GOVERNMENT OF MALAYSIA

FEASIBILITY STUDY ON RATIONALIZATION AND CROP DIVERSIFICATION IN NON-GRANARY IRRIGATED AREAS IN MALAYSIA

Volume 5-1

State Report - Perlis

October 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

GOVERNMENT OF MALAYSIA

FEASIBILITY STUDY ON RATIONALIZATION AND CROP DIVERSIFICATION IN NON-GRANARY IRRIGATED AREAS IN MALAYSIA

Volume 5-1

State Report - Perlis

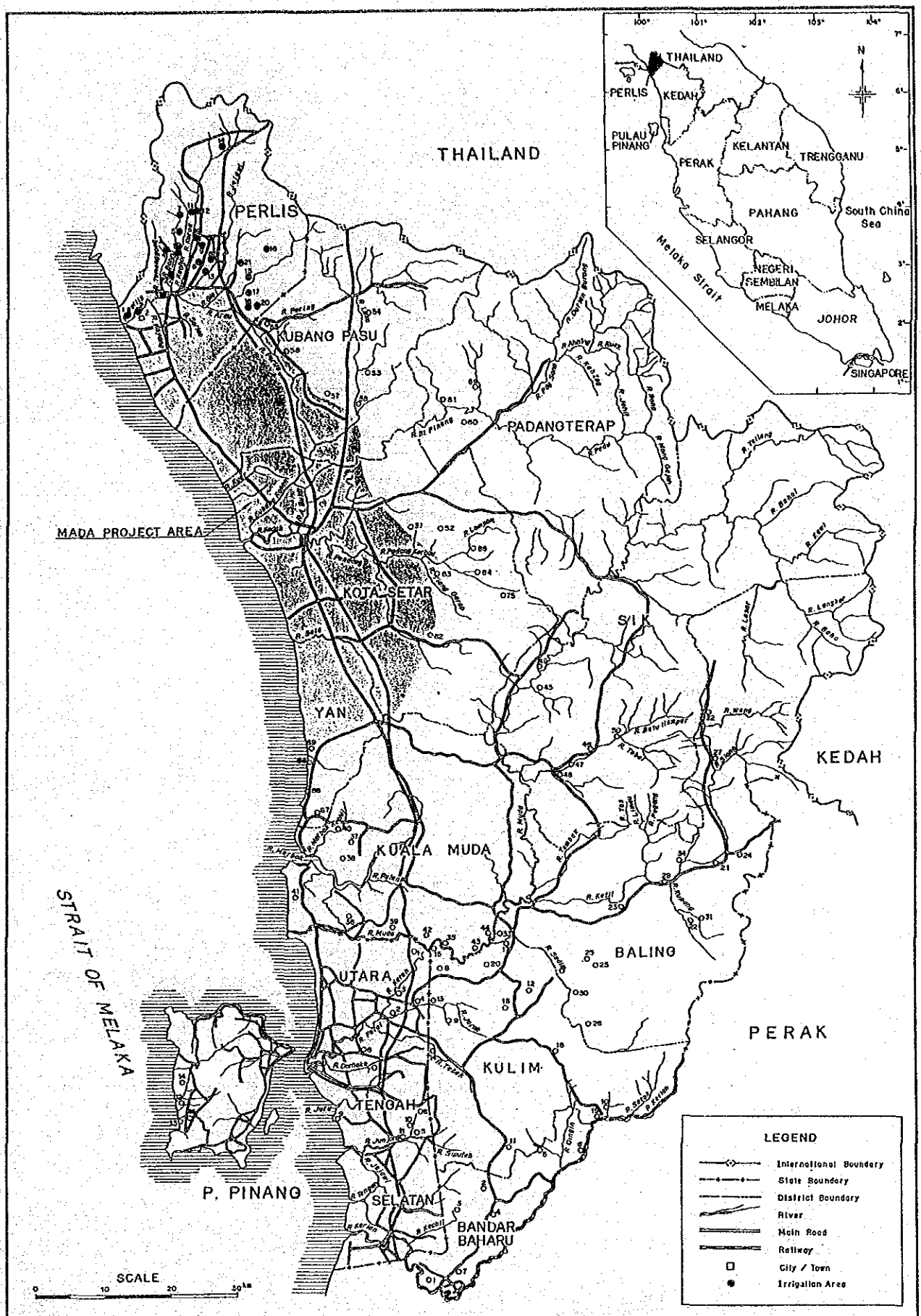
October 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

Feasibility Study on Rationalization and Crop Diversification in Non-granary Irrigated Areas in Malaysia

LIST OF REPORTS

Volume	1	Main Report
Volume	2	Crop Diversification Evaluation Methodology
Volume	3	Crop Diversification Study on Selected Schemes
Volume	4	Manual for Information Management System
Volume	5-1	State Report - Perlis
Volume	5-2	State Report - Kedah
Volume	5-3	State Report - P. Pinang
Volume	5-4	State Report - Perak
Volume	5-5	State Report - Selangor
Volume	5-6	State Report - N. Sembilan
Volume	5-7	State Report - Melaka
Volume	5-8	State Report - Johor
Volume	5-9	State Report - Pahang
Volume	5-10	State Report - Trengganu
Volume	5-11	State Report - Kelantan
Volume	5-12	State Report - Sabah
Volume	5-13	State Report - Sarawak



Location of Non-granary Irrigation Schemes

Perlis

FEASIBILITY STUDY ON RATIONALIZATION AND CROP DIVERSIFICATION IN NON-GRANARY IRRIGATED AREAS IN MALAYSIA

Japan International Cooperation Agency

Feasibility Study on Rationalization and Crop Diversification in Non-granary Irrigated Areas in Malaysia

Volume 5-1

State Report - Perlis

CONTENTS

TABLES & FIGURES

APPENDIX

1. INTRODUCTION

This is the State Report - Perlis, Volume 5-1, of the Final Report for Feasibility Study on Rationalization and Crop Diversification in Non-granary Irrigated Areas in Malaysia. This report includes the criteria, procedure and results of evaluation of crop diversification potential of non-granary irrigation schemes in the State of Perlis.

Detailed information on the criteria and procedure for evaluation is presented in Volume 2 of the Final Report, and the results of evaluation of crop diversification potential for each scheme are given in the Appendix attached to this Volume.

2. GENERAL CONDITIONS

2.1 Socio-economic Situation

Perlis is the smallest of the states in the country. It is bounded by the Thai frontier to the north, Kedah to the east and south and a coastline on the Straits of Melaka to the west. The total area is 795 km^2. The State has no administrative district. The estimated population was 165,700 persons for 1985 and 177,100 persons for 1988. The population density in 1988 was 223 person/km^2. Rural population ratio slightly went down from 90% in 1985 to 80% in 1988. In Perlis, the proportion of population by ethnic group in 1987 was 79% for Bumiputera, 15% for Chinese, and 3% each for Indian and others.

