 Agricultural Development Plan in SEDP-2

Agricultural Development Plan of SEDP-2 (draft) is composed of i) constraints to agricultural growth, ii) strategic vision, iii) priority of development, iv) key components, and v) development plan by sub-sectors. The plan is summarized as follows.

(1) Constraints to Agricultural Growth

1) Absence of a clear policy framework
   - Lack of a clear policy framework for agricultural and rural development, and
   - Undeveloped investment strategies for the development of resource- and technology- based production systems including agro-industries.

2) Undeveloped markets for rice and other crops

3) Barriers to export growth

- Illegal exportation of agricultural products,
- No tax, no record, or no control mechanism in the transactions,
- Undeveloped infrastructure, facilities and institutional mechanisms for handling, processing and export of food grain,
- Lack of institutional capacity for regulating and supporting the private sector,
- High post-harvest losses, and
- No national marketing institution.

4) Low crop productivity

- Low yield level and cropping intensity,
- Undeveloped agriculture-based processing industry,
- Poor soil fertility and low management and low technologies of suitable soil and fertilizer management,
- Low level of irrigation development, and poor performance of existing irrigation facilities,
- Paucity of knowledge of new farming technologies,
- Lack of funding for research and development, poor linkage of research and extension, and poor demonstration activities.

5) Institutional problems and financial constraints

- Overlaps and gaps in mandate of institutions in support of agriculture, fisheries and forestry, and
- Limited budgetary resources and poor access to development finance.

6) Inadequate extension services

- State institutions are unable to focus and effectively deliver essential services and function in support of highly productive, intensive and diversified farming systems timely, and
- Extension strategy has not work to farmers groups, associations, or cooperatives.

7) Limited access to production resources for farmers

- Ambiguous land laws, and conflicts and disputes on lands,
- Difficulty in access to land for returnees, displaced people by civil war or land mines, and female-headed households,
- Difficulty in access to public properties (forestland for timber and cooking fuel, inland water body for fishing), and
- Difficulty in access to credit and qualified agricultural inputs, and lack of

rural banking facilities.

(2) Strategic Vision of Agricultural Development Plan

- To aim at rapid, sustainable and equitable agriculture growth as well as empowerment of the poor,
- To invigorate the agriculture sector, generate employment, enhance household income, and improve access to food for the poor,
- To promote rapid and sustainable increase in production through the adoption of technologies that boost productivity and reduce production costs,
- To establish small-scale private irrigation systems and similar infrastructure appropriate to small farms,
- To maximize household income, and improve nutrition of the poor,
- To emphasize intensification and diversification of agricultural enterprises,
- To provide effective agricultural support services,
- To conserve and protect environmental resources,
- To strengthen downstream linkage with agro-environmental industry and the agribusiness sector,
- To highlight the need for an approach to enhance the ability of the rural poor and vulnerable groups to participate in the growth progress,
- To improve the groups' access to land, water and other production resources and right to choose technology to apply, commodity to produce, and timing and destination of selling their output, and
- To improve income, employment opportunities, health and living standards.

(3) Priority of Agricultural Development

- Food security and poverty alleviation,
- Global competitiveness of the agriculture sector,
- Equity of access to land, production resources, technology, and distribution of benefits,
- Irrigation development,
- Cost-effectiveness and simple and small-scale facilities with small-scale suitable to capacity of farmers, communities and NGOs to construct, repair, and maintain, and
- Sound investment criteria of infrastructure and technology for O & M cost recovery, suitability and sustainability.

(4) Key components

- Maintenance of an appropriate macroeconomic environment, favorable agricultural policy and institutional environment,
- Accelerated and sustainable irrigation development including extensive O & M

activities by farmers,

- Development of highly productive and diversified farming system through soil, pest and seed management, mechanization and post-harvest technologies,
- Accelerated program for land titling and land distribution,
- Development of an export market for rice and other agricultural products along with improvement of product quality and processing facilities,
- Strengthening of agricultural support services including marketing, input distribution, extension programs, research and development, and credit,
- Provision of social services and public facilities such as water supply, transport and communication facilities and storage and warehouse facilities,
- Expansion of livestock production by strengthening of animal health services, nutrition and natural pasture management; focusing on small-scale poultry and swine production, large animal husbandry and establishment of feed processing plants,
- Improved management of appropriate technologies for rice-fish farming and aquaculture,
- Promotion of community-based forestry, agro-forestry and agro-forestry-livestock farming system, sustainable production of fuel wood, and protection and management of critical watersheds,
- Direct support and protection for the poor through programs, and
- Clear delineation of mandates of different public institutions and agencies engaged in agricultural development (e.g., MAFF, MOWRAM and MRD), and strengthening of institutional capacity of the above agencies at different levels.

(5) Development Plan of Sub-sectors

1) Irrigation

Medium- and long-term objectives consist of the following;

- Construction of small-scale irrigation systems that are operated by the farmers,
- Improvement and expansion of areas covered by medium-size and large-scale irrigation systems through improvement of institutional capacity for planning, construction, and operation of those systems,
- Optimization of benefits from irrigation development, and
- Creation of comprehensive water development plan.

Three categories of irrigation development were planned in SEDP-2:

i) Small-scale pump irrigation systems,
ii) Improvement and selective rehabilitation of existing irrigation systems,

iii) Development of small reservoirs and *colmatage* canals

2) Development plan on improving of farming system
   - Crop intensification and diversification
   - Expansion and improvement in livestock production
   - Improved management and appropriate technologies for rice-fish farming and aquaculture schemes
3) Community-based forestry and agro-forestry
4) Land tenure and titling
5) Strengthening of essential agricultural support services
   - Marketing
   - Research and development
   - Delivery of extension service
   - Input supply and distribution
   - Credit
   - Farm mechanization
   - Post-harvest facilities
6) Support and empowerment for the poor
7) Environmental management and protection

D-1.1.4 Medium- and Long-term Agricultural Development Plan Prepared by MAFF

Ministry of Agriculture, Forestry and Fisheries (MAFF) presented long-term development plan, "Action Program for Development of Agriculture in Cambodia, 2001 - 2010", and medium-term development plan "Agricultural Development Plan, 2001 - 2005". These may be original plans of SEDP-2 prepared by MAFF. The proposed policies and programs for agricultural development are based on the SEDP-2. The summary of the plans is shown in Table D-1. The objectives are given below:

- Food security at community and household levels and poverty alleviation through increasing rice cultivated area to 2.5 million ha (equal to the area before the civil war) by 2010, and increasing of rice yield up to 2.0 ton/ha up by 2005 and up to 2.45 ton/ha by 2010, and expanding the irrigated areas from 16.6 % of the cultivated area at present to 20 % by 2005,
- Crop diversification for increasing of family income, agro-industry development, creation of job opportunities, and export should be focused on,
- Development of livestock sector for improving nutrition and income generation,

especially for small holders, through supporting services for animal husbandry, disease prevention, credit and marketing.

- Proper management of the natural resources through regulation and technical measures for sustainable exploitation.

To achieve these objectives, MAFF would undertake the following measures and programs:

- To improve the production, cropping techniques, quality of seeds, pest and disease protection and land quality,
- To improve technology and infrastructures for reducing of the dependency on the to the natural conditions,
- To improve quality of products and ensure safety of food for people,
- To reduce post-harvest losses,
- To authorize land occupation and land utilization, and prevent the illegal land occupation,
- To minimize the animal diseases and improve meat quality,
- To provide market information of agricultural commodities to the farmers,
- To add value through agro-processing in rural area,
- To revise the laws and regulations for fitting current development situation,
- To strengthen extension work for natural resource utilization and management, and for agricultural techniques to meet the requirement of the market,
- To conduct training of human resources that would enable them to perform leadership and management of their services in the free market economy system,
- To encourage agricultural agents at commune level,
- To strengthen farmers organization, farmers community and agricultural cooperative for ensuring farmer self-reliance of farmers,
- To promote establishment of rural finance for providing appropriate credit to farmers for purchasing agricultural inputs.

D-1.2 Agricultural Production

Paddy is the dominant agricultural crop for staple food for the people of Cambodia. Planted area of the paddy occupies more than 90 % of the total planted area in Cambodia (Refer to Tables D-2 and D-3).

Paddy production has been gradually increased through increase of planted area and yield level since the end of civil war. However, the yield level remains still low in comparison with neighboring countries. Average yield of the paddy in last five years (1995/96 - 1999/2000) was 1.69 ton/ha to the planted area. During the same period,

the average yields in the rainy and dry seasons are 1.53 ton/ha and 2.93 ton/ha, respectively. The difference of the yields by seasons was caused by following reasons:

- Water shortage and drought damage of rain-fed paddy in the rainy season,
- Flood damage in low-lying land in the rainy season,
- Rich sun radiation during the dry season,
- Higher fertility of soils in the receding paddy areas, which are cultivated in the dry season, and
- High proportion of irrigated area and HYVs area in the dry season than in the rainy season paddy area.

The average yield increased from 1.28 ton/ha in 1993/94 to 1.87 ton/ha in 1999/2000, while the planted area also increased from 1.86 million ha to 2.16 million ha. The average production of paddy during the last five years totalled at 3.57 million ton, and the food sufficiency has been attained in Cambodia.

Under the policy of attainment of the national food sufficiency, productions of other crops have not been developed, with their small planted areas and low yields. The development plan of agricultural sector in SEDP-2 put the priority on the steady food security and crop diversification in order to increase farm income and to promote exportation of agricultural products and agro-processing industries.

Table D-2 shows production of major crops in Cambodia and Takeo Province in recent years, which is summarized below.

Planted Area, Yield and Production of Major Crop in Cambodia

	Planted area (1,000 ha)	Unit yield (ton/ha)	Production (1,000 ton)
Paddy Total	2,119	1.69	3,574
Wet season paddy	1,885	1.53	2,888
Dry season paddy	234	2.93	686
Maize	51.0	1.33	61.1
Cassava	12.3	8.81	105.8
Sweet potato	9.8	3.60	33.8
Vegetables	38.7	5.49	203.7
Mung-bean	26.6	0.60	14.7
Groundnut	10.4	0.72	7.1
Soybean	28.9	1.28	32.9
Sugarcane	7.9	22.66	170.8
Sesame	13.7	0.42	4.9
Tobacco	12.9	0.77	9.5
Jute	1.2	1.15	1.4
Caster	1.5	0.90	1.4

Note : The figures are shown by average of recent 5 years (1995/96 - 1999/2000)
Source: Agricultural Statistics, 1995/96 - 1999/2000, MAFF

D-1.3 Food Security in Cambodia

Paddy rice is the staple food of all the Cambodians. In 1995 Cambodia achieved its self-sufficiency before the civil war in the late 1960s, and the surplus has been recorded since then. However, there are many Cambodians who do not access to the basic need of food due to their poor financial situation, transport and marketing systems. An amount of paddy is exported to Thailand and Vietnam. Moreover, the agricultural production system remains highly sensitive to natural disasters and pest damage, resulting in large fluctuation of yield. Despite the current surplus, nearly half of 24 provinces in Cambodia are food deficit areas and significant proportion of the population does not meet the minimum rice requirements. Critical period of the rice deficit is generally from mid-July to mid-October. High population growth rate of Cambodia requires subsequent production increase of the paddy rice.

Table D-4 shows the food balance of the country and Takeo Province. During the last five years, total paddy production was more than sufficient to meet the national food requirements. Total available rice per capita ranged from a low of 158 kg to a high of 179 kg, against 151.2 kg of the average annual consumption by MAFF indicator. Takeo Province is enjoying surplus paddy as a granary area in Cambodia, especially in the receding paddy cultivation area.

IV-1.4 Soils and Land Use

IV-1.4.1 Major Soils of Paddy Cultivation Areas in Cambodia

Soils in the rice growing area are classified into 10 soil series by “Soil of the Cambodian Agronomic Soil Classification” (CASC), which was prepared by Cambodia-IRRI-Australia Project (CIAP) in 1999. Details of the soil groups are introduced in “The Soils Used for Rice Production in Cambodia - A Manual for Their Identification and Management” and summarized in Table D-5.

D-1.4.2 Land Use and Irrigation Conditions of Cambodia

(1) Land Use

Total land area of Cambodia is approximately 18.1 million ha of which 37 % or 6.5 million ha is considered arable. Currently the land effectively utilized for agriculture is 2.7 million ha.

Agricultural land was estimated at around 3.9 million ha in 1996/97 in the Second Five Year Socioeconomic Development Plan (SEDP-2) as shown in following table.

It is supposed that the agricultural land consists of about 2.0 million ha of paddy field and 1.9 million ha of other crop land including tree crop land.

Land Use in Cambodia

(Unit: million ha)

Land use	1992/93	1996/97	Change (%)
Forest land	10.86	10.64	-0.22
Agriculture land	3.69	3.90	0.21
Grass land	0.48	0.49	0.01
Scrub land	2.20	2.52	0.32
Urban land	0.03	0.03	0.00
Wet land	0.54	0.55	0.01
Other land	0.36	0.02	-0.34
Total	18.15	18.15	0.00

Source: Second Five Year Socioeconomic Development Plan (Draft)

(2) Irrigation Condition

Only about 12 % of paddy land is irrigated during the dry season. The irrigated paddy land consists mainly of irrigated lowland (fully irrigated) and flood receding paddy (partially irrigated).

In the wet season, only 11 % of paddy area is served with supplementary irrigation water. The area consists of 10 % of gravity irrigation and 1 % of pump irrigation. Other annual crops planted during the dry season are mainly grown under rain-fed condition.

Cultivated Paddy by Irrigation Status

Season	Eco-system	Irrigation status	Cultivated area		Type of irrigation	
			(ha)	(%)	Type	(%)
Rainy	Low and Upland	Rain-fed paddy	1,518442	77	Gravity	10
		Supplemental irrigation	224,223	11	Pumping station	1
Dry	Lowland	Full irrigation	2,500	1	Pumping station	1
		Recession paddy	223,683	11	Gravity	11
Total			1,991,343	100		23

Source: Second Five Year Socioeconomic Development Plan (Draft)

D-1.5 Land Tenure Issues

Cambodian government attempted to implement land privatization and management policy in accordance with Sub-Degree No. 25 under the major economic reform in 1989. Land was redistributed to private individuals with rejection of pre-1979 ownership, and private ownership of land was reintroduced. Agricultural land was provided to farmers who had been working on the land. The land redistribution was applied based on the number of family members and land availability (soil fertility and location) in the area. In general the redistribution was implemented by the local authorities with full participation of the local community. Each family received a few

plots of agricultural land. Area of the land distributed to the households varied depending on the population density in the village.

However, the complexity and lack of clarity of the regulations caused enormous cases and conflicts related to land encroachment, land grabbing and land transactions. These processes brought about the incident of landlessness, especially among vulnerable groups such as female-headed household and disabled people. Most farmers occupy land without any legal authorization. Under such conditions, many private and state lands have changed hands either legally or illegally.

The growing population pressure on the land has resulted in three (3) undesirable consequences, i) reduction of farm size and increase of fragmentation, ii) migration of labor to urban areas, and iii) increase of landless people,

The Report "Land Ownership, Sales and Concentration in Cambodia - A preliminary review of secondary data and preliminary data from four recent surveys" [1] explains the issues on land tenure and land transactions as follows:

- Land holding size of female-headed households is smaller than that of male-headed households,
- Ratios of landless households and households that sold their agricultural lands are higher for female-headed households than those of male-headed-households,
- Occurrences of informal land transactions,
- More than 70 % of households do not have any land title authorized,
- Public lands consist of forests, rivers, lakes and agricultural land which did not been redistributed in 1989, have been utilized by privately individuals,
- Agricultural-land-lease market is relatively active,
- Land grabbing and land dispute are the common issues,
- Accelerating of land concentration to rich farmers, and increasing of the landlessness,
- Inequality of landholding size by area (region) due to the difference of population density.

Land registration and titling are important issues for the protection of food sufficiency for small holders, equal and fair land transaction, and agricultural development under market-oriented economy.

D-1.6 Administrative Organizations of Agricultural Sector

Governmental administration of agriculture sector is the responsibility of Ministry of

Agriculture, Forestry and Fisheries (MAFF). MAFF has about 10,000 permanent staff in the country. The organization structure is shown in Fig. D-1. MAFF has provincial branch office in every province, Provincial Department of Agriculture, Forestry and Fisheries (DAFF). Fig. D-2 illustrates organization and number of staff of DAFF Takeo. DAFF also has District branch office in each district.

D-1.7 International Aids to Agricultural Sector

RGC is receiving international aids to support the economic development, restructuring and strengthening of administrative organizations and human development after the civil war. The aids contribute to improvement of the national economy and living standard of Cambodian people. Major international aids for the agricultural sector are described below:

(1) Grant Aids

1) **The European Union** is providing aid for PRASAC (Support Program for the Agricultural Sector in Cambodia): the program of irrigation, rural infrastructure, water supply, rural credit, handicraft, and human resource development. The first stage of the program (1994 to 1999) granted Euro 39 million in 6 targeted provinces (Kompong Cham, Hompong Chhnang, Kampong Spueu, Takeo, Prey Veng, and Svay Rieng). For the second stage (1999 to 2003), EU and RGC signed for strengthening of PRASC-I activities in the program of improvement of food security and poverty alleviation.
2) **FAO** has provided the Technical Cooperation Program (TCP) with value of US$1.69 million, and US$2.88 million for equipment,
3) **UNDP** has funded US$0.87 million for forest inventory project, and US$0.15 million for food security project through FAO,
4) **Japan** has provided technical advisors, experts and expert group, and ¥2,750 million of grant aid and KR-II (agricultural materials and equipment, and fertilizer in order to increase food production) from 1992 to 1996,
5) **France** has granted F 22.0 million for rehabilitation of seawater protection dome, at Sihanouk Ville, rural credit and extension program,
6) **Australia** started to support to the agricultural sector in 1986 on three main programs: i) agricultural technology research program, ii) agricultural extension program, and iii) agricultural quality improvement program.

   i) Agricultural Technology Research Program

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[1] Sik Boreak, 2000, Cambodian Development Resource Institute

The fourth stage of the program is being implementing with a grant aid of Australian $10.2 million, focusing on;

- Development of agricultural technology, rice seed improvement, agricultural machinery, and integrated pest management,
- Improvement of plantation system, reduce of the damage of agricultural production, and evaluation on social and economic conditions,
- Institutional development, seminar and human resource development.

ii) Agricultural Extension Program (CAAEP)

The first stage of the program was implemented during 1995 to 2000 with Au$14.9 million in targeted 6 provinces (Takeo, Kandal, Kampong Spueu, Battambang, Kampong Tom, and Bantey Meanchey). The second stage started from 2000. The total cost is estimated at about Au$11.1 million, and it focuses on 13 provinces (Prey Veng, Svay Rieng, Kampong Cham, Siemreap, Kampot, Kampong Chnang, Pursat and 6 provinces of the first stage)

iii) Agricultural Quality Improvement Project (AQIP)

This project started in 2000 focusing on 4 targeted provinces (Kandal, Takeo, Prey Veng, and Svay Rieng)

7) **China** has granted US$3.0 million for irrigation, building of school and laboratory and heavy equipment
8) **FAO** and **South Korea** have provided experts, advisers, and technical assistants in order to study and develop agricultural marketing system.

(2) Loan Assistance

1) **World Bank (WB)** has provided loan for the Productivity Improvement Project for 5 years (1999 - 2003). The project focuses on eight (8) components: i) agricultural education and training, ii) human resource development, iii) planning and statistics, iv) fisheries, v) animal health and production, vi) agronomy, vii) research on small-holder rubber production, and viii) irrigation. The total cost is US$35.1 million in which US$27.0 million is credited from WB, US$4.75 million from IFAD loan, and US$3.35 million is counterpart fund of RGC.
2) **Asian Development Bank (ADB)** has provided loan of US$30 million to MAFF for supporting to the Agriculture Policy Reform Program in accordance with the free market economy. ADB also provided emergency loan of US$10 million for rehabilitation of irrigation and infrastructure and agricultural input (1994- 1996)
3) **International Fund for Agricultural Development (IFAD)** provided project loan for agricultural development support to SEILA program, which consisted of three sub-programs; i) agricultural development and production startup program,

ii) rural micro finance, and iii) project support and coordination. This program is implemented from 2000 to 2005, in four target provinces (Pursat, Battambang, Siemreap, and Bantey Meanchey). The total project cost is US$11.8 million in which IFAD loan is UD$8.46 million, UNDP/USAID credit is US$1.77 million, RGC's counterpart fund is US$1.14 million, and US$0.016 million is contributed as labors by Cambodian people.

CHAPTER D-2 MASTER PLAN STUDY

D-2.1 Present Situation of Farm Household

The Study Area covers the whole Tram Kak District and a part of neighboring districts in Takeo Province and Kampong Spueu Province, with total area of 650 km^2. Population and households in1998 in the Study Area were about 165,600 and 33,000, respectively. Average family size was 5.0 persons. Population density was 255 persons/km^2. Estimated labor force was 2.3 persons/household. Population in the rural area of Cambodia has been increased at around 2.5 % of annual growth rate.

It is estimated that 97 % of the total households are engaged in agriculture. Job opportunity other than agriculture is very limited in and around the Study Area. Rural or cottage industries have not developed as well as agro-processing. Government employment (school teacher, policeman, etc) and market activity in Angk Ta Saom provides major job opportunities in the Study Area. Income sources of farm households besides agriculture are mini-shop, selling of agricultural products, transportation services by motorcycle or oxen-cart, battery charging etc. A lot of villagers go out of their villages to get cash income by construction labor, and bike-taxi in Phnom Penh and Takeo town, and agricultural labor at Thai border during the idling season of agriculture activities.

Cultivated land in the Study Area is estimated at 44,240 ha, or 68 % of the whole area. It consists of 42,540 ha of paddy field and 1,700 ha of secondary crop field. The cultivated area per population is 0.27 ha per capita, which is smaller compared with average of the country (0.34 ha per capita). Average farm size per household is 1.34 ha (1.29 ha of paddy field and 0.05 ha of secondary crop field). However, the typical farm size (median farm size) is 0.80 ha (0.74 ha of paddy field, 0.04 ha of secondary crop field and 0.02 ha of tree crop land) according to the social environmental baseline survey conducted in this Study.

Tenant farmers and landless farm labor are few in the Study Area. Based on the interview survey to commune and village chiefs, it is estimated that the tenant farmers and landless farmers are less than 1 % and 3 % of the whole farm households. Most of them have not been given farmland, because they resettled from other village or returned from Thai border after the time of land allotment in 1989 - 1990 (Some families resettled or retuned were allocated with land even after the period, but some were not given due to no land available for allocation).

Table D-6 shows the farm household economy by operating farm size according to the social environmental baseline survey. The results show economic situation of

farm household as follows:

- Farm size of the respondents (201 in total) ranges between 0.09 and 4.16 ha, and median size is 0.80 ha. Distribution by farm size are classified below:

Farm size (ha)	< 0.25	0.25-0.5	0.5-0.75	0.75-1.0	1.0-1.5	1.5-2.0	> 2.0
Distribution ratio	5%	14%	28%	17%	20%	11%	5%

- Cash income ranges between Riel 275,000 (operating farm size of 0.25 ha or less) and Riel 690,000 (more than 2.0 ha), and the average is Riel 456,000,
- Cash income is obtained mainly from livestock of pig and poultry (66 %), then followed by off-farm income (28 %) and crop income (6 %),
- Gross income including home-consumption of agricultural products ranges between Riel 370,000 (operating farm size of 0.25 ha or less) and Riel 1,840,000 (more than 2.0 ha), and the income sources are; 47 % from crops, 38 % from livestock, and 15 % from off-farm,
- Crop products are mostly consumed by farmers them-selves: i.e., the farmers are operating agriculture for home consumption, and they are raising livestock to earn cash income,
- Ratios of production cost to production value of agriculture including livestock is 36 % for the typical farmer,
- Engel's coefficient (ratio of food expenses in living expenditure) is 74 % for the typical farmer.
- 69 % of the respondents bought paddy or rice, and only 37 % sold paddy or rice. Sixty-five percents of the respondents answered that the produced paddy was insufficient for their home consumption.

Table D-7 shows condition of food security in Tram Kak District by the District Office. Half of the households have deficit in food, and only 2 % of the households or less produce marketable surplus of the paddy.

D-2.2 Constraints and Development Potential of Agriculture

In the Study Area, paddy is the main crop for the staple food as well as an income source of households. However, the majority of farmers have deficit in food (rice). They live under poverty condition due to lack of proper cash income source. The operating farm size is small due to the limited land resource and population pressure, and the productivity is very low due to the rain-fed cultivation and low farming technology. They also live under poor conditions of roads, energy (electricity and cooking fuel), necessities of life, drinking water, and social services.

Cash income source of the farmers depends on livestock animal raising and cash crop cultivation, but the levels of the productivity and the income are still low, and they do

not have marketing means of products.

Fig. D-3 shows a problem tree on agriculture in the Study Area. The core problem is identified as poverty, which is caused mainly by i) insufficient food, and ii) low farm income. The reasons of these problems are:

- No irrigation, or deteriorated irrigation facilities,
- Poor knowledge on improved farming technologies and lack of agricultural extension activities,
- No certified paddy seed,
- Low application of farm inputs (fertilizer),
- Low productivity and low farming technologies on cash cops (diversified crops),
- Lack of social services for food security such as "Rice Bank[*1]",
- Poor agricultural credit system, lack of credit fund, and the high interest rate,
- Low knowledge on marketing, lack of marketing facilities and information,
- Poor road condition for marketing and input distribution, and
- Low productivity of livestock animals (pig, cattle, poultry), frequent occurrences of disease, poor supporting services for animal raising, and shortage of animal feed.

D-2.3 Basic Concept and Approach of Agricultural Development

D-2.3.1 Basic Concept and Strategy

The goal of the master plan is improvement of living conditions of farmers in the Study Area through attainment of food security and increase of farm income by irrigated agriculture development. The concept of agricultural development formulation is illustrated in Fig. D-4.

Basic concept and strategy for the irrigated agriculture development are as follows:

- To efficiently utilize water and land resources for sustainable development,
- To rehabilitate the existing irrigation facilities,
- To construct or rehabilitate ponds near residential area and use Pol Pot canals as pond for irrigation in low potential area of irrigation water,
- To continue the present paddy-based farming system for food security in the Study Area,
- To promote crop diversification with irrigation for increase of cash income of the farmers,
- To contribute to livestock development through utilizing of by-products of

[*1] Food security system in village level operated by Village Development Committee (VDC) or NGO.

agricultural products for animal feed,

- To apply sustainable and environmental conservation farming,
- To apply participatory approach in implementation and supporting services,
- To formulate plan as models of irrigation-based agricultural production in Cambodia,
- To improve and strengthen agricultural support program for realization of effects of irrigated agriculture development and to assure sustainable agricultural production system by farmers themselves,
- To organize the following farmers groups at village level, and activate them aiming at self-reliance through bottom-up approach,
    - Strengthening of agricultural extension services,
    - Micro credit system,
    - Support of marketing of agricultural products,
    - Paddy seed production, and
    - Group purchase of agricultural inputs.

D-2.3.2 Irrigation-based Agricultural Development Plans

Based on the available water resources for irrigation, following three (3) irrigation development plans were formulated in the Study Area for the Master Plan:

1) Upper Slakou River Irrigation Reconstruction Plan (USP)

USP will cover 3,500 ha of net irrigation command area by reconstruction of Kpob Trobek and Tumnup Lok Reservoirs and related irrigation facilities.

2) Small Reservoir Rehabilitation Plan (SRP)

Rehabilitation of 15 small reservoirs, which are located outside the USP. Area was proposed as technically and economically viable plan. SRP will supply irrigation water to 280 ha of net cultivated area in total.

3) Small Pond Development Plan (PDP)

Under limited water resources condition, the only way to increase irrigation water is to store as much rainfall and drain water coming from upstream areas as possible by constructing ponds and utilizing Pol Pot canals. PDP covers about 2,100 ha in 250 villages out of 276 village in the Study Area besides villages covered by USP and SRP. It was assumed that average irrigation area by a pond per household is 0.07 ha, average number of farm household per village is 120 families, and target villages are 250.

D-2.4 Master Plan of Agricultural Development

D-2.4.1 Soils in the Study Area

The Study Area is located mostly on the right bank of the Slakou River. Topography of the Study Area is mostly flat plain with a slope of 1/100 to 1/1,000 from west to east, and with elevation of 6 m to 34 m formulated by the Mekong River and the tributaries.

Six (6) land units in the Study Area were identified; 1) natural levees along the Slakou River, 2) old alluvial plain of the Slakou River, 3) foot of the Noreay mountains, 4) flat plain in the central part of the Study Area, 5) elevated older terrace with elavation of 10 m to 15 m, and 6) the Noreay mountains along the border of Kampot Province.

The soils in the Study Area are classified into five soil groups: A) recent alluvium soils, B) alluvium soils, C) gray soils D) gray lessive soils, and E) red yellow soils. The gray lessive soils are divided into three (3) soil sub-groups by soil depth and drainage condition. Among the soil groups, the lessive soils are dominant occupying 54,000 ha or 83 % of the Study area. The lessive soils of D2 and D3 are major soils for paddy rice cultivation.

The lessive soils of D2 and D3 are suitable for paddy and secondary crop cultivation. However the soil fertility is low due the coarse texture, poor nutrient content, and low nutrient-holding capacity.

Results of soil physical and chemical analysis in laboratory are shown in Table D-8. Evaluation of chemical characteristics is bellow:

Chemical Characteristics of Surface Soils

Item	Characteristics	Evaluation
Organic matter	0.5 - 1.0%	low
Total nitrogen	0.5 - 0.6%	low
Soil texture	Loamy fine sand - Sandy clay loam Clay (< 0.002 mm): 7 - 20% Silt (0.002 - 0.02 mm): 13 - 24% Sand (0.02 - 2.0 mm): 63 - 78%	Sandy soil
pH	5.0 - 5.7	Acid - slightly acid soil
Cation exchangeable capacity (CEC)	2.5 - 4.5 meq/100g	low
Exchangeable Cations	Ca: 1.2 - 1.6 meq/100g Mg: 0.75 - 1.25 meq/100g K: 0.04 - 0.08 meq/100g Na: 0.02 - 0.05 meq/100g	low
Cation saturation ratio	47 - 73%	moderate

Source: Laboratory analysis conducted by the Study Team

D-2.4.2 Land Use

Present and proposed land use is shown below:

Land Use in the Study Area

(Unit: ha)

	Cultivated land		Forest / Tree crops	Bush / Shrub	Residential / Others	Total
	Paddy	Sec. crops				
Present *1	42,540	1,700	4,370	9,130	7,260	65,000
Proposed *2	40,000	3,000	7,000	5,000	10,000	65,000
(USP)	(3,500)					
(SRP)	(280)					
(PDP)		(2,100)*2				
Balance	-2,450	1,300	2,630	-4,130	2,740	0

Source *1: Tram Kak District Office and JICA Study Team.
*2: Irrigation area by PDP.

Proposed cultivated area was estimated at 43,000 ha consisting of 40,000 ha of paddy field and 3,000 ha of secondary crop field (dry field) as of 2010. It is supposed that some paddy field will be converted to secondary crop field, facility area, etc.

Currently the forestry lands are located mainly in the mountain range of western boundary and the older terrace of eastern boundary of the Study Area. Forestry and tree-crop lands are scattered in small areas in the Study Area. The forestry land has been degraded by logging and fuel wood collection by villagers. Shrub and bush lands will be reforested by Department of Forest and Wildlife (DOFW) of MAFF, or by NGOs or local communities under the instruction of DOFW. The forest and tree-crop land will be planted with tropical fruit tree or cooking fuel tree for environmental conservation. The target area of forest including fruit tree and fuel wood tree is about 10,000 ha as of 2010.

Bush and shrub land will decrease from 9,130 ha to 5,000 ha by reforestation and new development for cultivation land.

Residential and facility area will be increased to 10,000 ha by economic development and expansion of residential area as a result of the population growth.

D-2.4.3 Crop Selection for Irrigated Agriculture

Proposed crops for the three (3) irrigation development plans are selected on the basis of the following principles.

i) To adopt paddy-based farming system in order to attain food sufficiency of the residents in the Study Area,
ii) To introduce crop diversification before or after paddy cropping within the extent of available irrigation water in order to increase on- farm income, and
iii) To select suitable diversified crops by examination of suitability for natural

conditions, profitability, marketability of products including processing capacity for industrial development in Cambodia, and present level of farmers farming technique.

Evaluation of crop selection is shown in Table D-9, and the selected crops for the plans are tabulated below:

Selected Crops for Irrigation Development Plans

Plans	Paddy	Diversified Crops
1. Upper Slakou River Irri. Reconstruction (3,500 ha)	HYVs (early maturing paddy of IR-series) and Improved local varieties (medium maturing varieties)	Maize, Beans (Mung-bean, Soybean), Groundnut, Sesame, and Vegetables (Cucumber, Tomato, Eggplant, String-bean, Watermelon, Pumpkin, Mustard green, Chili, etc.)
2. Small Reservoir Rehabilitation (280 ha)		
3. Small Pond Development (2,100 ha out of 39,220 ha)	HYVs or Improved local varieties (medium maturing varieties) under rain-fed condition	Beans (Mung-bean, Soybean), Groundnut, Sesame, and Vegetables (Cucumber, Tomato, Eggplant, String-bean, Watermelon, Pumpkin, Mustard green, Chili, etc.)

Table D-10 shows varieties of paddy rice applied by farmers in and around the Study Area.

D-2.4.4 Cropping Pattern and Crop Production

(1) Cropping Pattern and Planted Area

Present and proposed cropping patterns are shown in Fig. II-1.5.2 and II-4.5.1 of the Main Report, respectively.

The proposed cropping patterns for the three (3) development plans were examined considering efficient use of irrigation water, effectiveness of rainfall, maximization of crop profit, farmers willingness / attitude and available labor-force. The major items considered are as follows:

i) To plant HYV paddy in about 30 % of irrigated paddy area in due consideration of attainment of food sufficiency in the Study Area, increase of ratio of double cropping of paddy with diversified crops, and the farmers willingness and attitude to HYV varieties. (HYVs are higher yield and shorter growing period than improved local varieties, but are not liked by farmers because of their low market price and less pleasant taste of Cambodian people.)

ii) To carry out land preparation during the heavy rainfall period from July to October, because the highest water demand is for land preparation period,

iii) To avoid planting diversified crops during the heavy rainfall period to prevent flood or water-logging damages,

iv) To plant and irrigate diversified crops before or after paddy cropping within the extent of available irrigation water,

v) To plant high-profitability crops (vegetables) in the irrigation area taking due consideration on available labor force, marketability, technical level of farming and available supporting system of guidance on farming technique and marketing of products. In particular, for the Small Pond Development (PDP), such high-profitability crops are proposed for the whole irrigation area because one farmhouse operates only 0.07 ha of irrigation area on average.

(2) Unit Yield and Production of Crops

Proposed cropped area, unit yield, production, and incremental production are shown in Table II-4.5.1 in comparison with present condition.

1) Unit Yield at Present Condition

Unit yields under present conditions in the Study Area were estimated on the basis of field interview survey and statistics.