In the State of Perlis, GDP in 1988 amounted to M$452 million at 1978 constant prices of which 39% came from the agriculture sector followed by the service sector of 33% and the manufacturing sector of 21%. Per capita GDP increased from M$2,345 in 1986 to M$2,562 in 1988, while the both were far below the country's per capita GDP of M$3,551 in 1986 and M$3,858 in 1988. According to the Household Income Surveys conducted in 1984 and 1987, there existed 13,500 poor households accounting for 33.7% of 40,000 households in total for 1984 and 12,100 poor households accounting for 29.1% of the total households of 41,600 in 1987. The mean monthly income rose from M$692 in 1984 and M$711 in 1987, which was lower than that of Peninsular Malaysia by M$403 in 1984 and M$363 in 1987. The incidence of poverty declined from 33.7% in 1984 to 29.1% in 1987.

As of 1985, the coverage of electricity services was 90.3% of the total population, while that of piped water supply services was 93.0% in urban areas and 50.0% in rural areas. The total road length was 485 km with road network density of 610 m/km^2 and per capita road length of 2,940 every 1,000 population. The registered number of motor vehicles were 231 per 1,000 population. With respect to health service indicators, the State had 2.7 doctors and 2.5 acute care hospital

beds per 1,000 population with the infant mortality rate of 1.8 per 1,000 population. Each health center took care of 21,300 rural people on an average.

Under the revised 5MP, development expenditure of the Federal Government and Non-Financial Public Enterprise (NFPEs) allocated to the State of Perlis amounted to M$396 million and accounted for 1.3% of the national total of M$31,329 million excluding expenditure for multi-state projects. The Perlis State Development Cooperation (PSEDC) is solely responsible for the promotion of the economic development in Perlis. Main economic activities are to develop industrial estates, housing schemes, business premised and tourism as well as to encourage investment.

2.2 Present Agriculture

According to DOA's land use data, the total area under crops is about 56,700 ha or 72% of the whole territory of Perlis. Some 29,670 ha are paddy field. Rubber area covers 8,590 ha, while no planting of oil palm and cocoa is done in the State. Among miscellaneous crops, sugarcane has the largest coverage of 9,840 ha followed by mango of 1,100 ha and tobacco of 500 ha. Another 24 miscellaneous crops are grown in the total area of 490 ha. In 1987, the State produced paddy of 33,600 tons and rubber of 27,600 tons.

The following indicates the total demand for food crops, vegetables, fruits and freshwater fishes projected by FAMA for 1989.

Produce	Net Consumption (ton)	Outflow to Other States (ton)	Post-harvest Loss (ton)	Total Demand (ton)
Food crops	808	0	202	1,010
Vegetables	11,411	0	2,853	14,264
(Leafy)	(3,704)	(0)	(926)	(4,630)
(Fruit)	(4,696)	(0)	(1,174)	(5,870)
(Root)	(2,297)	(0)	(574)	(2,871)
(Other)	(714)	(0)	(179)	(893)
Fruits	7,270	0	1,817	9,087
Freshwater fishes	102	0	25	127

However, the total supply to consumers in Perlis is estimated to be 38 tons for food crops, 2,813 tons for fruits and 4 tons for freshwater fishes. Within the State, therefore, the market potential is almost equal to the total demand. Crops with large market potential are indicated below.

Produce	Market Potential (ton)	Major Crops (ton)
Food crops	972	Sweet potato (780), maize (155)
Vegetables	14,264	
(Leafy)	(4,630)	Mustard (1,466), Cabbage (1,316)
(Fruit)	(5,870)	Chilli (1,024), Cucumber (1,012)
(Root)	(2,871)	Shallot (2,410)
(Other)	(893)	Garlic (621)
Fruits	6,274	Banana (1,570), Durian (1,328)
Freshwater fishes	123	Siamese sepat (70)

2.3 Present Situation of Non-granary Irrigation Schemes

The total area under crops is about 56,700 ha or 72% of the whole territory of Perlis. Some 25,750 ha are paddy fields. Rubber area covers 8,590 ha, while no planting of oil palm and cocoa is done in the State. Among miscellaneous crops, sugarcane has the largest coverage of 9,840 ha followed by mango of 1,100 ha and tobacco of 500 ha. Another 24 miscellaneous crops are grown in the total area of 490 ha. There exist irrigable paddy fields of 23,715 ha as a whole. Of this, the Muda granary area covers 19,500 ha and non-granary irrigated areas amount to 4,215 ha.

- Number of schemes : 22
- Total irrigable area : - main season = 4,215 ha
  - off season = 475 ha
- Type of schemes : gravity=16, pump=2, gravity/pump=1 controlled drainage=3
- Irrigation water resources availability by scheme (except controlled drainage scheme)
  : - sufficient for double cropping = 5

- insufficient for off season presaturation = 12
- limited to only single cropping = 2

- Average cropping intensity (paddy + upland crops) for previous three years

: - main season = 98%
- off season = 0%

- Average cropping intensity (paddy only) for previous three years

: - main season = 97%
- off season = 0%

- Utilization of scheme
  - main season paddy cropping intensity of 100% = 15
  - main season paddy cropping intensity of more than 50% = 7

Due to small catchment areas of water source rivers and low rainfall during the off season, paddy cultivation in Perlis is featured by irrigated single cropping for the main season only. Tobacco is grown as the second crop in some parts of the paddy cultivation area, but there is no possibility to expand its planted area because the production quota presently allocated to Perlis is almost met. Under the Perlis IADP, one dam is under construction to create the off season irrigation water resources. Drip irrigation system is going to be practiced in hilly areas to grow fruits.

In Perlis, seasonal laborers can be hired at cheaply from neighboring Thailand. Therefore, the profit derived from paddy cultivation is at the highest level in the country and paddy farmers strongly adhere to paddy planting.

3. EVALUATION OF CROP DIVERSIFICATION POTENTIAL FOR NON-GRANARY IRRIGATION SCHEMES

This section presents a general concept, criteria and procedure of evaluation in order to facilitate understanding of the results of the evaluation of potential for crop diversification by scheme attached in Appendix of this volume. A detailed explanation of the evaluation is given in Volume 2.

3.1 Basic Considerations for Evaluation

The intended shift from paddy cultivation to diversified crops in non-granary irrigated areas would invariably require investigations on a range of issues such as the selection of the appropriate crops based on agronomic and economic factors, institutional support systems, and additional investments for providing new or upgrading of facilities. Since the areas concerned are both extensive and widespread, it is only proper that a coordinated study be carried out in order to evaluate the prevailing scheme conditions and to prepare crop diversification strategies including the selection of the suitable crops.