Unit Yield under Present Condition

(Unit: ton/ha)

Crop	Yield		Crop	Yield	
	Average	Range		Average	Range
Paddy (medium/late)	1.3	0.75 - 2.5	String-bean	3.0	2.5 - 4.0
Paddy (early/dry season)	1.3	0.75 - 2.5	Tomato	3.0	2.5 - 4.5
Maize	0.9	0.8 - 1.1	Watermelon	4.0	2.0 - 6.0
Groundnut	0.45	0.4 - 0.5	Pumpkin	4.5	4.0 - 5.0
Soybean	0.5	0.4 - 0.6	Cassava	4.0	3.0 - 5.0
Mung-bean	0.5	0.4 - 0.6	Sweet potato	2.5	2.0 - 3.0
Cucumber	4.0	3.0 - 5.0	Sugarcane	12	10 - 15

As for present paddy yield, various data have been examined as follows:

a) Paddy yield by the social environmental baseline survey

Paddy yields of respondents are averaged at 1,340 kg/ha, and distribution by yield level is shows below:

Yield (ton/ha)	0.5 - 1.0	1.0 - 1.5	1.5 - 2.0	2.0 - 2.5	2.5 - 3.0
Distribution (%)	31%	31%	22%	12%	4%

b) Average and high yields of paddy in each commune

Average yields and yields of advanced farmers under favorite climate condition were obtained through interview survey to 18 commune chiefs in the Study Area as shown in following table. Since communes have no statistics on the production, the yields were estimated ones by the commune chiefs through their experience and observation. The average yields range between 750 kg/ha and 2,000 kg/ha, and 1,300 kg/ha on average. The yields are generally higher in the

eastern part of the Study Area. The high yields range between 1,200 kg/ha and 3,000 kg/ha.

Average and High Yield under Present Condition in the Study Area

(Unit: kg/ha)

Commune	Average	High	Commune	Average	High
Angk Ta Saom	1,500	2,000	Samraong	1,200	1,800
Cheng Tong	1,500	2,500	Srae Ronoung	1,500	2,500
Kus	1,200	2,000	Ta Phem	1,200	1,800
Leay Bour	2,000	3,000	Tram Kak	1,000	2,000
Nhaeng Nhang	1,300	1,800	T. T. K. Cheung	1,500	2,500
O Saray	800	1,800	T. T. K. Tboung	1,200	2,500
Trapeang Kranhung	750	1,200	Basedth	1,200	2,000
Otdam Souriya	1,500	2,000	Pheakdei	1,500	2,000
Popel	1,200	2,500	Phong	1,200	1,500

c) Production statistics of Tram Kak District

According to the statistics of Tram Kak District, average paddy yield is 1,770 kg/ha on average for the latest 10 years. This yield is rather high compared with the above survey results by the Study Team.

Paddy Production in Tram Kak District

Year	Target planted area (ha)	Planted area (ha)	Damaged area (ha)	Harvested area (ha)	Average yield to planted area (kg/ha)	Production (ton)
1994	34,500	33,000	1,798	31,202	1,740	57,412
1995	34,500	34,500	0	34,500	1,500	51,750
1996	34,500	34,453	347	34,106	1,683	57,980
1997	34,500	33,619	279	33,340	1,587	53,344
1998	34,500	32,500	1,057	31,443	1,272	41,348
1999	35,000	34,552	230	34,322	2,520	87,075
2000	35,000	33,155	281	32,874	2,082	69,035
Average	34,643	33,683	570	33,112	1,769	59,706

Source: Tram Kak District Office

d) Paddy yield by national statistics

Average unit yields of paddy in Takeo Province and Cambodia for five (5) years of 1995/96 to 1999/2000 are shown below:

(Unit: ton/ha)

	Annual	Rainy season	Dry season
Takeo Province	2.09	1.85	2.84
Cambodia	1.69	1.53	2.93

Source: Agricultural Statistics, MAFF 1996/97 - 1999/2000
Refer to Table D-2 in detail

2) Anticipated Yields under Irrigated Condition

Anticipated unit yields of the irrigated crops were estimated on the basis of the existing high yields, results of agricultural research and information of extension workers. The target yields were estimated as shown below, taking due consideration

of low soil fertility, cropping under lower sunlight conditions in the rainy season, and application of water saving irrigation method.

Anticipated Unit Yield under Irrigated Condition

(Unit: ton/ha)

Crop	Yield		Crop	Yield	
	Average	Range		Average	Range
Paddy (medium)	2.8	2.5 - 3.0	Average of vegetables *2	8.3 *1	
Paddy (early)	3.3	3.0 - 3.5			
Maize	2.0	1.8 - 2.2	Cucumber	10.0	8.0 -12.0
Groundnut *2	0.85	0.8 - 0.9	String-bean	6.0	5.0 - 7.0
Soybean *2	1.0	0.9 - 1.1	Tomato	9.0	8.0 -10.0
Sesame *2	0.8	0.6 - 0.85			

Note *1: Average of three kinds of vegetables: Cucumber, string bean and tomato
*2: Yields of PDP area were estimated at 80% of the above yields for manual irrigation.

The anticipated paddy yield was examined on the basis of following data and information:

Data and Information		Local *1	HYVs *2	Source
1) Existing high yields under good farming condition in the Study Area		2.5 - 3.0	2.5 - 3.0	See table in page D-23
2) Demonstration plots in and around the Study Area		2.0 - 2.5	2.5 - 3.5	Takeo DAFF
3) Existing irrigation project				
Tnot Teh Irrigation Project		-	3.0	Interview survey
PRASAC in Takeo Province		-	2.5 - 3.5	Interview survey
4) Field Trials by CARDI				
Station trial	Rainy season	2.6 - 3.8	2.8	Annual Report 1997
	Dry season	-	3.9	do.
Farmers' preference	Rainy season	2.0 - 2.6	2.7±1.44	do.
	Dry season	-	3.7±1.33	do.
5) Extension officers of Takeo DAFF		2.5	3.0	DAFF Takeo
6) National target yield in 2005		2.0		MAFF's 5 year plan
7) National target yield in 2010		2.45		MAFF's 10 year plan

Note *1: Improved medium maturing-period varieties
*2: Early maturing-period varieties

D-2.4.5 Food Balance

As mentioned in Section D-2.1, the majority of farmers in the Study Area have deficit in food. Table D-11 shows food balances of present and with-project condition as of 2010. The population in 2010 was estimated with 2.4 % of population growth rate in rural area by Ministry of Planning on the basis of population census of 1998.

At present (population of at 1998), the food demand and supply nearly balanced (1.9 % of surplus to the produced paddy), and 4.9 % of surplus at 2010 under with project condition.

D-2.4.6 Crop Budget and Irrigation Benefit

Preliminary crop budgets on the proposed crops under with- and without project (present) conditions are shown in Table D-12. Total production values, production costs, net returns, and incremental benefits of three (3) irrigation development plans are shown in Table II-4.5.2 of the Main Report.

D-2.4.7 Livestock

Livestock animal husbandry and livestock production including extension and veterinary services are under jurisdiction of the Veterinary and Animal Production Department, MAFF. The Section of Veterinary and Animal Production of Takeo MAFF has 52 staff in total. Grade of the staff is as follows:

Staff of Veterinary and Animal Production Section of Takeo DAFF

Engineer (Graduats of Royal University of Agriculture)	5
Controller (Graduats of School of Agricultural College)	8
Agent (Graduats School of Agricultural College)	7
Graduats of Agricultural Technology Center (Kampong Ampil)	23
Attendants to short-term training (3 months)	2
No experience / Non-graduated	4
Worker	3
Total	52

Source: Veterinary and Animal Production Section of Takeo DAFF

Livestock animal husbandry is an important activity for the farmers in the Study Area. Cattle are main draft animals for plowing and carting, pig raising is a major cash income source of farm households, and poultry of chicken and duck are cash income source cum animal protein source for villagers. Most of villagers are raising livestock animals mentioned above.

Currently, shortage of animal feed is a major problem of the livestock sector. Feed of livestock animals depends on by-products of agricultural crop production. Rice straw and waste beans and vegetable fruits are used for cattle, while rice bran and broken rice and beans for pig and chicken. Increase of agricultural production will contribute to the production increase of livestock sub-sector.

Present conditions of animal husbandry of the cattle and pig in the Study Area are shown in Table D-13 and D-4, respectively. These conditions will be improved both in terms of production and productivity, and farmers would get more income from the livestock husbandry.

(1) Cattle

Cattle are raised mainly as draft animal. The feed depends on rice straw and natural grass. The cattle are grazing remaining rice straw in paddy field after harvest in the dry season, while during cropping season, they are fed with rice straw or natural grass in and around the house yard. The feed for the cattle is usually in short in the late dry season.

Health control of the cattle also has a serious problem. Mortality rate of the cattle is still high. Veterinary and Animal Production Section of Takeo DAFF is providing vaccination service to the cattle, but the achievement including NGO's service is less than 20 % of the total number of the cattle. Achievement of vaccination by Takeo DAFF is shown below:

Achievement of Vaccination by Takeo DAFF

(Unit: head)

District	Hemorrhagic Septicemia		Black leg		Anthrax	
	Cattle	Buffalo	Cattle	Buffalo	Cattle	Buffalo
Traing	19,980	76	1,627	39	921	0
Samrong	17,776	0	0	0	1,406	0
Bati	10,183	0	2,940	0	0	0
Tram Kak	7,385	0	2,450	0	3,525	0
Borei Chulasa	2,806	124	0	0	0	0
Ankor Borei	2,940	0	0	0	0	0
Kirivong	3,826	94	1,340	0	0	0
Prey Kabas	10,769	0	3,918	0	0	0
Doun Kaev	3,936	253	392	0	0	0
Koh Andaet	2,753	224	1,175	197	994	23
Total	82,354	771	13,842	236	6,846	23

Source: Veterinary and Animal Production Section of Takeo DAFF, 2000

The cattle are used as draft cattle from the age of three years old. Ratio of maturated cattle to total number of cattle is around 55 %, and 45 % is calf. In general, castrated male cattle are used as the draft animal. Reproduction rate of the matured male cattle is 50 %; or it has a birth every 24 months. Mortality is 5 % for new-born calf, 2 - 4 % for calf (0 - 3 years old), and 1 - 2 % for matured cattle (over 3 years old). In general, cattle of both male and female are exhausted around 8 years old.

Annual forage demand per cattle is 2,000 kg (5.5 kg per day), and 60 % of the demand depends on rice straw. It means that rice straw from a paddy field of one hectare (1,200 - 1,600 kg/ha of rice straw at 1.5 - 2.0 ton/ha of paddy yield level) would meet the demand of 1.0 to 1.5 heads of cattle.

(2) Pig

Pig raising is divided into three types: i) reproduction, ii) growing, iii) stud pig

raising. One male matured pig (sow) gives birth of around 10 heads of litter every 6-7 months. Mortality rate is 10 % for the new-born, 10 % for the 0 - 4 months old, 2 - 4 % for the 4 - 12 months old, and 2 % for over one years old. Usually sow and boar (stud pig) are exhausted at 4 years old. Grown pig is generally sold for pork meat at around 9 - 12 months old at 70 - 90 kg of weight. Ratio of grown pig, sow and boar is 70 : 10 : 1 in general.

Rice bran is the main feed for pig. About 50 % of grain feed for the pig is the rice bran. Yield rate of the rice bran from rice milling is 18 % of paddy. A pig of 6 - 12 months old requires the rice bran for feed at 275 kg/year or 0.75 kg/day. It means that one ton of paddy can feed 0.65 head of pig.

CHAPTER D-3 FEASIBILITY STUDY FOR PRIORITY AREAS

D-3.1 Priority Areas

Following four (4) irrigated agricultural development plans were selected from the Master Plan Study for the Feasibility Study as priority projects.

1) Upper Slakou River Irrigation Reconstruction Plan (**USP**),
2) Ang 160 Small Reservoir Rehabilitation Plan in Trapeang Chhuk Village, Trapeang Thum Khang Tboung Commune, (**Ang 160 SRP**),
3) Kim Sei Small Reservoir Rehabilitation Plan in Kim Sei Village, Nhaeng Nhang Commune (**Kim Sei SRP**), and
4) Small Pond Development Plan in Trapeang Snao Village, Nhaeng Nhang Commune (**Trapeang Snao PDP**) as a model plan of PDP.

D-3.1.1 Agricultural Conditions of the Priority Areas

General conditions of each priority area are shown below:

Irrigable Area, Beneficiaries and Average Farm Size in the Priority Areas

	USP	Ang160 SRP	Kim Sei SRP	Tr. Snao PDP
Irrigable area (ha)	3,500	25	27	5.8
Nos. of beneficiaries (family)	4,020	130	37	88
Average family size (person/family)	5.2	5.5	4.9	5.3
Average labor force (person/family)	2.8	3.3	2.3	2.8
Average farm size operated (ha/household)				
Paddy field	0.87	1.10	1.33	1.15
Secondary-crop field	0.03	0.07	0.07	0.06
Tree crop land	0.02	0.05	0.08	0.03
Total	0.92	1.22	1.48	1.24
Average irrigable area per household (ha/family)	0.87	0.19	0.73	0.066
No. of villages concerned	32	1	1	1

Source: JICA Study Team

Average farm sizes of the priority areas including secondary crop and tree crop field range from 0.92 ha to 1.48 ha, which are bigger than that of the Master Plan Study Area (0.80 ha). USP covers 32 villages, and 4,020 farm households. The average size of paddy field per beneficiary is 0.87 ha, most of which would be irrigated by USP. For the other priority areas, however, the average irrigable areas per household are 0.19 ha or 17 % of each beneficiary's paddy field in Ang 160 SRP, 0.73 ha or 55 % of the paddy field in Kim Sei SRP, and only 0.066 ha or 5.7 % of the paddy field in Trapeang Snao PDP.

D-3.1.2 Farm Household's Economy

Present situations of the farm household's economy of the priority areas are shown in Table D-15. The figures and ratio of income and expenditure are similar to the results of the Master Plan. The specific characteristics of the priority areas are described below:

- Average cash incomes per household are Riel 504 million for USP, Riel 553 million for Ang 160 SRP, Riel 933 million for Kim Sei SRP, and 598 million for PDP.
- The cash income of Kim Sei SRP is the largest among the priority areas, because many households (50 % of respondents) have regular salary income which is Riel 312 million on average, or 33 % of the cash income.
- Main source of the cash income is livestock in each priority area. The livestock income occupies 62 % of the total cash income for USP, 50 % for Ang 160 SRP, 51 % for Kim Sei SRP, and 42 % for PDP.
- Gross income including production value of the home-consumption ranges between million 919 Riel of USP and Riel 1,618 million of Kim Sei SRP. Average farm size of Kim Sei SRP is larger than other areas. Therefore, the farmers can get larger income from paddy rice.
- The gross farm income occupies around 80 % (between 78 % of PDP and 85 % of USP) of the total gross income. Farm household economy largely depends on agriculture including livestock.
- Ratio of agricultural production cost ratios to production value is 57 % for USP, 35 % for Ang 160 SRP, 38 % for Kim Sei SRP, and 44 % for PDP.
- Most of the crop production is consumed in the household. The marketed products are only 12 % of the total production value for USP, 12 % for Ang 160 SRP, 85 % for Kim Sei SRP, and 83 % for PDP.
- Farm households of deficit in food buy paddy or rice. Ratio of households which bought paddy or rice was 50 % for USP, 75 % for Ang 160 SRP, 25 % for Kim Sei SRP, and 30 % for PDP.
- On the other hand, the ratio of households which sold paddy or rice was 50 % for USP, 25 % for Ang 160 SRP, 60 % for Kim Sei SRP, and 65 % for PDP.
- Engel's Coefficient (ratio of food expenses in the living expenditure) was 71 % for USP, 71 % for Ang 160 SRP, 60 % for KimSei SRP, and 66 % for PDP.

D-3.2 Basic Concepts of Irrigation Agricultural Development

D-3.2.1 USP

USP will distribute irrigation water to 3,500 ha of paddy field. The whole area is proposed to irrigated in the rainy season, while in the rainy season, diversified crops of 500 ha and 550 ha would be irrigated before and after the paddy cultivation, respectively. Planting season of paddy, will be delayed by about one (1) month from the present aiming at effective use of rainfall for the puddling, and considering availability of irrigation water from the reservoirs during the late growing season. As for paddy rice, one cropping during the rainy season is proposed. Planting area of HYV paddy will be limited to about 30 % (1,100 ha) of the paddy field according to the following considerations:

i) As HYVs grow for 90 - 120 days (early maturing), the water requirement is small compared with the local varieties (120 - 150 days of growing period). It saves irrigation water, and contributes to expansion of the planted area of diversified crop after the paddy cultivation,
ii) HYVs will improve food balance in and around the project areas because of the higher yield, and
iii) Market price of HYVs has fallen recently due to the surplus production of HYVs, taste of Cambodian people, and low quality.

The diversified crops including vegetables will increase cash income of the farm households. However, it is necessary to support them in marketing of the products.

D-3.2.2 Ang 160 SRP

Cropping pattern similar to USP will be applied to Ang160 SRP considering similar conditions of farming at present. The reservoir rehabilitated will irrigate 25 ha of paddy in the rainy season consisting of 17 ha of local paddy and 8 ha of HYV paddy. Additionally, diversified crops will be irrigated in the area of 2 ha and 3 ha before and after paddy cultivation, respectively.

D-3.2.3 Kim Sei SRP

Irrigation is proposed to bestarted from early August. Only one cropping will be irrigated. It is proposed that three (3) ha of diversified crops will be planted after paddy nursery, 16 ha for local paddy, and 8 ha of HYV paddy. Irrigation for paddy nursery will improve production and yield of rain-fed paddy.