To prepare crop diversification options for revitalization of the non-granary irrigation schemes with a wide range of constraints, the potential for crop diversification in each scheme area has to be evaluated and then indicated as the crop diversification patterns. Such procedure is to be defined as evaluation of resource potential for crop diversification. Its outcome will provide indications of the crop diversification patterns being a basis for formulating development plans and programs.

For non-paddy crops, irrigation has recently become an important input for crop production in Malaysia like irrigation for paddy. In order to a accommodate crop diversification in the existing rice-based irrigation systems, special considerations are required for

the differences between paddy and non-paddy crops as well as paddy farmers behavior in addition to basic parameters such as soil-plant-water relations, water resources, climate, geographic, economic and social.

3.1.1 Differences between paddy and non-paddy crop

Paddy is very tolerant to fully saturated or flooded conditions, which is the main reason for it being planted in flood prone areas with heavy soils and poor drainage conditions. Non-paddy crops on the other hand need non-saturated and well aerated soils for healthy growth. Therefore poorly drained areas as found in most of the schemes can seriously affect growth and yields of non-paddy crops.

Sensitivity to water stress varies between their growth stages and also crop types. Cultural practices and production systems can be vastly different between types and varieties and the produce also tend to be more perishable than paddy.

These basic differences need some general criteria for the system design to be established. Irrigation for paddy is designed for continuous supply and drainage adequate for excess surface flow. Whereas for non-paddy, supply is intermittent since demand depends on available soil water storage and evapotranspiration rate. Besides irrigation, water is also required for fertilizer and pesticide application for non-paddy crops. Its drainage design will need to consider both surface and subsurface flows.

3.1.2 Paddy farmers' behavior

Paddy areas have a very long history of mono-cropping, and traditions and culture have evolved around paddy. Most paddy farmers are usually experienced and knowledgeable only in paddy production. Thus, diversification will require changes to deep-rooted life styles, values and technology of paddy farmers. On the other hand,

diversification will also require appropriate adjustments on its part to match with their behavior.

In this connection, a Socio-economic Sample Survey was performed in all non-granary irrigation scheme areas to identify paddy farmers' intentions and local community opinion leaders' view towards crop diversification. The results of the Socio-economic Sample Survey are presented in Appendix B for farmers' intentions and Appendix C for the leaders' opinions.

3.1.3 Determination of categories

In deciding options for crop diversification, it is apparent that there exists various possibilities for diversifying land utilization such as double cropping of paddy, combination of the main season paddy with short-term crops in the off-season, mix-farming, perennial tree crop cultivation, freshwater aquaculture, and cattle grazing ground. Any one of these taken singly on in combination with any other option can be a category. Taking into consideration the purpose of the evaluation under the Study, the following eight categories are to be made:

Category 1 : Schemes to be converted to high value crop cultivation under irrigated condition,

Category 2 : Schemes to be converted to tree crop cultivation;

Category 3 : Schemes to introduce two-cropping system planting paddy during the main season and short-term annual crops during the off-season;

Category 4 : Schemes to be converted to animal feeding crop cultivation or cattle raising fields;

Category 5 : Schemes to be converted to freshwater fish culture ponds;

Category 6 : Schemes to be positively maintained as mini-granary areas;

Category 7 : Schemes to be maintained as paddy cultivation areas within a definite period of time for social welfare purposes and thereafter to be further categorized; and

Category 8 : Schemes to be converted to housing/industrial and other uses.

3.2 Criteria for Evaluation

3.2.1 General

Inevitably, crop diversification involves the question of which crop or crops to be recommended based on a variety of factors. In the process to evaluate potential for crop diversification, each non-granary irrigation scheme is subjected to a screening process on a variety of factors. For this purpose, seven main factors are taken into account.

- Water resources availability,
- Farmers' intention towards continuation of paddy cultivation and introduction of crop diversification,
- Land suitability for carrying out direct seeding and mechanized plowing and harvesting for growing paddy,
- Soil and climatic suitability and limitations for the cultivation of specific crops,
- Crop profitability,
- Crop marketability, and
- Investment performance with regard to crop diversification.

3.2.2 Water resources availability

The evaluation of water resources in quantitative and qualitative terms is based on the information collected during the Scheme Inventory Survey. Reconfirmation of water resources availability is carried out through supplementary investigations on rainfall data, catchment characteristics, river discharges, reference on the existing hydrological procedures, and previous study reports on the availability of water resources on a specific catchment. The criteria for evaluating water availability of each non-granary irrigation scheme is expressed in the following four terms:

A. Irrigation water is sufficient for double cropping of paddy;

B. Sufficient for supplying irrigation water to the main season paddy cultivation but insufficient for meeting presaturation water requirement for the off season paddy cultivation;

C. Limited to single cropping of the main season paddy and upland crop cultivation; and

D. Insufficient for paddy cultivation but no limitation to grow upland crops for the main season.

The detailed information on water resources evaluation for the various non-irrigation schemes is compiled in Appendix A of Volume 2.

3.2.3 Farmers' intention towards continuation of paddy cultivation and introduction of crop diversification

This factor is important as the success of the crop diversification program is depended on farmers' willingness to participate and also their attitude and preference to move towards a more diversified cropping pattern. To evaluate this factor, the Socio-economic Sample Survey results are referred to in respect to paddy farmers' intention towards continuation of paddy cultivation and introduction of crop diversification.

The evaluation criteria established are based on the proportion of respondent farmers who strongly intend to continue the present paddy cultivation pattern among the total sample farmers and that of paddy planted area for the last three years (1985-1987) against the irrigable area of each scheme. The evaluation method is to identify the State in which more than half of the respondent farmers show intentions towards continuation of paddy cultivation and to screen out the scheme with paddy cropping intensity of more than 50%.

- Schemes possible for promoting double cropping of paddy in case that the proportion of intended farmers against the total samples in each State is over 50%. Also, possible for promoting double cropping of paddy if the scheme-by-scheme planted area for the last three years is more than 50% every year in case of the State with the above proportion of less than 50%.

- Schemes impossible for promoting intensive paddy cultivation when the above proportion on the State basis is less than 50% and the cropping intensity is below 50%.

3.2.4 Land suitability for mechanized farming practices

This factor is optionally evaluated to clarify suitability of undertaking modern farming practices of paddy cultivation in case of schemes where intensive double cropping of paddy can be promoted. To evaluate this factor, special attention is paid to soil physical characteristics, size of scheme, availability of mechanical service centers and distance between schemes and available service sources. The evaluation criteria is established taking into account soil physical characteristics among others as below.

- Schemes suitable for mechanized farming practices are expressed in terms of the existence of alluvial soils.
- Schemes not suitable for mechanized farming practices are indicated by inappropriate soil physical conditions derived from peat soils and organic mac soils which are featured by low bearing capacity for using tractors and harvesters commonly used in Malaysia.