D-3.2.4 Trapeang Snao PDP

PDP in Trapeang Snao village is a model project of pond-based irrigation. PDP will consist of group ponds and individual ponds. Land use of the target areas will be

changed from paddy field to diversified crop field. The diversified crop production using pond water will be a major income source of farm households. Total of 30 ponds composed of 14 group ponds, 3 canal ponds and 13 individual ponds were identified, which had been requested by the villagers in Trapeang Snao Village. The irrigable area using the ponds is 5.82 ha in total, and 88 households (80 % of total households in the village) are covered. The average irrigable area per household is 0.066 ha. Target area will be planted with diversified crops including vegetables in order to increase farm income. About 1.0 ha out of irrigable area of 6.0 ha will be used for paddy nursery, since the area is in short of water for nursery irrigating nursery of paddy in the early rainy season. Besides the nursery, the diversified crops of 4.82 ha will be irrigated in the rainy season, which in the dry season, the diversified crops of 2.64 ha will be irrigated. The irrigation will be conducted manually.

D-3.3 Cropping Pattern and Crop Production

Proposed cropping pattern and crop production of each project are shown in Fig. IV-5.1.1 and Table IV-5.1.1 in the Main Report, respectively. Beneficiaries of USP and SRP should apply the respective cropping patterns; kinds of crops, cropping season and planted area. The kinds of crops and cropping season are categorized into four (4) categories; i) local paddy, ii) HYV paddy, iii) diversified crops in the rainy season, and iv) diversified crops in the dry season. FWUC should adjust to the cropping pattern the kinds of crops and planted areas on the basis of beneficiary's cropping plan in each irrigation unit (FWUG of tertiary irrigation unit for USP, and FWUC for SRPs) every cropping season. The recommendable procedures are as follows:

- Before the cropping season (April), each beneficiary applies to the Farmer Organizer (FO) of SC FWUC (FWUG for SRP project) about own cropping plan including the kind of crop and planted area,
- FO totals the planted areas of the applications by crops and season in each tertiary unit, and adjust the area in accordance with the assumed cropping pattern,
- The beneficiaries must plant crops in accordance with the adjusted crop and area, then irrigation water will be distributed,
- After the harvesting, FO collects ISF (Irrigation Service Fee) from the beneficiaries according to the planted area by season and crop.

Water saving irrigation method will be applied for paddy to use the limited water resource effectively. Under the water saving irrigation, the paddy field will not be

submerged with water after transplanting until head-initiation period starts. Even with such irrigation method, the yield will not be decreased. The water saving irrigation method should be disseminated to the beneficiaries through extension activity and training by FWUC.

D-3.4 Prices of Inputs and Outputs

(1) Farm-gate and Market prices of Agricultural Products

Farm-gate prices of agricultural products were estimated on the basis of the social environmental baseline survey, interview survey to farmers, and the market price of agricultural products. Table D-17 shows the market prices of the agricultural products in Takeo Province surveyed by DAFF Takeo. Table D-18 shows the market prices and estimated farm-gate prices during the field study period surveyed by JICA Study Team.

A large part of crop products are consumed in the household, and marketable products are sold at local markets by the producers themselves in and around the project area. The prices also fluctuate seasonally, namely in harvest season and lean season. Considering the above conditions, the farm-gate prices of the agricultural products for the Study were estimated as shown Table D-19. Price of vegetables is given as an average of 16 kinds of vegetables, which are suitable for the priority areas.

(2) Prices of Agricultural Inputs

The price fluctuation of fertilizer in Takeo market is shown in Table D-17. Farm-gate prices of fertilizer are higher than those in market by a few percent. The farm-gate prices include transportation cost from the market to the farm gate.

Seed prices of proposed crops are shown in Table D-18. Prices of vegetables seeds are shown as an average of 16 kinds of vegetables.

D-3.5 Crop Budget and Irrigation Benefit

Crop budget, production value, production cost, net return, and incremental benefit (financial irrigation benefit) are shown in Tables IV-5.1.5 and IV-5.1.6 in the Main Report. Major components of proposed production cost by crop are shown in Table D-20. The production cost of the vegetables is shown in as average of 15 kinds of vegetables in Table D-21.

D-3.6 Requirements of Labor Force and Draft Animal

Labor and draft animal balances for on-farm work were examined for the proposed cropping plan. The labor requirement and the balance by month for USP and Kim Sei SRP are shown in Table D-20. The balance analysis was examined on the basis of the following assumption.

Estimation of Available Labor Force for on-farm work in USP and Kim Sei SRP

	Unit	USP	Kim Sei SRP
Beneficiaries households	family	4,020	37
Average family size	person/h.h	5.1	4.9
Average labor force per household	person/h.h	3.1	2.3
Agricultural labor force per household	person/h.h	2.8	2.8
Agricultural labor force in the project area	person	11,256	104
Available labor force for on-farm work *1 (80% for male, 50% for female)	%	65%	65%
Workable days for on-farm work per month *2	day/month	24	24
Available labor force for on-farm work per month	1000 man-day	175.6	1.62

Note *1: Available labor force for on-farm work was assumed as follows:
- 80% of male labor force (20% will be used for livestock husbandry, marketing, transport, etc.)
- 50% of female labor force (50% will be used for housekeeping, child care, cooking, live stock husbandry, marketing, etc.)

*2: Workable days for on-farm work per month was assumed at 24 days or 80%

Both plans of USP and Kim Sei SRP have sufficient labor for the on-farm work for the proposed cropping plan. During busy season of August, September, November and December, the actual labor requirement is 46 % in September for USP, and 60 % in September for Kim Sei SRP of available labor force. For the other two (2) plans the labor force must be enough because the irrigable area per household is smaller, and the labor force per household is larger than those of the the above plans.

Average draft animals per ha is 0.65 pair, 0.63 pair, 0.47 pair and 0.63 pair for USP, Ang 160 SRP, Kim Sei SRP and PDP, respectively. The draft animal requirement per ha is seven (7) animal pair-days. The above number of draft animals can perform land preparation of paddy field of 1.0 ha to 1.4 ha spending 15 days in a month. Period of the land preparation required for the proposed cropping patterns is 2 - 2.5 months. The present number of draft animals are sufficient to perform the plowing and puddling under proposed condition.

Availability and Working Potential of Draft Animal

	Unit	USP	Ang 160 SRP	Kim Sei SRP	PDP
Available draft animal	pair/ha	0.65	0.63	0.47	0.63
Draft animal requirement	pair animal-day/ha	7	7	7	7
Workable days per month *	day/month	15	15	15	15
Workable area per month	ha/month	1.4	1.4	1.0	1.4

Note *: Workable days for plowing and puddling assumed at 50 % or 15 days/month

D-3.7 Input Requirement and Supply

Most of fertilizer and seeds including vegetable seeds are distributed to market by private sector under the market economy policy. Certified paddy seeds are rarely available in the Study Area. Farmers generally use paddy seed produced by themselves repeatedly.

Input requirements for the proposed farming practices are shown in Table D-21. Requirement of fertilizer will increase by 4.7 times the present for USP, 3.4 times for Ang 160 SRP, 3.3 times for Kim Sei SRP, and 5.4 times for PDP. The average cost of the seed and fertilizer per ha will increase from Riel 64,000 at present to Riel 232,000 in the future for USP, from Riel 87,000 to Riel 205,000 for Ang 160 SRP, from Riel 69,000 to Riel 169,000 for Kim Sei SRP, and Riel 68,000 to Riel 332,000 for PDP. The costs are divided into two (2) to three (3) cropping seasons, consiting of rainy season diversified crops, rainy season paddy, and dry season diversified crops.

Input Requirement

	USP	Ang160 SRP *1	Kim Sei SRP *1	Tr. Snao PDP *1
Fertilizer (ton)				
Urea	390	2.5	2.3	0.6
DAP	238	1.4	1.3	0.6
KCL	139	0.8	0.7	0.4
Paddy seeds (ton)	211	1.5	1.4	-
Compost/farm manure (ton)	12,700	79	76	15
Cost per household *2 (Riel 1000)				
Proposed	202	39	123	22
(per ha)	(232)	(205)	(169)	(332)
Present	60	17	50	5
(per ha)	(64)	(87)	(69)	(68)
Incremental	142	22	73	17

Note *1: Figures are for the irrigable area excluding rain-fed field
*2: Average cost of fertilizer and seed per household

Tables

Table D-1 Agricultural Development Plan (1/2)

Objectives and Goals	Activities		Expected outcomes
	Policy and strategy	Specific programs	
Agronomy - To ensure food security and production surplus for export	- To promote rice production programs	- To use high yield seed in accordance with market demand - To increase cultivation area - To promote ground water utilization - To promote activities of CARDI, experimental stations and development center - To establish agricultural policy	- Paddy yield of 2.0 ton/ha at 2005, and 2.45 ton/ha at 2010 - Paddy cropped area 25,000 ha by 2010 - Attainment of steady food security, - Paddy rice export 600,000 ton by 2005
- Crop diversification to reduce poverty and to meet domestic market demand	- To improve farming system - To promote small holder production and investment - To promote agro-industry	- To expand research on diversified crop - To strengthen extension services - To improve farming system of secondary crop field - To research market needs and market information	- Income increase and poverty reduction - Sustainable land use and soil improvement - Reduction of import of agricultural products - Creation of job opportunity - Development of agro-industry
- Crop protection and reduction of pesticides	- To promote IMP program	- To strengthen farmers training through Farmer Field School	- Reduction of pesticide use - Trainers training of 4,000 - Trained farmers of 16,000
- To manage and improve land resources for sustainable agriculture	- To promote soil fertility management	- To strengthen farmers training - To promote experiment of soil fertility	- Increase soil fertility - Reduction of use of chemical fertilizer
- Safe food production with environmental conservation	- To improve crop production - To promulgate low and regulation	- To reinforce application of regulation on agricultural material standard and management - To research and analysis of agricultural chemicals	- Reduction of negative impacts on environment, people and animal - Extermination of illegal pesticides
Rubber - Rubber export and development of rubber industry	- To improve rubber tree management - To promote small holder rubber production	- To cut down of low yield trees and plant high yield seed - To disseminate new technology of tree management - To plant tree in basaltic soil area	- Rubber production area in 2005: 30,800 ha -Total area for small holder rubber development in 2005: 256 ha
Livestock - To increase household income	- To promote small holder animal husbandry	- To extend animal husbandry - To provide new technologies - To provide animal health and disease control service	- Income increase, and reduction of poverty - Creation of job opportunity in rural area
- Exportation of meat products	- To develop animal industry	- To strengthen large-scale animal husbandry - To provide high priority on investment from private sector	- Private investment in livestock - Acquisition of foreign exchange
- Appropriate control of slaughtering and trading live animal and products	- To disseminate of appropriate knowledge - To promulgate low and regulation	- To provide appropriate inspection on animals and products, - To control animal health and production	- Elimination of illegal animal movement and slaughtering

Table D-1 Agricultural Development Plan (2/2)

Fisheries - Supply fishery food for people and export fishery products	- To increase fishery products - To develop inland and marine aquaculture	- To provide techniques for family fish culture - To protect and conserve fishery resources - To prevent illegal fishing - To establish fishery research and experimental center	- Export of fish and crocodile - Family income increase - Conservation of fishery resources
Forestry Preservation of natural environment and sustainable forest management	- To developing comprehensive legal framework - To enhance human resource capacity and finance	- To prevent illegal logging and forest activities, - To establish seedling nurseries - To afforsest and replant on degraded area	- Sustainable forest management - Increase of revenues from timber royalty
Agricultural mechanization	- To develop agricultural mechanization	- To use effective machinery - To implement pilot area for mechanization	- Reduction of product loss
Private Investment	- To develop national economy	- To develop industrial crops, animal husbandry	- Creation of job opportunities
Human Resource development and extension	- To train skilled staff and farmers	- To train staff and strengthen extension activity	- Trained staff 1,500 up to 2005 - Well farmers' knowledge on economy and marketing

Source: Agricultural Development Plan (2001 - 2005) and
Action Program for Development of Agriculture in Cambodia (2001 - 2010)

Table D-2 Agricultural Production in Cambodia and Takeo Province (1/8)

1 Paddy

		Cambodia								Takeo Province							
	Unit	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	1,856,560	1,923,699	2,085,991	2,170,900	2,076,011	2,104,013	2,157,592	2,118,901	216,240	227,730	237,577	245,060	231,648	228,973	235,102	235,672
Destroyed area	ha	0	424,275	161,950	291,900	147,322	141,447	78,150	164,154	0	37,261	7,706	35,060	9,519	9,648	3,971	13,181
Harvested area	ha	1,823,625	1,494,000	1,924,041	1,879,000	1,928,689	1,962,566	2,079,442	1,954,748	207,405	189,100	229,871	210,000	222,129	219,325	231,131	222,491
Yield *1	t/ha	1.31	1.49	1.79	1.84	1.77	1.79	1.94	1.83	1.49	1.28	1.90	2.07	2.64	2.02	2.40	2.21
Yield *2	t/ha	1.28	1.16	1.65	1.59	1.64	1.67	1.87	1.69	1.43	1.06	1.84	1.77	2.53	1.94	2.36	2.09
Production	ton	2,383,350	2,223,000	3,447,827	3,458,000	3,414,920	3,509,871	4,040,900	3,574,304	309,455	242,100	437,312	434,280	585,560	443,680	554,890	491,144
Wet season																	
Cultivated area	ha	1,701,560	1,753,699	1,869,991	1,936,900	1,827,328	1,873,093	1,915,592	1,884,581	174,240	185,140	184,865	188,060	170,648	170,648	176,102	178,065
Early	ha		275,413	354,298	393,733	333,089	347,869	371,553	360,108		70,460	78,459	75,130	65,789	66,359	74,095	71,966
Medium	ha		645,666	721,388	755,641	706,323	761,032	838,237	756,524		78,525	74,034	82,232	77,870	79,918	84,477	79,706
Upland	ha		37,381	37,899	31,871	33,563	43,318	48,138	38,958								
Late	ha		703,818	672,517	673,455	669,690	636,153	601,095	650,582		22,305	25,069	22,728	20,129	21,585	15,021	20,906
Floating	ha		91,421	83,889	82,200	84,663	84,721	56,569	78,408		13,850	7,303	7,970	6,860	2,786	2,509	5,486
Destroyed area	ha		424,275	160,950	287,900	142,422	127,697	69,150	157,624		37,261	7,706	34,060	8,619	8,648	2,971	12,401
Flood	ha		190,775	147,235	281,400	39,008	23,320	50,433	108,279		31,625	7,706	34,060	5,745		1,147	12,165
Mouse	ha						1,310	1,196	1,253							660	660
Drought	ha		230,900	8,774	400	98,486	92,727	9,119	41,901		5,636			2,835	8,648	1,164	4,216
Insect	ha		2,600	4,941	6,100	4,928	10,340	8,402	6,942					39			39
Damaged area	ha		424,275		465,194	404,655	412,803		427,551		37,261		47,544	9,540	9,668		22,251
Flood	ha		190,775		457,467	122,525	30,495		203,496		31,625		47,544	6,592			27,068
Mouse	ha						1,430		1,430								
Drought	ha		230,900		7,109	272,590	368,043		215,914		5,636			2,835	9,668		6,252
Insect	ha		2,600		618	9,540	12,835		7,664					113			113
Harvested area	ha	1,701,560		1,709,041	1,649,000	1,684,906	1,745,396	1,846,442	1,726,957	174,240	147,879	177,159	154,000	162,029	162,000	173,131	165,664
Yield *1	t/ha			1.64	1.67	1.59	1.65	1.81	1.67			1.65	1.80	2.50	1.73	2.20	1.98
Yield *2	t/ha			1.50	1.42	1.46	1.53	1.74	1.53			1.58	1.47	2.37	1.64	2.16	1.85
Production	ton			2,802,827	2,759,000	2,672,597	2,873,906	3,332,900	2,888,246			292,312	277,200	405,073	280,300	380,890	327,155
Dry season																	
Cultivated area	ha	155,000	170,000	216,000	234,000	248,683	230,920	242,000	234,321	42,000	42,590	52,712	57,000	61,000	58,325	59,000	57,607
Destroyed area	ha			1,000	4,000	4,900	13,750	9,000	6,530				1,000	900	1,000	1,000	975
Harvested area	ha			215,000	230,000	243,783	217,170	233,000	227,791	42,000		52,712	56,000	60,100	57,325	58,000	56,827
Yield *1	t/ha			3.00	3.04	3.05	2.93	3.04	3.01			2.75	2.81	3.00	2.85	3.00	2.88
Yield *2	t/ha			2.99	2.99	2.99	2.75	2.93	2.93			2.75	2.76	2.96	2.80	2.95	2.84
Production	ton			645,000	699,000	742,323	635,965	708,000	686,058			145,000	157,080	180,487	163,380	174,000	163,989

Note *1: Average yield to harvested area
*2: Average yield to cultivated area
*3: Average during 5 years (from 1995/96 to 1999/2000)

Source: Agricultural Statistics, 1994 - 2000, MAFF

Table D-2 Agricultural Production in Cambodia and Takeo Province (2/8)