The detailed information is presented in Appendix D of Volume 2.

3.2.5 Soil and agro-climatic suitability and limitations for the cultivation of specific diversified crop

These factors are the basis to identify crops suitable for each scheme from the agronomic viewpoints. In identifying suitable crops, soil criteria for optimum crop growth is prepared for the following 28 crop groups referring to documents such as "Soil-Crop Suitability Classification for Peninsular Malaysia" prepared by the Department of Agriculture (DOA), "The Land Capability Classification" collected from DOA, Sabah and "Sarawak Land Capability Classification and Evaluation for Agricultural Crops" issued by DOA, Sarawak.

Short-term food crops:

maize, sorghum, wet paddy and upland rice as food crops, and ginger, groundnut and vegetables as vegetable crops,

Fruits:

mango/durian, guava, banana, cashewnut, papaya, citrus, pineapple and watermelon,

Perennial industrial crops:

coconut, oil palm, cocoa, rubber, sago palm, coffee, tea, clove, tobacco, sugarcane and pepper,

Feeding crops:

fodder grasses and pasture.

As the basic information to evaluate soil suitability and limitations, soil services that distribute in each scheme are identified referring to the available reconnaissance soil maps and those limitations to growth of each of 28 crops are evaluated on the basis of the soil criteria. The evaluated limitations are expressed in the farm of soil suitability classed with a symbol indicating the specific limitation such as acid sulphate layer, depth to compacted layer, drainage, nutrient imbalance, organic horizon, salinity, and texture and structure. The followings are the grade of limitations to crop growth.

Class 1 soils with no limitation or only minor limitations to crop growth are suitable for the widest range of crops.

Class 2 soils with moderate limitations to crops growth are suitable for a narrower range of crops than Class 1 soils. Minor management practices according to limitations are required.

Class 3 soils with one serious limitation to crop growth are restricted to an even narrower range of crops. Necessary management practices involve moderate expenses.

Class 4 soils with more than one serious limitation to crop growth are suitable for a very narrow range of crops with provision of major amelioration measures.

Class 5 soils with at least one very serious limitation to crop growth are least suitable for crop growth.

Through the identification and grading of limitations to crop growth for soil series which is identified in each non-granary irrigation scheme, soil suitability of 28 crops is classified into four groups such as suitable, marginally suitable, very marginally suitable and not suitable for promoting crop diversification.

The correlation between suitability grades and soil classes as follows:

Suitable:
Class 1 soils,

Marginally suitable:
Class 2 soils and partly Class soils of which limitations can be physically improved,

Very marginally suitable:
Class 3 soils with limitations of which limitations can be hardly graded up by direct physical measurements, and

Not suitable:
Classes 4 and 5 soils.

After evaluating soil suitability in the above procedure, identified crops with suitable to very marginally suitable grades are to be succeedingly confirmed from the agro-climatic viewpoint. For this purpose, two basic references are utilized, being "Agro-ecological regions in Peninsular Malaysia" and "Climatic and Agricultural Planning in Peninsular Malaysia" both prepared by the Malaysian Agricultural Research and Development Institute (MARDI). Among the identified crops, those which are not suited to regional climatic conditions in the specific scheme are eliminated from a list of suitable crops identified on the basis of soil conditions.

The detailed information is presented in Appendix D of Volume 2.

3.2.6 Crop profitability

To confirm the net income difference between paddy cultivation and other diversified crops, crop budget is computed based on average crop yield under normal farming practices, production cost and selling price. For this, "Guideline on Economic Viability of Selected Crops" prepared by the Ministry of Agriculture (MOA) is used as the basic reference. This includes crop budget data on 25 food crops and vegetables, 14 fruits and one industrial crop. With regard to other industrial crops, data on crop budgets are supplemented from MOA, DOA and agencies concerned. All the information is presented in Appendix E of Volume 2. The evaluation criteria is set up as below.

- Crop suitable for promoting diversified cropping are more profitable as compared with net income derived from the single cropping of paddy.
- Crops not suitable for incorporating in diversified cropping are less profitable in comparison with the net income obtained from the single cropping of paddy.

3.2.7 Crop marketability

This factor is also very important when crop diversification is promoted is specific areas, because most paddy farmers are aware that success of diversified cropping especially for short-term upland crops demand largely on availability of markets where they can expect to sell their produce at profitable price levels.

In terms of export-oriented perennial crops, the respective responsible agencies provide smallholder farmers with easy access to the existing marketing channel actively maintained. As for short-term upland crops, the Federal Agricultural Marketing Authority (FAMA) is responsible for promotion of marketing activities to encourage growers. Every year, FAMA gives a guideline for market potential in each State for about 30 varieties of vegetables and cash crops, 20 varieties of fruits and 15 kinds of freshwater fishes and livestock products. The data on market potential is compiled in Annex F of

Volume 2. By referring to this guideline, the crop marketability is evaluated in terms of quantified market potential on the administrative district-by-district bases. The evaluation criteria is set up as below.

- Crops suitable for promoting crop diversification have less marketable volume as compared with the demand of a specific administrative district where one particular scheme is located major market situated nearby or easily accessed from the scheme.

- Crops not suitable for promoting crop diversification have marketable quantity exceeding over more than twice of the demand in the specific administration district.

3.2.8 Investment performance with regard to crop diversification

This factor is evaluated for the purpose of judging the priority among categories and crops of which suitability to promote crop diversification are both identified. The evaluation procedure is based on economic viability indicated by net present value and benefit-cost ratio.

3.3 Procedure of Evaluation

3.3.1 General procedure

The potential of crop diversification for each non-granary irrigation scheme is evaluated category by category based on the following seven stepwise procedure as illustrated in Fig. 1.

Step 1 : Evaluation water resources availability,

Step 2 : Evaluation of farmers' intention towards continuation of paddy cultivation and introduction of crop diversification,

Step 3 : Evaluation of land suitability for carrying out direct seeding and mechanized plowing and harvesting in growing paddy,

Step 4 : Evaluation of soil and climatic suitability and limitations for the cultivation of specific crops,

Step 5 : Evaluation of crop profitability,

Step 6 : Evaluation of crop marketability, and

Step 7 : Evaluation of investment performance with regard to crop diversification.

The flow chart of evaluation procedure is illustrated in Fig. 2. In general, evaluation of factors in each Category starts from Step 1 and ends Step 7 for the respective schemes. As Step 3 is the optional gate to evaluate land suitability for conducting mechanized paddy cultivation practices, all Categories other than Category 6 jumps evaluation in Step 3. Before entering Step 1, the following two items are preliminarily checked to understand the present condition on how a scheme is utilized by beneficially farmers:

- Type of irrigation water intake facilities, and
- Planted area for the last three years.