2 Maize

	Unit	Cambodia 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	Takeo Province 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	43,306	52,000	51,580	49,448	49,447	44,915	59,835	51,045		702	375	901	387	434	341	488
Harvested area	ha	42,913	37,000	45,035	46,998	34,138	39,857	59,739			700	375	897	387	434	341	487
Yields *1	t/ha	1.06	1.22	1.22	1.37	1.24	1.22	1.59	1.33		0.97	1.08	1.29	0.94	1.10	1.11	1.10
Production	ton	45,415	45,000	54,900	64,563	42,423	48,510	95,274	61,134		682	404	1,154	365	476	377	555
Yellow maize																	
Cultivated area	ha					22,308	16,459	32,185	23,651								
Harvested area	ha					9,707	14,086	32,011	18,601								
Yields *1	t/ha					1.55	1.38	1.71	1.55								
Production	ton					15,037	19,456	54,680	29,724								
White maize																	
Cultivated area	ha					27,139	28,456	27,650	27,748		702			387	434	341	387
Harvested area	ha					24,431	25,771	27,728	25,977					387	434	341	387
Yields *1	t/ha					1.12	1.13	1.46	1.24					0.94	1.10	1.11	1.05
Production	ton		45,000			27,386	29,054	40,594	32,345					365	476	377	406
Wet season total																	
Cultivated area	ha	39,969	44,000	45,000	43,648	46,447	41,486	56,455	46,607		452	340	837	332	392	310	442
Harvested area	ha			38,570	41,988	31,138	36,453	56,385	40,907			340	837	332	392	310	442
Yields *1	t/ha			1.24	1.39	1.24	1.19	1.60	1.33			1.10	1.31	0.90	1.10	1.10	1.10
Production	ton			47,820	58,563	38,616	43,487	90,220	55,741			374	1,100	300	430	340	509
Yellow maize																	
Cultivated area	ha					21,946	16,098	31,396	23,147								
Harvested area	ha					9,346	13,725	31,230	18,100								
Yields *1	t/ha					1.55	1.38	1.72	1.55								
Production	ton					14,510	18,918	53,560	28,996								
White maize																	
Cultivated area	ha	39,969	44,000			24,501	25,388	25,059	24,983		452			332	392	310	345
Harvested area	ha					21,792	22,728	25,155	23,225					332	392	310	345
Yields *1	t/ha					1.11	1.08	1.46	1.21					0.90	1.10	1.10	1.03
Production	ton					24,106	24,569	36,660	28,445					300	430	340	357
Dry season total																	
Cultivated area	ha	3,337	8,000	6,580	5,800	3,000	3,429	3,380	4,438		250	35	64	55	42	31	45
Harvested area	ha			6,465	5,010	3,000	3,404	3,354	4,247			35	60	55	42	31	45
Yields *1	t/ha			1.10	1.20	1.27	1.48	1.51	1.31			0.86	0.90	1.18	1.10	1.19	1.05
Production	ton			7,080	6,000	3,807	5,023	5,054	5,393			30	54	65	46	37	46
Yellow maize																	
Cultivated area	ha					362	361	789	504								
Harvested area	ha					361	361	781	501								
Yields *1	t/ha					1.46	1.49	1.43	1.46								
Production	ton					527	538	1,120	728								
White maize																	
Cultivated area	ha	3,337	8,000			2,638	3,068	2,591	2,766		250			55	42	31	43
Harvested area	ha					2,639	3,043	2,573	2,752					55	42	31	43
Yields *1	t/ha					1.24	1.47	1.53	1.42					1.18	1.10	1.19	1.16
Production	ton					3,280	4,485	3,934	3,900					65	46	37	49

Note *3: Average during 5 years (from 1995/96 to 1999/2000)
Source: Agricultural Statistics, 1994 - 2000, MAFF

Table D-2 Agricultural Production in Cambodia and Takeo Province (3/8)

3 Cassava

	Unit	Cambodia 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	Takeo Province 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	10,078	11,000	14,190	14,000	10,509	8,792	14,039	12,306	1,900	1,250	1,235	888	601	673	768	833
Harvested area	ha	9,800	10,000	12,410	13,000	10,056	8,208	14,003	11,535	1,900	900	1,000	855	613	613	760	768
Yields	t/ha	5.23	6.50	6.60	5.36	7.68	8.11	16.32	8.81	2.47	5.83	5.83	7.13	6.75	6.82	8.13	6.93
Production	ton	51,292	65,000	81,950	69,656	77,266	66,534	228,512	104,784	4,700	5,250	5,830	6,100	4,140	4,180	6,180	5,286
Wet season																	
Cultivated area	ha	7,841	9,000	12,000	11,625	9,230	7,062	12,519	10,487	1,800	830	805	635	523	540	688	638
Harvested area	ha			10,370	10,778	8,804	6,537	12,500	9,798			600	635	535	535	680	597
Yields	t/ha			6.87	5.36	7.91	8.54	16.44	9.02			6.38	7.87	7.01	7.01	8.09	7.27
Production	ton			71,220	57,758	69,666	55,812	205,530	91,997			3,830	5,000	3,750	3,750	5,500	4,366
Dry season																	
Cultivated area	ha	2,237	2,000	2,190	2,375	1,279	1,730	1,520	1,819	100	420	430	253	78	133	80	195
Harvested area	ha			2,040	2,222	1,252	1,671	1,503	1,738			400	220	78	78	80	171
Yields	t/ha			5.26	5.35	6.07	6.42	15.29	7.68			5.00	5.00	5.00	5.51	8.50	5.80
Production	ton			10,730	11,898	7,600	10,722	22,982	12,786			2,000	1,100	390	430	680	920

4 Sweet Potato

	Unit	Cambodia 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	Takeo Province 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	8,297	11,000	10,240	11,000	9,316	9,339	9,341	9,847	950	990	970	1,599	408	353	524	771
Harvested area	ha	8,152	10,000	9,400	10,000	9,144	9,008	9,322	9,375	950	800	850	1,599	406	353	524	746
Yields	t/ha	5.89	3.60	4.16	3.80	3.16	3.38	3.49	3.60	7.47	3.33	3.45	3.92	2.46	3.00	3.00	3.17
Production	ton	48,000	36,000	39,140	38,032	28,922	30,476	32,516	33,817	7,100	2,660	2,930	6,270	1,000	1,060	1,570	2,566
Wet season																	
Cultivated area	ha	4,257	8,000	7,000	7,116	7,088	6,302	6,572	6,816	600	580	550	1,459	317	213	105	529
Harvested area	ha			6,340	6,734	6,966	5,977	6,557	6,515			450	1,459	315	213	105	508
Yields	t/ha			4.20	3.65	2.75	3.26	3.32	3.44			3.50	3.98	2.22	3.00	3.05	3.15
Production	ton			26,650	24,574	19,168	19,461	21,738	22,318			1,577	5,800	700	640	320	1,807
Dry season																	
Cultivated area	ha	4,040	3,000	3,240	3,884	2,228	3,037	2,769	3,032	350	410	420	140	91	140	2,769	712
Harvested area	ha			3,060	3,266	2,178	3,031	2,765	2,860			400	140	91	140	2,765	707
Yields	t/ha			4.08	4.12	4.48	3.63	3.90	4.04			3.38	3.36	3.30	3.00	3.90	3.39
Production	ton			12,490	13,458	9,754	11,015	10,778	11,499			1,353	470	300	420	10,778	2,664

Note *3: Average during 5 years (from 1995/96 to 1999/2000)

Source: Agricultural Statistics, 1994 - 2000, MAFF

Table D-2 Agricultural Production in Cambodia and Takeo Province (4/8)

5 Vegetables

	Unit	Cambodia 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	Takeo Province 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	30,348	35,000	41,650	46,009	36,684	37,747	31,450	38,708	2,610	4,300	3,117	3,777	2,031	2,110	2,460	2,699
Harvested area	ha	28,108	34,000	39,200	41,886	36,201	36,940	31,240	37,093	2,610	4,300	3,115	3,777	2,031	2,110	2,430	2,693
Yields	t/ha	7.86	5.79	4.92	5.96	4.88	5.88	5.82	5.49	8.32	6.64	6.67	6.13	4.99	6.32	6.35	6.09
Production	ton	220,875	197,000	193,010	249,710	176,788	217,258	181,851	203,723	21,720	28,540	20,780	23,150	10,125	13,340	15,425	16,564
Wet season																	
Cultivated area	ha	9,475	22,000	25,560	27,509	25,589	23,406	22,845	24,982	2,400	3,070	1,877	2,677	1,628	1,390	1,800	1,874
Harvested area	ha			25,210	23,886	25,193	22,602	22,641	23,906			1,875	2,677	1,628	1,390	1,770	1,868
Yields	t/ha			4.56	5.56	5.34	5.65	5.68	5.36			6.78	5.98	4.50	6.00	6.10	5.87
Production	ton			114,840	132,710	134,623	127,646	128,596	127,683			12,720	16,000	7,325	8,340	10,805	11,038
Dry season																	
Cultivated area	ha	20,873	13,000	16,090	18,500	11,095	14,341	8,605	13,726	210	1,230	1,240	1,100	403	720	660	825
Harvested area	ha			13,990	18,000	11,008	14,338	8,599	13,187			1,240	1,100	403	720	660	825
Yields	t/ha			5.59	6.50	3.83	6.25	6.19	5.67			6.50	6.50	6.95	6.94	7.00	6.78
Production	ton			78,170	117,000	42,165	89,612	53,255	76,040			8,060	7,150	2,800	5,000	4,620	5,526

6 Mung-bean

	Unit	Cambodia 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	Takeo Province 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	21,015	27,000	25,580	28,043	27,614	25,163	26,812	26,642	2,016	1,250	1,260	879	415	133	385	614
Harvested area	ha	20,825	26,000	25,150	26,756	27,417	16,463	26,747	24,507	1,076	1,230	1,240	878	415	133	385	610
Yields	t/ha	0.52	0.65	0.78	0.51	0.56	0.56	0.59	0.60	0.49	0.54	0.60	0.42	0.45	0.45	0.61	0.51
Production	ton	10,887	17,000	19,550	13,758	15,312	9,155	15,913	14,738	525	670	744	370	188	60	235	319
Wet season																	
Cultivated area	ha	16,881	17,000	15,340	18,493	17,553	17,097	22,623	18,221	1,076	730	730	768	410		385	573
Harvested area	ha			15,184	17,756	17,372	8,411	22,558	16,256			720	768	410		385	571
Yields	t/ha			0.81	0.49	0.57	0.59	0.60	0.61			0.60	0.40	0.45		0.61	0.52
Production	ton			12,340	8,758	9,864	4,962	13,575	9,900			434	310	185		235	291
Dry season																	
Cultivated area	ha	4,134	10,000	10,240	9,550	10,061	8,066	4,189	8,421	940	520	530	111	5	133		195
Harvested area	ha			9,966	9,000	10,045	8,052	4,189	8,250			520	110	5	133		192
Yields	t/ha			0.72	0.56	0.54	0.52	0.56	0.58			0.60	0.55	0.60	0.45		0.55
Production	ton			7,210	5,000	5,448	4,193	2,338	4,838			310	60	3	60		108

Note *3: Average during 5 years (from 1995/96 to 1999/2000)

Source: Agricultural Statistics, 1994 - 2000, MAFF

Table D-2 Agricultural Production in Cambodia and Takeo Province (5/8)

7 Groundnut

	Unit	Cambodia 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	Takeo Province 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	7,256	8,000	9,900	11,875	9,841	9,695	10,587	10,380	120	290	1,084	489	812		255	660
Harvested area	ha	7,075	7,000	9,000	11,243	9,702	9,605	10,557	10,021	120	280	1,070	488	812		250	655
Yields	t/ha	0.69	0.71	0.75	0.55	0.72	0.69	0.88	0.72	0.50	0.61	0.63	0.49	0.80		0.53	0.61
Production	ton	4,889	5,000	6,750	6,166	6,952	6,612	9,244	7,145	60	170	674	241	650		132	424
Wet season																	
Cultivated area	ha	4,865	5,000	6,810	8,565	6,708	6,714	8,766	7,513	120	150	944	418	812		235	602
Harvested area	ha			6,135	8,243	6,569	6,628	8,736	7,262			930	418	812		230	598
Yields	t/ha			0.74	0.55	0.80	0.59	0.90	0.72			0.63	0.50	0.80		0.52	0.61
Production	ton			4,530	4,566	5,270	3,942	7,830	5,228			586	210	650		120	392
Dry season																	
Cultivated area	ha	2,391	3,000	3,090	3,310	3,133	2,981	1,821	2,867		140	140	71			20	77
Harvested area	ha			2,865	3,000	3,133	2,977	1,821	2,759			140	70			20	77
Yields	t/ha			0.77	0.53	0.54	0.90	0.78	0.70			0.63	0.44			0.60	0.56
Production	ton			2,220	1,600	1,682	2,670	1,414	1,917			88	31			12	44

8 Soybean

	Unit	Cambodia 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	Takeo Province 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha		25,000	16,510	28,988	32,881	30,981	35,085	28,889								
Harvested area	ha		22,000	16,150	16,738	32,739	30,975	34,945	26,309								
Yields	t/ha		1.05	1.07	1.69	1.72	0.89	1.00	1.28								
Production	ton		23,000	17,240	28,299	56,342	27,709	35,063	32,931								
Wet season																	
Cultivated area	ha		25,000	16,510	28,988	32,881	30,749	34,860	28,798								
Harvested area	ha			16,150	16,738	32,739	30,743	34,720	26,218								
Yields	t/ha				1.69	1.72	0.89	1.00	1.33								
Production	ton				28,299	56,342	27,504	34,840	36,746								
Dry season																	
Cultivated area	ha						232	225	229								
Harvested area	ha						232	225	229								
Yields	t/ha						0.88	0.99	0.94								
Production	ton						205	223	214								

Note *3: Average during 5 years (from 1995/96 to 1999/2000)

Source: Agricultural Statistics, 1994 - 2000, MAFF

Table D-2 Agricultural Production in Cambodia and Takeo Province (6/8)

9 Sugarcane

		Cambodia								Takeo Province							
	Unit	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	10,505	8,000	8,520	7,147	8,351	7,068	8,417	7,901	90	1,095	249	383	211	148	236	245
Harvested area	ha	10,203	7,000	7,420	7,022	8,035	6,933	8,374	7,557	90	1,000	245	383	211	148	236	245
Yields	t/ha	0.47	31.29	27.29	24.40	23.34	19.19	19.09	22.66	0.44	38.00	40.00	25.78	20.00	15.00	15.08	23.17
Production	ton	4,773	219,000	202,490	171,305	187,532	133,053	159,859	170,848	40	38,000	9,800	9,875	4,220	2,220	3,558	5,935
Wet season																	
Cultivated area	ha	10,215	6,000	5,950	5,070	6,732	4,824	6,784	5,872	90	995	139	358	209	133	200	208
Harvested area	ha			5,100	5,022	6,416	4,689	6,745	5,594			135	358	209	133	200	207
Yields	t/ha			27.58	23.13	21.25	18.25	18.39	21.72			40.00	24.86	20.10	15.00	15.00	22.99
Production	ton			140,650	116,139	136,332	85,593	124,010	120,545			5,400	8,900	4,200	1,995	3,000	4,699
Dry season																	
Cultivated area	ha	290	2,000	2,570	2,077	1,619	2,244	1,633	2,029		100	110	25	2	15	36	38
Harvested area	ha			2,320	2,000	1,619	2,244	1,629	1,962			110	25	2	15	36	38
Yields	t/ha			26.66	27.58	31.62	21.15	22.01	25.80			40.00	39.00	10.00	15.00	15.50	23.90
Production	ton			61,840	55,166	51,200	47,460	35,849	50,303			4,400	975	20	225	558	1,236

10 Sesame

		Cambodia								Takeo Province							
	Unit	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	10,505	11,000	8,655	12,191	16,383	14,787	16,462	13,696	90	40	10	1,222	15	2	2	250
Harvested area	ha	10,203	9,000	8,295	11,691	15,898	9,435	16,410	12,346	90	40	10	1,222	15	2	2	250
Yields	t/ha	0.47	0.44	0.45	0.45	0.20	0.54	0.45	0.42	0.44	0.50	0.50	0.42	0.33	0.50	0.50	0.45
Production	ton	4,773	4,000	3,756	5,245	3,143	5,087	7,385	4,923	40	20	5	514	5	1	1	105
Wet season																	
Cultivated area	ha	10,215	10,000	8,280	11,291	16,033	14,400	16,187	13,238	90	20		1,221			2	612
Harvested area	ha			7,920	10,890	15,548	9,048	16,135	11,908				1,221			2	612
Yields	t/ha			0.45	0.44	0.19	0.54	0.45	0.42				0.42			0.50	0.46
Production	ton			3,580	4,795	3,003	4,915	7,263	4,711				514			1	258
Dry season																	
Cultivated area	ha	290	1,000	375	900	350	387	275	457		20	10	1	15	2		7
Harvested area	ha			375	801	350	387	275	438			10	1	15	2		7
Yields	t/ha			0.47	0.56	0.40	0.44	0.44	0.46			0.50		0.33	0.50		0.44
Production	ton			176	450	140	172	122	212			5		5	1		4

Note *3: Average during 5 years (from 1995/96 to 1999/2000)

Source: Agricultural Statistics, 1994 - 2000, MAFF

Table D-2 Agricultural Production in Cambodia and Takeo Province (7/8)

11 Tobacco

	Unit	Cambodia 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	Takeo Province 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	8,840	15,000	13,568	13,817	14,953	13,791	8,292	12,884		40	5		50	50		35
Harvested area	ha	8,790	14,000	13,380	11,850	14,944	13,761	8,292	12,445		35	5		50	50		35
Yields	t/ha	0.57	0.86	0.83	0.81	0.70	0.74	0.77	0.77		0.71	0.74		0.60	0.50		0.61
Production	ton	4,980	12,000	11,079	9,621	10,492	10,144	6,358	9,539		25	4		30	25		20
Wet season																	
Cultivated area	ha		200	90	150	244	247		183		10			50	50		50
Harvested area	ha			90	150	235	217		173					50	50		50
Yields	t/ha			0.51	0.50	0.77	0.51		0.57					0.60	0.50		0.55
Production	ton			46	75	180	111		103					30	25		28
Dry season																	
Cultivated area	ha	8,840	14,800	13,478	13,667	14,709	13,544	8,292	12,738		30	5					5
Harvested area	ha			13,290	11,700	14,709	13,544	8,292	12,307			5					5
Yields	t/ha			0.83	0.82	0.70	0.74	0.77	0.77			0.74					0.74
Production	ton			11,033	9,546	10,312	10,033	6,358	9,456			4					4

12 Jute

	Unit	Cambodia 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	Takeo Province 1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha	2,348	2,000	915	1,700	2,025	1,251	273	1,233								
Harvested area	ha	2,348	1,800	915	1,700	1,950	1,021	261	1,169								
Yields	t/ha	0.98	1.06	1.04	1.41	1.19	1.08	1.01	1.15								
Production	ton	2,304	1,900	952	2,398	2,329	1,104	264	1,409								
Wet season																	
Cultivated area	ha	2,263	1,900	810	1,591	1,990	1,231	259	1,176								
Harvested area	ha			810	1,591	1,915	1,001	247	1,113								
Yields	t/ha			1.02	1.42	1.20	1.08	1.01	1.15								
Production	ton			830	2,255	2,295	1,084	250	1,343								
Dry season																	
Cultivated area	ha	85	100	105	109	35	20	14	57								
Harvested area	ha			105	109	35	20	14	57								
Yields	t/ha			1.16	1.31	0.97	1.00	1.00	1.09								
Production	ton			122	143	34	20	14	67								

Note *3: Average during 5 years (from 1995/96 to 1999/2000)

Source: Agricultural Statistics, 1994 - 2000, MAFF

Table D-2 Agricultural Production in Cambodia and Takeo Province (8/8)

13 Caster Oil — Cambodia

	Unit	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total																	
Cultivated area	ha							1,521	1,521								
Harvested area	ha							1,515	1,515								
Yields	t/ha							0.90	0.90								
Production	ton							1,365	1,365								
Wet season																	
Cultivated area	ha							1,501	1,501								
Harvested area	ha							1,495	1,495								
Yields	t/ha							0.90	0.90								
Production	ton							1,345	1,345								
Dry season																	
Cultivated area	ha							20	20								
Harvested area	ha							20	20								
Yields	t/ha							1.00	1.00								
Production	ton							20	20								

Note *3: Average during 5 years (from 1995/96 to 1999/2000)

Source: Agricultural Statistics, 1994 - 2000, MAFF

Table D-3 Total Planted Area in Cambodia and Takeo Province

Cultivated Area — Cambodia — Takeo Province

	Unit	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	Average *3
Total	ha	2,009,058	2,128,699	2,287,299	2,395,118	2,294,015	2,307,542	2,379,706	2,332,736	224,016	237,687	245,882	255,198	236,578	232,876	240,073	242,121
Wet season	ha			2,013,341	2,100,946	1,997,823	2,026,611	2,104,963	2,048,737			190,250	196,433	174,929	173,366	179,827	182,961
Dry season	ha			273,958	294,172	296,192	280,931	274,743	283,999			55,632	58,765	61,649	59,510	62,596	59,630
Paddy	ha	1,856,560	1,923,699	2,085,991	2,170,900	2,076,011	2,104,013	2,157,592	2,118,901	216,240	227,730	237,577	245,060	231,648	228,973	235,102	235,672
Wet season	ha			1,869,991	1,936,900	1,827,328	1,873,093	1,915,592	1,884,581			184,865	188,060	170,648	170,648	176,102	178,065
Dry season	ha			216,000	234,000	248,683	230,920	242,000	234,321			52,712	57,000	61,000	58,325	59,000	57,607
Other crops	ha	152,498	205,000	201,308	224,218	218,004	203,529	222,114	213,835	7,776	9,957	8,305	10,138	4,930	3,903	4,971	6,449
Wet season	ha			143,350	164,046	170,495	153,518	189,371	164,156			5,385	8,373	4,281	2,718	3,725	4,896
Dry season	ha			57,958	60,172	47,509	50,011	32,743	49,679			2,920	1,765	649	1,185	3,596	2,023

Note *3: Average during 5 years (from 1995/96 to 1999/2000)

Source: Agricultural Statistics, 1994 - 2000, MAFF

Table D-4 Food Balance in Cambodia and Takeo Province

Cambodia

		Unit	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00
1	Paddy production	ton	2,383,350	2,373,480	3,447,827	3,458,000	3,414,918	3,509,871	4,040,900
2	Seed reserve and post-harvest loss	%	15%	15%	15%	17%	17%	17%	17%
3	Available paddy for consumption	ton	2,025,848	2,017,458	2,930,653	2,870,140	2,834,382	2,913,193	3,353,947
4	Milled rice rate from paddy	%	62%	62%	62%	62%	62%	62%	62%
5	Available rice for food	ton	1,256,025	1,250,824	1,817,005	1,779,487	1,757,317	1,806,180	2,079,447
6	Population	1000 person	9,500	9,700	10,500	10,700	10,934	11,747	12,029
7	Rice consumption per capita	kg/year	151.2	151.2	151.2	151.2	151.2	151.2	151.2
8	Rice requirement	ton	1,436,400	1,466,640	1,587,600	1,617,840	1,653,271	1,776,097	1,818,737
9	Surplus of rice	ton	-180,375	-215,816	229,405	161,647	104,046	30,083	260,711
10	Surplus of paddy	ton	-290,927	-348,090	370,008	260,721	167,815	48,521	420,501
11	Percentage of Surplus production	%	-12%	-15%	11%	8%	5%	1%	10%
12	Rice production per capita	kg/capita	132	129	173	166	161	154	173

Takeo Province

		Unit	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00
1	Paddy production	ton	309,455	353,428	437,312	434,280	585,559	443,680	554,890
2	Seed reserve and post-harvest loss	%	15%	15%	15%	17%	17%	17%	17%
3	Available paddy for consumption	ton	263,037	300,414	371,715	360,452	486,014	368,254	460,559
4	Milled rice rate from paddy	%	62%	62%	62%	62%	62%	62%	62%
5	Available rice for food	ton	163,083	186,257	230,463	223,480	301,329	228,318	285,546
6	Population	1000 person	616.9	655.4	753.3	744.0	783.5	813.5	833.0
7	Rice consumption per capita	kg/year	151.2	151.2	151.2	151.2	151.2	151.2	151.2
8	Rice requirement	ton	93,277	99,096	113,899	112,493	118,466	123,003	125,955
9	Surplus of rice	ton	69,806	87,160	116,564	110,988	182,863	105,314	159,591
10	Surplus of paddy	ton	112,590	140,581	188,007	179,012	294,940	169,862	257,405
11	Percentage of Surplus production	%	36%	40%	43%	41%	50%	38%	46%
12	Rice production per capita	kg/capita	264	284	306	300	385	281	343

Note: Milling recovery assumed as 62%. It is an average of 55% for village mills and 65% for commercial mills. Potential full recovery is 70%.
Source: Agricultural Statistics (1994 - 2000), MAFF

Table D-5 General Characteristics of Soil Groups in Paddy Cultivation Areas

Soil Group	Physio-graphic unit	Land use	Soil color	Physical and chemical characteristics	% of paddy area in Cambodia
Prey Khmer soils	Alluvial/ collovial plain	Paddy field	Pale brawn or light gray	Deep sandy surface; low water-holding capacity; very poor nutrient and organic matter; acidic soil	11%
Prateah Lang soils	Old alluvial/ collovial plain or terrace	Paddy field	Pale brawn or light gray	Sandy topsoil, heavier subsoil; low water- holding capacity; very poor nutrient and organic matter; acidic soil	28%
Bakan soils	Depression of old alluvial/ collovial plain	Paddy field	Gray or light gray.	Medium texture topsoil, heavier subsoil; high water-holding capacity; poor drainage; Moderate nutrient and organic matter	13%
Koktrap soils	Alluvial plain	Paddy field	Dark gray or black soil	Heavy texture soil; high water-holding capacity; moderate nutrient and much organic matter	5%
Toul Samroung soils	Undulating alluvial/ collovial plain	Dry-crop and paddy field	Brown or gray	Heavy texture; high water-holding capacity; moderate nutrient; slightly acidic or neutral	10%
Kein Svay soils	Recent alluvial plain/ natural river levees	Paddy (rainy season, dry-crops (dry season)	Gray or brown	Medium to heavy texture; high water-holding capacity; good drainage; fertile soil, moderate organic matter	2%
Kbal Po soils	Recent alluvial plain	Paddy (dry season), flooded (rainy season)	Gray, brown, or dark gray	Heavy texture; flooded for 3 - 5 months; high water-holding capacity; fertile soil; moderate organic matter; acidic	13%
Krakor soils	Recent alluvial plain	Paddy (dry season), flooded (rainy season)	Gray, brown or dark gray	Heavy texture; flooded for 3 - 5 months; high water-holding capacity; fertile soil, moderate organic matter; acidic	12%
Labansiek soils	Undulating sloping hill land	Mainly dry-crop field	Red or reddish brown	Heavy texture; high water-holding capacity; moderate nutrient; slightly acidic or neutral	1%
Kompong Siem soils	Hill slopes	Mainly dry-crop field	Black or dark gray	Clay soil gravel and boulders; high water-holding capacity; fertile soil; neutral to slightly alkaline	2%

Source: "The Soils Used for Rice Production in Cambodia - A Manual for Their Identification and Management" and "Rice production in Cambodia", and "Rice Production in Cambodia", IRRI and AusAID

Table D-6 Farm Household Economy by Operating Farm Sizes (1/2)

1. Actual Cash Income and Cash Expenditure (Unit: 1,000 Riel/household)

	Farm Size Class (ha/household)							Average	Typical Farmer *1	
	< 0.25	0.25 - 0.5	0.5 - 0.75	0.75 - 1.0	1.0 - 1.5	1.5 - 2.0	> 2.0			
No. of respondents	11	29	55	35	39	22	10	201	90	
Average family size	3.6	4.8	4.9	5.5	6.0	6.2	7.1	5.4	5.1	
Average farm size (ha)	0.16	0.40	0.64	0.87	1.16	1.64	2.58	0.92	0.80	
Paddy field (ha)	0.13	0.35	0.58	0.80	1.09	1.50	2.50	0.85	0.74	
A Gross Income										
Farm Income										
Paddy	5.2	5.3	7.7	22.1	42.2	58.5	76.5	25.4	13.3	2.9%
Vegetables/Other crops	15.8	15.1	16.1	9.4	18.4	18.0	12.5	15.3	13.5	3.0%
Fruits	14.5	8.4	1.8	1.4	5.5	6.1	0.9	4.5	1.7	0.4%
Livestock	170.9	254.8	289.7	306.9	285.0	292.0	301.0	281.1	296.4	65.6%
Subtotal	206.5	283.7	315.4	339.8	351.1	374.6	390.9	326.3	324.9	71.9%
Off-farm Income										
Sale Fish	0.0	0.3	4.9	0.4	0.0	0.0	0.0	1.5	3.2	0.7%
Salary	0.0	0.0	1.5	99.4	0.0	57.3	152.4	31.6	39.6	8.8%
Wage by on-farm job	0.0	0.0	0.0	2.0	0.0	0.9	0.0	0.4	0.8	0.2%
Wage by off-farm job	30.2	118.3	48.7	43.3	42.6	49.3	61.0	56.3	46.6	10.3%
Business/										
Cottage industry	1.5	22.4	18.2	14.6	11.8	9.1	0.0	14.1	16.8	3.7%
Firewood collection	31.5	2.8	14.1	10.9	11.3	56.4	75.0	20.0	12.9	2.8%
Forest products	4.5	2.8	3.4	2.9	2.3	0.9	5.0	2.9	3.2	0.7%
Others	0.8	0.2	5.0	1.7	4.5	3.6	6.0	3.3	3.7	0.8%
Subtotal	68.5	146.7	95.8	175.1	72.4	177.5	299.4	130.0	126.7	28.1%
Total	275.0	430.4	411.2	514.9	423.6	552.0	690.3	456.3	451.5	100.0%
B Gross Outgoing										
Production Cost										
Paddy	40.5	48.6	65.9	68.3	69.8	85.0	92.3	66.6	66.9	14.6%
Other crops	0.4	1.1	1.9	0.4	0.8	0.6	0.2	1.0	1.4	0.3%
Livestock	187.3	138.6	188.4	173.7	194.4	188.5	217.8	181.2	182.7	40.0%
Subtotal	228.1	188.4	256.2	242.5	265.0	274.1	310.3	248.9	250.9	54.9%
Living Expenses										
Paddy/Rice	27.2	33.5	27.6	17.8	10.5	12.0	10.1	20.8	23.8	5.2%
Other food	17.6	29.8	27.5	36.4	27.8	33.9	35.8	30.0	31.0	6.8%
Health/medicine	20.7	25.9	22.6	21.6	21.6	22.0	20.0	22.4	22.2	4.9%
Education	14.2	22.2	21.6	34.5	26.0	31.9	56.8	27.3	26.6	5.8%
Clothes	14.6	15.4	16.1	14.4	14.8	16.6	13.1	15.3	15.4	3.4%
Fuel/electricity	2.2	3.3	5.0	7.0	3.8	5.5	3.0	4.7	5.8	1.3%
Transportation	15.0	21.3	21.4	23.5	18.6	22.2	22.9	21.0	22.2	4.9%
Housing	18.9	24.3	20.7	16.6	21.3	18.0	15.0	19.9	19.1	4.2%
Cost/investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
of business	8.2	21.6	9.7	17.4	14.4	10.0	5.0	13.4	12.7	2.8%
Tax	0.0	1.2	2.6	1.9	1.9	2.9	2.3	2.0	2.3	0.5%
Others	20.6	21.5	25.0	25.1	31.0	30.2	29.9	26.3	25.0	5.5%
Subtotal	159.1	220.1	199.7	216.2	191.8	205.1	213.8	203.1	206.1	45.1%
Total	387.2	408.5	455.9	458.7	456.8	479.3	524.1	451.9	457.0	100.0%
C Balance	-112.2	22.0	-44.7	56.2	-33.2	72.8	166.2	4.4	-5.5	-1.2%

Note

*1: Typical farmer is a median farm size farmer (0.80 ha farm land consisting of 0.74 ha of paddy field, 0.04 ha of secondary crop field, and 0.02 ha of tree crop land)
The income and outgo are shown with average of 90 respondents between 0.5 ha - 1.0 ha of farm size farmers.

Source: Social environmental baseline survey conducted by JICA Study Team

Table D-6 Farmers Economy by Operating Farm Sizes (2/2)

2. Including Production Value Home Consumed (Unit: 1,000 Riel/household)

	Farm size class (ha/household)							Average	Typical farmer *1	
	< 0.25	0.25 - 0.5	0.5 - 0.75	0.75 - 1.0	1.0 - 1.5	1.5 - 2.0	> 2.0			
No. of respondents	5%	14%	27%	17%	19%	11%	5%	100%	45%	
Average family size	3.6	4.8	4.9	5.5	6.0	6.2	7.1	5.4	5.1	
Average farm size (ha)	0.16	0.40	0.64	0.87	1.16	1.64	2.58	0.92	0.80	
Paddy field (ha)	0.13	0.35	0.58	0.80	1.09	1.50	2.50	0.85	0.74	
A Gross Income										
Farm Income										
Paddy *2	62.5	168.4	279.0	384.8	524.3	721.5	1,202.5	408.9	355.9	43.2%
Vegetables/Other crops *3	31.6	30.2	32.2	18.8	36.9	35.9	25.0	30.5	27.0	3.3%
Fruits *3	29.1	16.9	3.7	2.9	10.9	12.2	1.8	9.1	3.4	0.4%
Livestock *4	179.5	267.6	304.2	322.2	299.3	306.6	316.1	295.1	311.2	37.8%
Subtotal	302.7	483.0	619.1	728.7	871.4	1,076.2	1,545.4	743.6	697.5	84.6%
Off-farm Income										
Sale Fish	0.0	0.3	4.9	0.4	0.0	0.0	0.0	1.5	3.2	0.4%
Salary	0.0	0.0	1.5	99.4	0.0	57.3	152.4	31.6	39.6	4.8%
Wage by on-farm job	0.0	0.0	0.0	2.0	0.0	0.9	0.0	0.4	0.8	0.1%
Wage by off-farm job	30.2	118.3	48.7	43.3	42.6	49.3	61.0	56.3	46.6	5.7%
Business/										
Cottage industry	1.5	22.4	18.2	14.6	11.8	9.1	0.0	14.1	16.8	2.0%
Firewood collection	31.5	2.8	14.1	10.9	11.3	56.4	75.0	20.0	12.9	1.6%
Forest products	4.5	2.8	3.4	2.9	2.3	0.9	5.0	2.9	3.2	0.4%
Others	0.8	0.2	5.0	1.7	4.5	3.6	6.0	3.3	3.7	0.5%
Subtotal	68.5	146.7	95.8	175.1	72.4	177.5	299.4	130.0	126.7	15.4%
Total	371.3	629.7	714.9	903.8	943.8	1,253.7	1,844.8	873.6	824.2	100.0%
B Gross Outgoing										
Production Cost										
Paddy	40.5	48.6	65.9	68.3	69.8	85.0	92.3	66.6	66.9	8.1%
Other crops	0.4	1.1	1.9	0.4	0.8	0.6	0.2	1.0	1.4	0.2%
Livestock	187.3	138.6	188.4	173.7	194.4	188.5	217.8	181.2	182.7	22.0%
Subtotal	228.1	188.4	256.2	242.5	265.0	274.1	310.3	248.9	250.9	30.2%
Living Expenses										
Paddy/Rice *5	84.5	196.5	298.8	380.6	492.5	675.0	1,136.1	404.2	366.4	44.2%
Other food *6	56.5	66.0	59.9	62.6	66.0	72.6	64.2	63.9	61.0	7.3%
Health/medicine	20.7	25.9	22.6	21.6	21.6	22.0	20.0	22.4	22.2	2.7%
Education	14.2	22.2	21.6	34.5	26.0	31.9	56.8	27.3	26.6	3.2%
Clothes	14.6	15.4	16.1	14.4	14.8	16.6	13.1	15.3	15.4	1.9%
Fuel/electricity	2.2	3.3	5.0	7.0	3.8	5.5	3.0	4.7	5.8	0.7%
Transportation	15.0	21.3	21.4	23.5	18.6	22.2	22.9	21.0	22.2	2.7%
Housing	18.9	24.3	20.7	16.6	21.3	18.0	15.0	19.9	19.1	2.3%
Cost/investment										0.0%
of business	8.2	21.6	9.7	17.4	14.4	10.0	5.0	13.4	12.7	1.5%
Tax	0.0	1.2	2.6	1.9	1.9	2.9	2.3	2.0	2.3	0.3%
Others	20.6	21.5	25.0	25.1	31.0	30.2	29.9	26.3	25.0	3.0%
Subtotal	255.3	419.4	503.3	605.1	712.0	906.8	1,368.3	620.3	578.7	69.8%
Total	483.4	607.8	759.6	847.6	977.0	1,180.9	1,678.6	869.2	829.6	100.0%
C Balance	-112.2	22.0	-44.7	56.2	-33.2	72.8	166.2	4.4	-5.5	-0.7%

Note

*1: Typical farmer is a median farm size farmer (0.80 ha farm land consisting of 0.74 ha of paddy field, 0.04 ha of secondary crop field, and 0.02 ha of tree crop land)
The income and outgo are shown with average of 90 respondents between 0.5 ha - 1.0 ha of farm size farmers.