3.3.2 Evaluation procedure for Category 1

In Step 1, one scheme has potential for promoting intensive short-term upland crop cultivation under irrigated condition if available water resources are enough for double cropping of paddy and short during the presaturation period of the off season. Upland crops can be grown maximum twice a year under irrigated condition in case that available water resources can meet irrigation water demand only for the main season paddy. Irrigated cropping of upland crops are limited to the main season if available water resources are insufficient for paddy cultivation. Therefore, each scheme can pass Step 1 with the exceptions of control drainage and inundation schemes.

In Step 2, schemes are evaluated as possible for promoting crop diversification and then go to Step 4. To provide information on technical and economical choice of upland crops if requested, other schemes also move down to Step 4 additionally.

In Step 4 after skipping Step 3, suitable upland crops are firstly identified through soil-crop-suitability assessment. Further, suitable varieties of upland crops are selected among the above crops identified paying special attention agro-climatic condition in lowland areas. If there is an identified and selected crop, schemes enter into the next step.

In Step 5, net income data of the selected crops are compared with that earned from single cropping of paddy. In case of higher net income expected, schemes shift to the next step.

In Step 6, marketability of upland crops confirmed its profitability are evaluated through comparison with the local demand in the District where schemes are located and in the local marketing centers. Usually, mono-cropping of the specific upland crop is very risky from the viewpoints of crop management and marketing. In this connection, crop production is estimated based on such assumed figures as the national average yield and the maximum planted area equivalent to 50% of the scheme's irrigable area for each of profitable crops.

In Step 7, economic viability is evaluated in terms of benefit-cost ratio and net present value. For this, benefit and cost are estimated on the basis of the assumption as below. The result is used for determining the priority among marketable upland crops and in comparison with other categories.

- Cost and benefit are estimated on the unit area basis,
- Cost required for upgrading drainage and access conditions is assumed to be M$8,000/ha and time required for constructing these on-farm service facilities is one year, and
- Benefit born before diversification depends on single cropping of paddy and after diversification comes from marketable upland crops in the same planted area of paddy. Crop budget figures refer to those used in evaluating crop profitability. Buildup period to reach the target yields of upland crops is also assumed to be five years.

3.3.3 Evaluation procedure for Category 2

In Step 1, consideration is given only to improve drainage and farm access conditions for evaluating potential for converting paddy fields to perennial crop fields. Thus, all the schemes except control drainage and inundation types go to the next step.

In Step 2, the same procedure taken for Category 1 is applied and therefore schemes jump Step 3 and enter to Step 4.

In Step 4, suitability of fruit and industrial tree crops is assessed from the viewpoint of soil-crop suitability relationship. Then, identified tree crops as suitable are evaluated on the basis of agro-climatic condition of each scheme. When a tree crop is identified and selected, schemes shift to the next step.

In Step 5, annualized net income is calculated according to the economic life of a tree crop and then compared with net income gained from single cropping of paddy. If the annualized income is higher, schemes enter into the next step.

In Step 6, profitable tree crops are evaluated to confirm those marketability as compared with local demand on the administrative district basis firstly and in major markets secondly. Crop production amount is equal to the annualized yield used for estimate of crop profitability.

In Step 7, the same procedure as taken for Category 1 is applied. Cost required for upgrading drainage and farm access conditions is assumed to be M$4,000/ha for scheme of which soils have marginally drainage limitation to crop growth and M$8,000/ha for the case of very marginally drainage limitation.

3.3.4 Evaluation procedure for Category 3

In Step 1, schemes with sufficient water resources for the main season paddy cultivation are identified as possible schemes where two cropping system can be promoted. While, schemes with water shortage problems during the main season are deleted from further evaluation in Step 2 and onward.

In Step 2, schemes that are evaluated as possible for promoting crop diversification and intensive double cropping of paddy go to Step 4. In case of schemes with no possibility of improving the present paddy cultivation pattern, further evaluation in Step 4 and onward is made to get information on suitable crops with those profitability and marketability as reference data.

In Step 4 after skipping Step 3, short-term upland crops suitable for the off season cultivation are identified resulting from assessment of soil-crop-suitability. Then, crop selection is made after confirming crop adaptability to agro-ecological situation in each scheme. If there is identified and selected crop, schemes move to the next step.

In Step 5, net income of the main season paddy is estimated taking into account increase in average unit yield from 2.25 ton/ha to 3.5 ton/ha through improvement of farming practices. The off season upland crops have the same yield level of Category 1.

In Step 6, evaluation of marketability is made for the off season upland crops by applying the similar method to Category 1.

In Step 7, additional investment requirement is assumed to be M$4,000/ha. Benefit estimate and economic viability confirmation are made following the same procedure employed for Category 7.

3.3.5 Evaluation procedure for Category 4

In Step 1, no attention is paid to availability of water resources so that all the schemes can pass this step.

In Steps 2 and 3, no evaluation of these two factors is made as possibility of introducing this Category is examined from the technical and economical viewpoints.

In Step 4, soils with excessively drained feature are evaluated as possible for converting paddy fields to animal grazing land. In case of growing animal feeding crops, those suitability is assessed from the soil-crop-suitability assessment. When both results indicate as suitable for conversion of paddy fields for the livestock purpose, schemes go to the next step.

In Step 5, profitability is evaluated focussing upon the contribution of both grazing and feeding practices to livestock outputs. For this purpose, the average annual income is estimated based on beef production value obtained from unit yield of animal feeding crops. If the profit is higher than that derived from single cropping of paddy, schemes enter into the next step.

In Step 6 and , marketability is evaluated with the same procedure of Category 1.

In Step 7, additional investment cost is assumed to be M$500/ha for the use of paddy fields to rear animals and M$4,000/ha for growing animal feeding crops. Benefit is estimated referring to the result of profit evaluation.

3.3.6 Evaluation procedure for Category 5

In Step 1, special attention is paid to availability of sufficient water resources to meet daily freshwater requirement. If the available water resources are enough to grow paddy twice a year, schemes enter into the next step. For the case of control drainage schemes located along the coast in Sarawak, intake of brackish water is evaluated according to topographic condition.

In Steps 2 and 3, all the schemes with sufficient water resources skip these two steps with the same reason of Category 4.

In Step 4, soils with heavy texture are prerequisite to convert paddy fields to fish ponds. From the agro-climatic viewpoints, schemes with no effect of flooding are recognized as possible for promoting freshwater fish pond culture. Schemes that can pass these two checking points move to the next step. In case of brackish water fish culture, flooding or excess inundation problem is only assessed.