*2: It is estimated on such assumption as planted area: paddy field own-operated, yield: 1,300 kg/ha, and price of paddy = 370 Riel/kg.

*3: It is estimated that 50% of products are used for their home consumption and 50% for sale.

*4: It is estimated that 5% of products are used for their home consumption and 95% for sale.

*5: Actual expense for purchase of rice + Production value of paddy - Actual income from sold rice

*6: Actual expense for other food + self-consumed products

Source: Social environmental baseliner conducted by JICA Study Team

Table D-7 Situation of Food Security in Tram Kak District (1999/2000)

Actual Number of Households

	Commune	Surplus households	Balanced households	Deficit households	Households without cultivated land	Total
1	Angk Ta Saom	8	1,006	1,324	214	2,552
2	Cheang Tong	0	1,099	840	32	1,971
3	Kus	8	1,006	1,324	214	2,552
4	Leay Bour	76	1,305	2,081	126	3,588
5	Nhaeng Nhang	0	648	455	31	1,134
6	O Saray	51	750	1,480	270	2,551
7	Trapeang Kranhung	0	420	530	62	1,012
8	Otdam Souriya	66	720	863	53	1,702
9	Popel	0	560	810	20	1,390
10	Samraong	58	564	491	79	1,192
11	Srae Ronoung	49	568	776	62	1,455
12	Ta Phem	39	1,048	1,339	90	2,516
13	Tram Kak	105	1,251	791	105	2,252
14	Trap. Thum Khang Cheung	15	816	610	23	1,464
15	Trap. Thum Khan Tboung	21	394	1,102	156	1,673
	Total	496	12,155	14,816	1,537	29,004

Ratio of households

	Commune	Surplus households	Balanced households	Deficit households	Households without cultivated land	Total
1	Angk Ta Saom	0.3%	39.4%	51.9%	8.4%	100%
2	Cheang Tong	0.0%	55.8%	42.6%	1.6%	100%
3	Kus	0.3%	39.4%	51.9%	8.4%	100%
4	Leay Bour	2.1%	36.4%	58.0%	3.5%	100%
5	Nhaeng Nhang	0.0%	57.1%	40.1%	2.7%	100%
6	O Saray	2.0%	29.4%	58.0%	10.6%	100%
7	Trapeang Kranhung	0.0%	41.5%	52.4%	6.1%	100%
8	Otdam Souriya	3.9%	42.3%	50.7%	3.1%	100%
9	Popel	0.0%	40.3%	58.3%	1.4%	100%
10	Samraong	4.9%	47.3%	41.2%	6.6%	100%
11	Srae Ronoung	3.4%	39.0%	53.3%	4.3%	100%
12	Ta Phem	1.6%	41.7%	53.2%	3.6%	100%
13	Tram Kak	4.7%	55.6%	35.1%	4.7%	100%
14	Trap. Thum Khang Cheung	1.0%	55.7%	41.7%	1.6%	100%
15	Trap. Thum Khan Tboung	1.3%	23.6%	65.9%	9.3%	100%
	Total	1.7%	41.9%	51.1%	5.3%	100%

Source: Tram Kak District Government, February, 2000

Table D-8 Results of Soil Laboratory Analysis

Pit No.	Depth	Natural Moisture	Bulk Density	Organic Matter	Total Carbon	Total Nitrogen	C/N ratio	Particle Distribution (%)				Soil texture
								<0.002mm	0.02-0.02mm	0.02-0.2mm	0.2-	
	(cm - cm)	(%)	(g/cm^3)	(‰)	(‰)	(‰)		Clay	Silt	F. Sand	C. Sand	by FAO
P2	0 - 20	11.6	1.21	0.4	2.37	0.59	4.0	9	13	47	31	F. LS
	20 - 45	20.4	1.26	0.4	2.20	0.49	4.5	8	14	50	28	F. LS
	45 -100	14.0	1.27	0.5	2.98	0.42	7.1	10	32	28	30	C. SL
P5	0 - 15	14.1	1.20	0.5	2.97	0.54	5.5	13	19	50	18	F. LS
	15 - 45	15.0	1.20	0.3	1.50	0.48	3.1	11	18	54	17	F. SL
	45 - 100	18.1	1.25	0.2	0.93	0.45	2.1	9	21	52	18	F. SL
P6	0 - 15	10.4	1.20	0.6	3.65	0.70	5.2	9	13	53	25	F. LS
	15 - 40	11.0	1.29	0.1	0.70	0.61	1.1	18	14	40	28	F. SL
	45 - 100	16.2	1.23	0.4	2.55	0.46	5.5	26	12	45	17	F. SCL
P8	0 - 10	10.6	1.28	1.0	7.59	0.60	12.7	20	16	43	21	F. SCL
	10 - 45	13.1	1.24	0.6	3.67	0.55	6.7	27	20	35	18	F. SCL
	45 - 100	16.9	1.16	0.4	2.03	0.48	4.2	34	18	32	16	F. SCL
P9	0 - 20	5.5	1.16	0.6	3.53	0.56	6.3	13	24	53	10	F. SL
	20 - 45	14.8	1.20	0.4	2.43	0.50	4.9	9	21	62	8	F. SL
	45 - 100	18.1	1.05	0.2	1.35	0.44	3.1	4	10	61	25	F. LS
P11	0 - 20	8.2	1.18	0.4	2.30	0.49	4.7	7	14	50	29	F. LS
	20 - 45	8.3	1.26	0.4	2.23	0.46	4.8	13	9	52	26	F. SL
	45 - 100	9.3	1.29	0.3	1.83	0.42	4.4	15	10	31	44	F. SL

Pit No.	Depth	Total P_2O_5	Available P_2O_5	pH (H_2O)	pH (KCl)	CEC	Exchangeable Cations (meq/100g)					Cation Sat. Ratio
	(cm - cm)	(‰)	(ppm)			(meq/100g)	Total	Ca	Mg	K	Na	(%)
P2	0 - 20	0.07	31	5.20	3.75	4.5	2.10	1.25	0.75	0.06	0.04	47
	20 - 45	0.09	60	5.38	3.99	3.5	1.81	1.00	0.75	0.04	0.02	52
	45 -100	0.10	60	5.71	3.92	3.0	2.00	1.20	0.75	0.03	0.02	67
P5	0 - 15	0.04	10	5.72	4.85	3.0	1.88	1.15	0.65	0.05	0.03	63
	15 - 45	0.03	33	5.93	4.64	2.5	1.95	1.00	0.83	0.07	0.05	78
	45 - 100	0.05	55	5.39	3.98	3.5	2.12	1.00	0.75	0.24	0.13	61
P6	0 - 15	0.08	25	5.71	4.66	3.5	2.38	1.25	1.00	0.08	0.05	68
	15 - 40	0.03	49	6.32	5.85	2.5	1.83	1.00	0.75	0.05	0.03	73
	45 - 100	0.13	50	7.24	5.72	7.5	6.89	4.00	2.75	0.09	0.05	92
P8	0 - 10	0.16	32	5.04	3.95	4.0	2.37	1.25	1.00	0.08	0.04	59
	10 - 45	0.07	30	5.89	4.77	6.5	4.00	2.65	1.25	0.06	0.04	62
	45 - 100	0.06	29	5.10	3.75	8.0	5.63	4.00	1.50	0.08	0.05	70
P9	0 - 20	0.05	31	5.30	3.92	2.5	1.62	1.00	0.50	0.07	0.05	65
	20 - 45	0.02	31	5.07	3.57	5.5	1.90	1.00	0.75	0.09	0.06	35
	45 - 100	0.03	29	5.99	3.71	2.5	1.73	1.00	0.65	0.05	0.03	69
P11	0 - 20	0.06	55	5.54	4.41	4.0	2.93	1.62	1.25	0.04	0.02	73
	20 - 45	0.05	21	5.52	4.30	3.5	2.32	1.37	0.85	0.06	0.04	66
	45 - 100	0.05	21	6.67	5.23	3.0	2.58	1.50	1.00	0.05	0.03	86

Source: JICA Study Team (conducted by sub-contract basis)

Table D-9 Selection of Crops for Irrigation Agricultural Development

	Crops	High potential crops in Study Area	Existence in Study Area	Suitability to natural conditions				Main purpose of production	Marketability/ market channel	Easiness of cultivation	Growing period (days)	Yield of present condition (ton/ha)	Anticipated yield (ton/ha)	Farm-gate Price (Riel/kg)
				Climate	Soil	Flood/ drainage	Draught/ moisture							
1	Paddy rice (Local)	○	+++	S	M	Tolerant	Sensitive	Food	Local	E	120~150	1.3	2.8	370
2	Paddy rice (HYV)	○	+++	S	M	Tolerant	Sensitive	Food	Local	E	90 ~ 120	1.3	3.3	330
3	Maize	○	+	S	M	Moderate	Moderate	Animal feed	Local	E	100	0.9	2.0	600
4	Sweet potato		+	S	S	Moderate	Tolerant	Food/A. feed	Local	E	110	2.5	5.0	250
5	Cassava		+	S	S	Moderate	Tolerant	Food/A. feed	Local	E	200	3.5	7.0	200
6	Mung-bean	○	++	S	S	Moderate	Moderate	Processing/Sprout	Local/Processing	E	70	0.35	0.9	1,400
7	Groundnut	○	+	S	S	Moderate	Tolerant	Oil mill/Food	Local/Processing	E	110	0.45	0.85	1,300
8	Soybean	○	-	M	S	Moderate	Moderate	Oil mill/Food	Local/Processing	M	70	0.5	1.0	1,200
9	Sesame	○	+-	S	M	Sensitive	Tolerant	Oil mill/Food	Processing	E	70	0.3	0.8	1,800
10	Castor bean		-	S	M	Sensitive	Tolerant	Chemical oil	Processing	E				
11	Sugarcane		++	S	M	Moderate	Moderate	Sugar mill	No sugar-mill	E	200	12.0	15.0	
12	Cauliflower	○	-	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	H	70		6.0	1,000
13	Chayote	○	-	M	M	Moderate	Moderate	Raw vegetable	Local/urban	M	90			500
14	Chili	○	+	S	M	Sensitive	Sensitive	Raw/Dry vegetable	Local/urban	H	70	3.0	6.0	1,000
15	Chinese Kale	○	+	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	H	70	5.0	8.0	900
16	Cucumber	○	++	S	M	Sensitive	Sensitive	Raw vegetable	Local/urban	H	110	4.0	10.0	450
17	Eggplant	○	++	S	M	Moderate	Sensitive	Raw vegetable	Local/urban	H	80	4.0	9.0	500
18	Garlic	○	+-	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	H	120			
19	Sponge Gourd	○	+	S	M	Moderate	Moderate	Raw vegetable	Local/urban	M	100	3.5	7.0	700
20	Bitter gourd	○	+	S	M	Moderate	Moderate	Raw vegetable	Local/urban	M	100	5.0	8.0	350
21	Kangkong		++	S	M	Tolerant	Sensitive	Raw vegetable	Local	E	60			300
22	Leek	○	++	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	H	60	5.0	7.0	900
23	Lemon grass		++	S	S	Moderate	Moderate	Raw vegetable	Local/urban	E	80			300
24	Mustard green	○	+	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	H	70	4.0	8.0	600
25	Okra	○	-	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	M	80		6.0	700
26	Pumpkin	○	++	S	M	Sensitive	Sensitive	Raw vegetable	Local/urban	M	70	4.0	9.0	450
27	Chinese radish	○	+-	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	M	80	4.0	8.0	600
28	Chinese spinach	○	+-	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	M	70		8.0	900
29	String-bean	○	++	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	M	60	3.0	6.0	800
30	Sweet corn	○	-	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	H	70		6.0	600
31	Tomato	○	+	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	H	80	3.0	9.0	700
32	Salad	○	+	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	H	60	4.0	6.0	1,100
33	Onion leaf	○	+	M	M	Sensitive	Sensitive	Raw vegetable	Local/urban	H	70	3.0	4.0	1,000
34	Watermelon	○	++	S	M	Sensitive	Sensitive	Fruit	Local/urban	M	70	4.0	9.0	450

Existence in the area +++: very many, ++: many, +: some exist, +-: rarely exist, -: not exist
Suitability to climate S: suitable, M: moderately suitable, N: not suitable
Easiness of cultivation technique E: easy, M: moderate, H: necessity of high level technique

Table D-10 Paddy Rice Varieties in Cambodia

	Year released	Origin	Ecology *1	Photoperiod-sensitive	Growth period (days)	Yield (ton/ha)	Variety type
Early maturing varieties							
IR 66	1990	IRRI	IRR	Insensitive	114	4.0 - 6.5	Indica
IR 72	1990	IRRI	IRR	Insensitive	120	3.5 - 6.0	Indica
Kru	1990	IRRI	IRR	Insensitive	115	3.5 - 6.0	Indica
IR Kesar	1993	IRRI	IRR	Insensitive	120	4.0 - 6.0	Indica
IR 65		Vietnam	IRR	Insensitive	100	5.0	
Baray	1995	IRRI		Sensitive	112	4.0 - 6.0	Indica
Chul'sa	1995		IRR		110	4.0 - 6.0	Indica
Riangchey	1999	Cambodia				3.5 - 5.5	Indica
Rohat	1999	IRRI-CIAT			120	4.0 - 6.0	Indica
Rumpe	1999	IRRI			120	4.0 - 6.0	Indica
Medium maturing varieties							
Santeheap 1	1992	IRRI	IRR	Insensitive	140	4.0 - 6.0	Indica
Santeheap 2	1992	IRRI	IRR	Insensitive	143	4.0 - 6.0	Indica
Santeheap 3	1992	India	IRR	Weakly sensitive	145	4.0 - 6.0	Indica
CAR 1	1995	Cambodia	RFL	Sensitive	140	2.5 - 4.0	Indica
CAR 2	1995	Cambodia	RFL	Sensitive	140	2.5 - 4.0	Indica
CAR 3	1995	Cambodia	RFL	Sensitive	140	2.5 - 4.5	Indica
CAR 11	1995	Cambodia	RFL	Sensitive	150	2.5 - 4.5	Indica
Late maturing varieties							
CAR 4	1995	Cambodia	RFL	Sensitive	150	2.5 - 5.0	Indica
CAR 5	1995	Cambodia	RFL	Sensitive		2.5 - 4.5	Indica
CAR 6	1995	Cambodia	RFL	Sensitive	150	2.5 - 5.0	Indica
CAR 7	1995	Cambodia	RFL	Sensitive		2.5 - 4.0	Indica
CAR 8	1995	Cambodia	RFL	Sensitive	150	2.5 - 4.5	Indica
CAR 9	1995	Cambodia	RFL	Sensitive	150	2.5 - 4.5	Indica
CAR 12	1995	Cambodia	RFL	Sensitive	160	2.5 - 4.5	Indica
CAR 13	1995	Cambodia	RFL	Sensitive	160	2.5 - 4.5	Indica
DON	1991	Thailand	RFL	Sensitive		2.0 - 4.5	Indica
Upland rice							
Rimke	1991	IITA	UPL		120	2.5 - 4.0	Indica
Sita	1991	IITA	UPL		110	2.5 - 4.0	Indica
Floating rice							
Khao Tah Petch	1991	Thailand	DPW			2.0 - 4.0	Indica
Tewarda			DPW				Indica
Aromatic rice							
Phka Rumchang	1999	Thailand				3.0 - 5.0	Aromatic
Pkha Rumchek	1999	Cambodia				3.0 - 5.0	Aromatic
Pkha Rumduoul	1999	Cambodia				3.5 - 5.5	Aromatic
Phka Sla							Aromatic
Other Traditional Variety in Takeo							
Sombak Ongkrong		Early					
Aruth		Early					
Jentuas Pluk		Early					
Srao Krohom		Early					
Phka Khnyai		Medium					
Kung Kombot		Medium					
Chma Phrom		Medium					
Phka Tian		Medium					
Tong Mulu		Medium					
Prambai Kua		Medium					
Niang Manh		Medium					
Pkaha Sla		Late					
Muai Roi Jai		Late					

Note: *1 IRR: Irrigated RFL: Rainfed lowland UPL: Upland
DPW: Deep water TDL: Tidal wetland

Source: Takeo DAFF

Table D-11 Food Balance in the Study Area

Present Condition (1998)