In Step 5, profitability is evaluated on the basis of annualized net income earned from carp, freshwater shrimp and brackish water prawn cultures by in excavated fish pond with modern practices. If higher profit is expected as compared with single cropping of paddy, schemes shift to the next step.

In Step 6, the evaluation procedure of marketability is the same as Category 1.

In Step 7, required cost for excavating fish pond is assumed to be M$10,000/ha. Benefit is estimated by referring to the profitability evaluation results.

3.3.7 Evaluation procedure for Category 6

In Step 1, supply of irrigation water for the off season is the most important key factor for this category. Schemes pass this step if available water resources can meet the normal irrigation water demand for the off season paddy.

In Step 2, schemes evaluated as possible for promoting double cropping of paddy enter into the next step.

In Step 3, land suitability for performing mechanized farming practices is evaluated. Schemes identified as suitable pass this step and go to the next step.

In Step 4, soil and agro-climatic suitabilities are reconfirmed and schemes with no limitation shift to the next step.

In Step 5, assumption is made in terms of increase in unit yield of paddy from 2.25 ton/ha to 3.5 ton/ha per one season. Schemes pass this step.

In Step 7 after skipping Step 6, cost is assumed to be M$4,000/ha to improve on farm-service facilities matching with undertaking of mechanized farming practices. Benefit estimate is made referring the results of profitability evaluation.

3.3.8 Evaluation procedure for Category 7

Evaluation of potential for the Category 7 is to be made in case that a scheme is presently used for the paddy cultivation purpose and no potential use for the Categories 1 to 6 is identified.

In Step 1, schemes with available water resources for the main season paddy cultivation goes to the next step.

In Step 2, schemes shift the next step if identified as impossible for promoting crop diversification from the social viewpoint.

In Step 4 after skipping Step 3, soil limitations to growth of paddy are reconfirmed. If schemes have poorly drained soils caused by frequent flooding and stagnant water problems, these are deleted from further evaluation. In this connection, inundation and controlled drainage schemes can be taken into consideration only for the case that more than half of the irrigable area is grown with paddy for the last three years. All the schemes that pass this step are identified as Category 7 without further evaluation of factors in Step 5 and onward.

3.3.9 Evaluation procedure for Category 8

If no crop diversification potential is found through evaluation for the Categories 1 to 7, the following factors are to be evaluated. These are water availability and soil limitation to crop growth. Schemes with no available water resources and unsuitable soils for crop growth are defined as Category 8.

4. RESULTS OF EVALUATION

The evaluation results of crop diversification potential are adjusted to agro-climatic factors, regional market demand for diversified crops and investment performance. The State of Perlis is divided into two agro-ecological zones, Regions 1 and 2. Both have the advantages in growing such perennial lowland crops as described in Appendix D of Volume 2. Taking into account these conditions, recommendable crops are selected with the priority order as shown in Table 1 and some of crops judged as suitable in each step of the potential evaluation are deleted.

Regarding the Category 6, adjustment is made on the basis of such conditions as scheme size of more than 100 ha and main season paddy planted area covering more than the half of irrigable area in each scheme.

If marketable quantities of specific crops produced in one non-granary irrigated area is over the State demand, surplus amount is then compared with potential market demand in the neighboring consumption centers, Alor Setar and Penang, in order to confirm the possibility of selling surplus to such markets.

As a result of the above process, the crop diversification potential is adjusted to the present condition category by category for each scheme. Table 2 shows the summary of crop diversification potential evaluation. The process of evaluation is attached to this Volume 5 as Appendix in a form of scheme-by-scheme description sheet.

Out of 22 non-granary irrigation schemes as shown in Table 2, 11 schemes are grouped into the Category 6 with the first priority. These schemes have also high potential for crop diversification under the Categories 1 to 3. The first priority is given to the Category 1 for three schemes, the Category 2 for two schemes and the Category 3 for five schemes, while it is given to the Category 7 for one scheme due to no possibility of introducing other crops.

Tables & Figures

Table 1 Priority Order of Selected Crops for Each Scheme

State : Perlis

Code No.	Scheme	Annual Crops	Perennial Crops
PR001	Ban Seberang Ramai	VG*	CN, SC
PR002	Ban Bukit Tok Poh	VG	
PR003	Ban Wang Bintong	VG	CN, SC
PR004	Tali Air Bt. Pahat Kanan	DP, VG	DM, CN, SC, CR, PL*
PR005	Sg. Siran	DP, VG, GG*	DM, CN, SC, CR*, PL*
PR006	Alur Baroh	VG	CN, SC, DM*, PL*
PR007	Pdg. Melangit	DP, VG	DM, CN, SC, CR*, PL*
PR008	Alor Sena	DP, VG, GG*	DM, CN, CR, SC, PL*
PR009	Bukit Tau	DP, VG, GG*	DM, CN, CR, SC, PL*
PR010	Kubang Badak	DP, VG	DM, PL, CN, SC, CR
PR011	Kg. Belukar	DP, VG	
PR012	Kg. Darat/Tok Daboi	SP	
PR013	Sg. Repoh	DP, VG*, GG*	CN, SC, CR*, PL*
PR014	Titi Tinggi	DP, VG, GG*	DM, CN, SC, PL*
PR015	Pdg. Siding	DP, VG*	CN, SC, DM*, PL*
PR016	Kok Klang	DP, VG	DM, CN, SC, CR, PL*
PR017	Kuala Tunggang	DP, VG	DM, CN, SC, PL*
PR018	Alor Melaka	DP, VG	CN, SC, DM*, PL*
PR019	Sg. Santan	DP, VG*	CN, SC, DM*, PL*
PR020	Pdg. Telela	DP, VG*	CN, SC, DM*, PL*
PR021	Kg. Parit		DM
PR022	Sg.Siran/Jln.Abi/Kurong Batang	DP, VG	DM, CN, SC, CR, PL*

Remarks:
- *; Needs for regional marketing promotion
- DP; Double cropping of paddy
- SP; Single cropping of paddy
- VG; Vegetables
- GG; Ginger
- DM; Durian/mango
- CN; Cashewnut
- CR; Citrus
- PL; Pineapple
- SC; Sugarcane