Paddy production	ton	51,480	1,300 kg/ha
Seed reserve and post-harvest losses	%	17%	MAFF's indicator
	ton	8,752	
Available paddy for consumption	ton	42,728	
Recovery rate of rice mill	%	60%	MAFF's indicator
Available rice for food	ton	25,637	
Population	person	165,600	
Rice consumption per capita	kg/capita	151.2	MAFF's indicator
Rice demand	ton	25,039	
Surplus of rice	ton	598	
Surplus of paddy	ton	997	1.9% of production

With Project (2010)

Population	person	220,000	
Rice consumption per capita	kg/capita	151.2	MAFF's indicator
Rice demand	ton	33,264	
Recovery rate of rice mill	%	62%	MAFF's indicator
Consumption of paddy	ton	53,652	
Seed reserve and post-harvest losses	%	17%	MAFF's indicator
Paddy demand	ton	64,640	
Paddy production	ton	68,000	Table II-4.5.1
Surplus of paddy	ton	3,360	4.9% of production

Population forecast

Annual growth rate *1 2.4%

Year	Population	Year	Population
1998	165,600	2005	195,700
1999	169,600	2006	200,400
2000	173,700	2007	205,200
2001	177,900	2008	210,100
2002	182,200	2009	215,100
2003	186,600	2010	220,000
2004	191,100	2011	225,300

Note

*1: Forcasted population growth rate by MOP on the basis of 1998 population census

Table D-12 Crop Budgets of With and Without-Program

(Unit: 1,000Riel/ha)

	Gross Income			Direct Production Cost										Indirect cost	Profit
	Total	Main product	By-product	Total	Inputs				Labor			Draft animal	Tool/ equipment		
					Total	Seed	Fertilizer	Others	Total	Hired	Family				
Paddy (medium)	1,081	1,036	45	417	298	26	170	102	27	27	0	56	35	30	634
Paddy (early)	1,134	1,089	45	409	292	20	170	102	27	27	0	56	35	29	695
Maize *1	1,238	1,200	38	300	220	40	160	20	12	12	0	42	26	22	916
Groundnut	1,119	1,105	14	354	274	135	114	25	10	10	0	39	32	27	737
Soybean/Mung-bean	1,216	1,200	16	363	284	144	114	26	8	8	0	39	32	28	825
Sesame	1,453	1,440	13	212	147	20	114	13	8	8	0	39	19	15	1,226
Cucumber *2	4,016	4,000	16	610	496	105	246	145	18	18	0	42	54	50	3,356
String-bean *2	4,810	4,800	10	535	429	120	170	139	17	17	0	42	47	43	4,232
Tomato *2	5,414	5,400	14	412	317	8	230	79	18	18	0	42	36	32	4,970
Vegetable Average	4,747	4,733	13	519	414	78	215	121	18	18	0	42	46	41	4,186

With-Program (Small Pond Development Plan)

(Unit: 1,000Riel/ha)

	Gross Income			Direct Production Cost										Indirect cost	Profit
	Total	Main product	By-product	Total	Inputs				Labor			Draft animal	Tool/ equipment		
					Total	Seed	Fertilizer	Others	Total	Hired	Family				
Groundnut	895	884	11	298	224	135	68	20	10	10	0	39	26	22	574
Soybean/Mung-bean	973	960	13	309	234	144	68	21	10	10	0	39	27	23	640
Sesame	1,034	1,024	10	159	97	20	68	9	10	10	0	39	14	10	865
Cucumber *2	2,813	2,800	13	483	388	105	148	135	10	10	0	42	43	39	2,291
String-bean *2	3,368	3,360	8	446	354	120	102	132	10	10	0	42	40	35	2,887
Tomato *2	3,612	3,600	12	293	215	8	138	70	10	10	0	42	26	22	3,297
Vegetable Average	3,264	3,253	11	407	319	78	129	112	10	10	0	42	36	32	2,825

Present/Without-Program

(Unit: 1,000Riel/ha)

	Gross Income			Direct Production Cost										Indirect cost	Profit
	Total	Main product	By-product	Total	Inputs				Labor			Draft animal	Tool/ equipment		
					Total	Seed	Fertilizer	Others	Total	Hired	Family				
Paddy (medium)	502	481	21	201	105	26	44	35	24	24	0	56	16	10	291
Paddy (early)	450	429	21	193	98	20	44	34	24	24	0	56	15	10	246
Maize *1	557	540	17	114	62	40	16	6	0	0	0	42	10	6	437
Groundnut	592	585	7	221	163	135	13	15	0	0	0	39	20	16	354
Soybean/Mung-bean	908	900	8	232	173	144	13	16	0	0	0	39	21	17	658
Sesame	545	540	5	76	31	20	8	3	0	0	0	39	7	3	465
Cucumber *2	1,606	1,600	6	297	228	105	52	71	0	0	0	42	27	23	1,287
String-bean *2	2,405	2,400	5	315	244	120	52	72	0	0	0	42	29	24	2,066
Tomato *2	1,805	1,800	5	179	121	8	52	61	0	0	0	42	16	12	1,614
Vegetable Average	1,939	1,933	5	264	198	78	52	68	0	0	0	42	24	20	1,655

*1: Maize of Present/without-program is includes sweet-potato, cassava, sugarcane

*2: Cucumber, string-bean and tomato are substitutes of vegetables in the area

Table D-13 Present Condition of Cattle Husbandry

	Unit	New born	Calf < 1 yo	Calf 1 yo	Calf 2 yo	Draft Cattle 3 yo	Draft Cattle 4 yo	Draft Cattle 5 yo	Draft Cattle 6 yo	Draft Cattle 7 yo	Draft Cattle 8 yo	Average /Total
Female												
Attrition rate	%	5.0%	4.0%	9.0%	9.0%	5.0%	5.0%	5.0%	5.0%	5.0%	100.0%	
Death rate	%	5.0%	4.0%	3.0%	2.0%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	
Sold/Slaughtered rate	%	0.0%	0.0%	6.0%	7.0%	3.5%	3.5%	3.5%	3.5%	3.5%	98.5%	
Raising number	head	11.4	10.8	10.4	9.4	8.6	8.2	7.7	7.4	7.0	6.6	76.1
Matured cattle	head											45.5
Dead	head	0.6	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	2.2
Sold/Slaughtered	head	0.0	0.0	0.6	0.7	0.3	0.3	0.3	0.3	0.2	6.5	9.2
Reproduction rate	%					50%	50%	50%	50%	50%	50%	
Calf born	head					4.3	4.1	3.9	3.7	3.5	3.3	22.8
Male (Castrated)												
Attrition rate	%	5.0%	4.0%	5.0%	3.0%	2.0%	2.0%	2.0%	2.0%	2.0%	100.0%	3%
Death rate	%	5.0%	4.0%	3.0%	2.0%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	2%
Sold/Slaughtered rate	%	0.0%	0.0%	2.0%	1.0%	0.5%	0.5%	0.5%	0.5%	0.5%	98.5%	
Raising number	head	11.4	11	10	10	10	9	9	9	9	9	85.6
Matured cattle	head											54.5
Dead	head	0.6	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	2.3
Sold/Slaughtered	head		0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	8.5	9.0
Total raising	head		22	21	19	18.1	17.5	16.9	16.4	15.8	15.3	161.7
Matured cattle	head											100.0
Total sold/slaughtered	head		0.0	0.8	0.8	0.3	0.3	0.3	0.3	0.3	15.1	18.2
Weight	kg/head		80	200	250	300	300	300	300	300	300	
Total	kg		0	166	190	104	100	95	91	87	4,516	5,348
Average	kg/head											293
Cattle unit												
Conversion factor			0.3	0.5	0.7	1.0	1.0	1.0	1.0	1.0	1.0	
Cattle unit	unit		6.5	10.4	13.5	18.1	17.5	16.9	16.4	15.8	15.3	130.4
Nos. of draft cattle												
Female	head	75%				6.4	6.1	5.8	5.5	5.2	5.0	34.1
Male	head	100%				9.6	9.4	9.2	9.0	8.8	8.6	54.5
Total	head					16.0	15.5	15.0	14.5	14.1	13.6	88.7
Nos. of pairs	pair											44.3

Working capacity of pair cattle					
One animal day		One pair of cattle works about 5 hours per day			
Land preparation rate		7	animal days / ha including plowing and harrowing for paddy field		
Working days a year	day/year	90			
Land preparation	day/year	35		5.0	ha/pair-year
Transportation	day/year	55			
Working cost of draft animal					
Land preparation	Riel/animal day	7,000		245,000	Riel/pair-year
Transportation	Riel/animal day	7,000		385,000	Riel/pair-year
			Total	630,000	Riel/pair-year
Land preparation rate	Riel/ha	49,000			
Transportation rate					
Feed requirement of cattle					
Forage (dry matter kg/unit)	kg/unit	2,000		5.5	kg/day-unit
Rice straw	kg	60%	1,200		
Cut grass	kg	20%	400		
Grass grazing	kg	20%	400		
Grain feed	kg		20		

Rice straw production (dry matter) Paddy yield level (ton/ha)	Straw (ton/ha)	Utilization rate	Available straw for feed (ton/ha)	Available unit. of cattle (unit/ha)
1.3	1.3	80%	1,040	0.87
1.8	1.8	80%	1,440	1.20
2.0	2.0	80%	1,600	1.33
2.5	2.5	80%	2,000	1.67
3.0	3.0	80%	2,400	2.00

Table D-14 Present Condition of Pig Husbandry

	Unit	New born	<2 mo	2-4 mo	4-6 mo	6-8 mo	8-10 mo	10-12 mo	1 yo	2 yo	3 yo	4 yo	Average /Total
Female		Litter	Piglet		Grower pig				Sow				
Attrition rate	%	10%	10%	15%	11%	19%	23%	92%	6%	6%	6%	100%	
Death rate	%	10%	10%	15%	5%	4%	3%	2%	2%	2%	2%	2%	
Sold/Slaughtered	%	0%	0%	0%	6%	15%	20%	90%	4%	4%	4%	98%	
Raising numbers	head	100.0	15.0	13.5	11.5	10.2	8.3	6.4	3.1	2.9	2.7	2.5	76.0
Subtotal	head				64.8					11.2			
Dead	head		9.0	12.2	3.4	2.5	1.5	0.8	0.1	0.1	0.1	0.1	29.5
Sold/Slathered	head		0.0	0.0	4.1	9.2	9.9	34.4	0.1	0.1	0.1	2.5	60.5
Reproduction rate	head								17.9	17.9	17.9	17.9	
Reproduction	head								54.7	51.4	48.4	45.5	200.0
Male		Litter	Piglet		Grower pig				Boar				
Attrition rate	%	10%	10%	15%	11%	19%	23%	99%	6%	6%	6%	100%	
Death rate	%	10%	10%	15%	5%	4%	3%	2%	2%	2%	2%	2%	
Sold/Slaughtered	%	0%	0%	0%	6%	15%	20%	97%	4%	4%	4%	98%	
Raising numbers	head	100.0	15.0	13.5	11.5	10.2	8.3	6.4	0.38	0.36	0.34	0.32	66.2
Subtotal	head				64.8					1.40			
Dead	head		9.0	12.2	3.4	2.5	1.5	0.8	0.0	0.0	0.0	0.0	29.3
Slaughtered	head		0.0	0.0	4.1	9.2	9.9	37.1	0.0	0.0	0.0	0.3	60.7
Total raising number	head		30.0	27.0	23.0	20.4	16.5	12.7	3.4	3.2	3.0	2.9	142.2
Sold/Slathered	head		0.0	0.0	8.3	18.4	19.9	71.5	0.1	0.1	0.1	2.8	121.2
Pig unit													
Conversion factor	unit		0.0	0.5	0.5	1.0	1.0	1.0	2.0	2.0	2.0	2.0	
Pig unit	unit		0.0	13.5	11.5	20.4	16.5	12.7	6.9	6.5	6.1	5.7	99.8
Weight (Raising)	kg/head		2.0	30	45	60	70	80	120	120	120	120	
	kg		60	810	1,033	1,226	1,158	1,019	413	388	365	343	6,814
Average	kg/head												48
Weight (Sold/Slaughtered)	kg		0	0	372	1,103	1,390	5,717	17	16	15	336	8,965
Average	kg/head												74
Price of live pig	Riel/kg												2,700
Price	1000Riel/head			81	122	162	189	216	324	324	324	324	
Amount	1000Riel			0	1,004	2,978	3,752	15,437	45	42	39	907	24,204
Average	1000Riel/head												200
Feed of grain	kg/day-head			1.0	1.0	1.5	1.5	1.5	2.5	2.5	2.5	2.5	
Rice bran	%			50%	50%	50%	50%	50%	50%	50%	50%	50%	
Others (rice, maize, etc.)	%			50%	50%	50%	50%	50%	50%	50%	50%	50%	
Grass/fiber feed	kg												
Rice bran	kg/day-head			0.50	0.50	0.75	0.75	0.75	1.25	1.25	1.25	1.25	
	kg/year-head			183	183	274	274	274	456	456	456	456	
	ton/year			4.9	4.2	5.6	4.5	3.5	1.6	1.5	1.4	1.3	28.5
Average	kg/year-unit												285
	kg/year-head												200

Production of rice bran in village millers

			Whole rice			Bran *	Husk	Heads be able to raise	Units be able to raise
			Total	White	Broken				
Recovery Rate			66%	56%	10%	18%	16%		
Yield level of paddy	kg/ha	1,300				234		1.17	0.82
	kg/ha	1,800				324		1.62	1.14
	kg/ha	2,000				360		1.80	1.26
	kg/ha	2,500				450		2.25	1.58
	kg/ha	3,000				540		2.70	1.89

Table D-15 Present Crop Yield in the Priority Areas by Villages

Plan / Commune / Village	Early Paddy			Medium Paddy			Vegetables			Beans *1		
	Planted area (ha)	Average yield (kg/ha)	High yield (kg/ha)	Planted area (ha)	Average yield (kg/ha)	High yield (kg/ha)	Planted area *2 (ha)	Average yield (kg/ha)	High yield (kg/ha)	Planted area (ha)	Average yield (kg/ha)	High yield (kg/ha)
USP												
Trapeang Kranhumg	5	700	1,400	15	700	1,600						
Khpob Svay												
O Saray												
1 Trapeang Dang Tuek	30	1,000	1,500	70	1,000	1,500	5	4,000	5,000		600	
2 Trapeang Krasang	10	1,000	1,500	280	700	900	5			3	600	800
3 Boeng Satong	5	700	850	80	700	800	15	3,000	4,000	5	600	750
4 Trapeang Khchau	5	700	850	85	800	910	5			3		
T.T.K. Cheung												
1 Peak Bang'aong	30	1,000	1,200	130	1,000	1,600	7			2		
2 Prey Khvav	5	1,500	2,000	60	1,500	2,000	4			1		
3 Trapeang Svay	15	1,000	1,500	10	1,200	2,000	10	4,000	5,000			
4 Ta Suon	15	1,500	2,000	75	1,500	2,000	7			1		
5 Prey Ta Lei	5	1,800	2,500	55	1,800	2,500	6	4,000	6,500	1		
6 Pou Doh	50	1,000	1,500	120	1,200	2,000	5			2		
7 Prey Sbat	10	1,500	2,000	85	1,800	2,300	5			1		
8 Prey Dok Por	10	1,500	2,000	40	1,500	2,000	5			1		
9 Prey Kdouch												
Cheang Tong												
1 Srae Khvav	10	1,600	1,800	115	1,800	2,200	14	4,500	6,000	1		
2 Ta Reab	10	2,000	2,500	75	2,000	2,500	8	4,500	6,500	2		
3 Angk Kralanh	25	1,700	2,200	90	1,600	2,300	18	3,500	6,000			
4 Angk Baksei	10	1,500	2,000	85	1,500	2,000	7			1		
5 Trapeang Srangae	5	1,200	1,800	45	1,500	2,000	3					
6 Totueng Thnga	10	1,500	2,000	70	1,500	2,000	6			2		
7 Trapeang Tuek	5	1,500	1,800	45	1,800	2,300	4			1		
8 Ta Koem	10	1,600	2,000	65	1,300	1,700	19	4,500	6,000	3	600	800
9 Moeang Char	15	1,500	2,300	165	1,500	3,000	6			4	1,000	1,800
10 Ti Pat	5	1,500	2,000	75	1,300	2,000	10	4,000	5,000	1		
11 Srae Kruo	10	1,500	2,000	65	1,300	2,000	35	4,000	5,000	1	600	750
12 Tuol Tbaeng	10	1,500	1,700	160	1,300	1,500	3			2	500	600
13 Nomou	15	2,000	2,500	100	1,800	2,800	8			2		
Ta Phem												
1 Mrum	40	700	1,000	110	900	1,300	3			1	600	900
2 Trapeang Ampil	25	800	1,100	65	900	1,500	2			1	600	900
3 Ta Much	5	1,500	3,000	100	1,300	1,700	6	5,000	6,000	1	600	900
4 Moha Sena	35	800	1,100	180	1,200	1,500	10	5,000	7,000	2	600	900
5 Ta Mom	15	1,500	3,000	90	1,300	1,700	3			1	550	890
SRP												
T. T. K. Thboung												
Trapeang Chhuk		1,300	2,000		1,200	1,500						
Nhaeng Nhang												
Kim Sei		1,200	1,500		1,100	1,200						
PDP												
Nhaeng Nhang												
Trapeang Snao		1,200	2,000		1,200	1,200						
Average/Total		1,309	1,826		1,315	1,824						
Average/Total of USP	455	1,316	1,826	2,805	1,329	1,875	243	4,167	5,667	44	621	908

Note *1: Mung-bean and groundnut

*2: Planted areas include secondary crop field and kichen garde

Average Paddy Yield by Social Environmental Baseline Surve

	kg/ha
USP	1,209
Ang 160 SRP	1,332
Kamsei SRP	1,367
PDP	1,294