Table 2 Crop Diversification Potential for Each Scheme

State : Perlis

Code	Scheme	Category 1	2	3	4	5	6	7	8
PR001	Ban Seberang Ramai	*4	***1**	·	·	·	·	*2	·
PR002	Ban Bukit Tok Poh	***1**	·	·	·	·	·	*2	·
PR003	Ban *Wang Bintong*	***1**	*2	·	·	·	·	*3	·
PR004	Tali Air Bt. Pahat Kanan	*2	*2	***1**	·	·	·	*3	·
PR005	Sg. Siran	*2	*3	*2	·	·	***1**	·	·
PR006	Alur Baroh	***1**	*3	*2	·	·	·	*3	·
PR007	Pdg. Melangit	*3	*2	*3	·	·	***1**	·	·
PR008	Alor Sena	*2	*3	*2	·	·	***1**	·	·
PR009	Bukit Tau	*2	*3	***1**	·	·	·	*3	·
PR010	Kubang Badak	*2	*2	***1**	·	·	·	*3	·
PR011	Kg. Belukar	*2	·	***1**	·	·	·	*3	·
PR012	Kg. Darat/Tok Daboi	·	*4	·	·	·	·	***1**	·
PR013	Sg. Repoh	*4	*2	*4	·	·	***1**	·	·
PR014	Titi Tinggi	*2	*3	*2	·	·	***1**	·	·
PR015	Pdg. Siding	*4	*2	*4	·	·	***1**	·	·
PR016	Kok Klang	*2	*3	***1**	·	·	·	*3	·
PR017	Kuala Tunggang	*3	*2	*3	·	·	***1**	·	·
PR018	Alor Melaka	*2	*3	*2	·	·	***1**	·	·
PR019	Sg. Santan	*4	*2	*4	·	·	***1**	·	·
PR020	Pdg. Telela	*4	*2	*4	·	·	***1**	·	·
PR021	Kg. Parit	·	***1**	·	·	·	·	*2	·
PR022	Sg.Siran/Jln.Abi/Kurong Batang	*3	*2	*3	·	·	***1**	·	·
***1**	**Super category**	**3**	**2**	**5**	·	·	**11**	**1**	·
*2	2nd priority category	9	10	5	·	·	·	3	·
*3	3rd priority category	3	7	3	·	·	·	7	·
*4	4th priority category with needs of regional marketing promotion	5	1	4	·	·	·	·	·

Fig. 1

Criteria and Procedure of Evaluation for Crop Diversification Potential

FEASIBILITY STUDY ON RATIONALIZATION AND CROP DIVERSIFICATION IN NON-GRANARY IRRIGATED AREAS IN MALAYSIA

Japan International Cooperation Agency

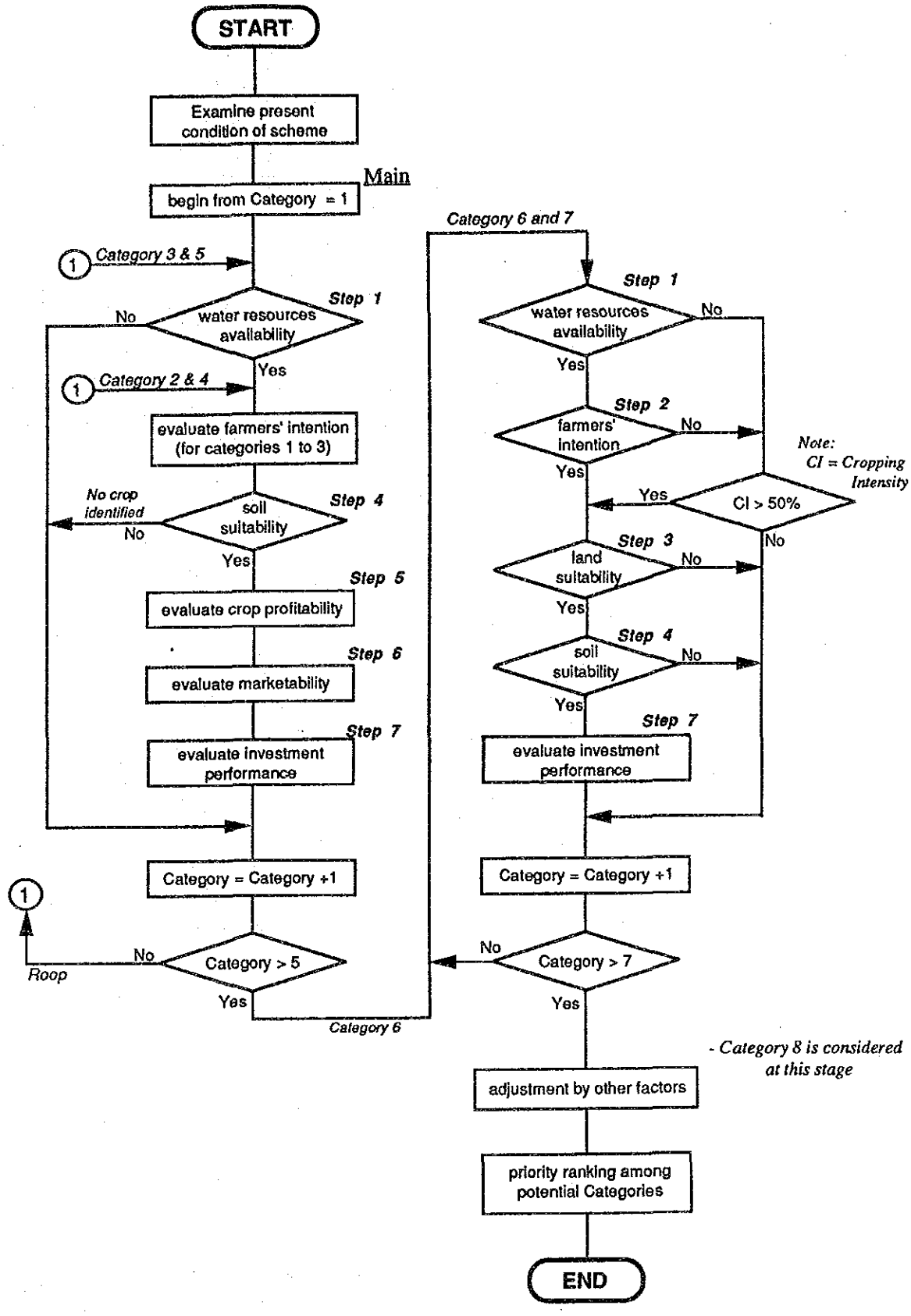


Fig. 2

General Flow of Evaluation for Crop Diversification Potential

FEASIBILITY STUDY ON RATIONALIZATION AND CROP DIVERSIFICATION IN NON-GRANARY IRRIGATED AREAS IN MALAYSIA

Japan International Cooperation Agency

Appendix

Results of Evaluation for Crop Diversification Potential

Remarks

Category

Category 1	*Schemes to be converted to high value crop cultivation under irrigated condition*
Category 2	*Schemes to be converted to tree crop cultivation*
Category 3	*Schemes to introduce two-cropping system planting paddy during the main season and short-term annual crops during the off-season*
Category 4	*Schemes to be converted to animal feeding crop cultivation or cattle raising fields*
Category 5	*Schemes to be converted to freshwater fish culture ponds*
Category 6	*Schemes to be positively maintained as mini-granary areas*
Category 7	*Schemes to be maintained as paddy cultivation areas within a definite period of time for social welfare purposes and thereafter to be further categorized*
Category 8	*Schemes to be converted to housing/industrial and other uses*

Evaluation Item in Each Step

Step 1	*Available irrigation water quantity*
Step 2	*Farmers' intention towards paddy cultivation*
Step 3	*Land suitability for mechanized farming practices*
Step 4	*Soil suitability and limitations to diversify crops*
Step 5	*Crop profitability*
Step 6	*Crop marketability*
Step 7	*Investment performance*

Note:

a. *If any item is examined, steps for the respective categories are indicated with a star mark "*".*
b. *In step 7, B/C ratio at the interest rate of 10% is described.*

Evaluation Results of Each Scheme

CONTENTS

Crop Diversification Potential for PR001

Code Number : PR001 Name of Scheme : Ban Seberang Ramai
State : Perlis District : Perlis
Type of Scheme : Controlled drainage
Water source : Insufficient for main season paddy
Soil series : 2dt

Irrigable area (ha) Main : 323 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	B	A	-	2.5	4,845
				Groundnut	A	A	A	0.9	843
				Vegetable	A	A	-	13.8	5,717
2	*	*	*	Durian/Mango	C	A	-	11.0	2,196
				Guava	C	A	-	3.1	7,752
				Banana	C	A	-	0.7	3,392
				Cashewnut	A	A	A	8.7	568
				Papaya	B	A	-	0.6	8,075
				Citrus	B	A	-	2.9	3,392
				Pineapple	A	A	-	9.5	7,752
				Coconut	A	-	A		1,415
				Oilpalm	C	A	A	0.9	6,202
				Cocoa	C	A	A	0.6	1,001
				Rubber	B	A	A	0.6	443
				Sago	C	-	A		2,907
				Coffee	A	A	A	0.7	284
				Tea	A	A	A	10.4	420
				Clove	B	A	A	1.1	100
				Tabacco	B	A	A	0.7	2,907
				Sugarcane	A	A	A	3.3	6,460
				Pepper	A	A	A	16.4	953
3									
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5									
6									
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR002

Code Number : PR002 Name of Scheme : Ban Bukit Tok Poh
State : Perlis District : Perlis
Type of Scheme : Controlled drainage
Water source : Insufficient for main season paddy
Soil series : 3d(t)

Irrigable area (ha) Main : 25 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Vegetable	B	A	A	6.9	443
2	*	*	*	Coconut	B	-	A		110
				Sago	A	-	A		225
3									
4	*	*	*	Fodder grasses	A	-	A		
5									
6									
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR003

Code Number : PR003 Name of Scheme : Ban Wang Bintong
State : Perlis District : Perlis
Type of Scheme : Controlled drainage
Water source : Insufficient for main season paddy
Soil series : 2dt

Irrigable area (ha) Main : 246 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	B	A	-	2.5	3,690
				Groundnut	A	A	A	0.9	642
				Vegetable	A	A	A	13.8	4,354
2	*	*	*	Durian/Mango	C	A	-	11.0	1,673
				Guava	C	A	-	3.1	5,904
				Banana	C	A	-	0.7	2,583
				Cashewnut	A	A	A	8.7	433
				Papaya	B	A	-	0.6	6,150
				Citrus	B	A	-	2.9	2,583
				Pineapple	A	A	-	9.5	5,904
				Coconut	A	-	A		1,077
				Oilpalm	C	A	A	0.9	4,723
				Cocoa	C	A	A	0.6	763
				Rubber	B	A	A	0.6	337
				Sago	C	-	A		2,214
				Coffee	A	A	A	0.7	216
				Tea	A	A	A	10.4	320
				Clove	B	A	A	1.1	76
				Tabacco	B	A	A	0.7	2,214
				Sugarcane	A	A	A	3.3	4,920
				Pepper	A	A	A	16.4	726
3									
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5									
6									
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR004

Code Number : PR004 Name of Scheme : Tali Air Bt. Pahat Kanan
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2d

Irrigable area (ha) Main : 38 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Groundnut	A	A	A	0.9	99
				Vegetable	A	A	A	13.8	673
2	*	*	*	Durian/Mango	A	A	A	43.6	258
				Guava	A	A	-	12.2	912
				Banana	A	A	A	2.7	399
				Cashewnut	A	A	A	8.7	67
				Citrus	B	A	A	2.9	399
				Pineapple	A	A	-	9.5	912
				Coconut	A	-	A		166
				Oilpalm	A	A	A	3.6	730
				Cocoa	A	A	A	2.2	118
				Rubber	B	A	A	0.6	52
				Coffee	B	A	A	0.4	33
				Tea	A	A	A	10.4	49
				Clove	B	A	A	1.1	12
				Tabacco	B	A	A	0.7	342
				Sugarcane	A	A	A	3.3	760
				Pepper	A	A	A	16.4	112
3	*	*	*	Maize	A	-	-		124
				Sorghum	A	-	A		143
				Groundnut	A	A	A	0.9	99
				Vegetable	A	A	A	13.8	673
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
\- : Not suitable

Crop Diversification Potential for PR005

Code Number : PR005 Name of Scheme : Sg. Siran
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2t

Irrigable area (ha) Main : 122 Off : 122
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	A	A	-	5.0	1,830
				Groundnut	A	A	A	0.9	318
				Vegetable	A	A	A	13.8	2,159
2	*	*	*	Durian/Mango	C	A	A	11.0	830
				Guava	C	A	-	3.1	2,928
				Banana	C	A	A	0.7	1,281
				Cashewnut	A	A	A	8.7	215
				Papaya	A	A	-	1.2	3,050
				Citrus	A	A	-	5.7	1,281
				Pineapple	A	A	-	9.5	2,928
				Coconut	A	-	A		534
				Oilpalm	C	A	A	0.9	2,342
				Cocoa	C	A	A	0.6	378
				Rubber	A	A	A	1.1	167
				Coffee	A	A	A	0.7	107
				Tea	A	A	A	10.4	159
				Clove	A	A	A	2.3	38
				Tabacco	A	A	A	1.4	1,098
				Sugarcane	A	A	A	3.3	2,440
				Pepper	A	A	A	16.4	360
3	*	*	*	Maize	A	-	-		397
				Sorghum	A	-	A		458
				Ginger	A	A	-	5.0	1,830
				Groundnut	A	A	A	0.9	318
				Vegetable	A	A	A	13.8	2,159
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR006

Code Number : PR006 Name of Scheme : Alur Baroh
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Limited to single cropping
Soil series : 2d

Irrigable area (ha) Main : 232 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Groundnut	A	A	A	0.9	606
				Vegetable	A	A	A	13.8	4,106
2	*	*	*	Durian/Mango	A	A	-	43.6	1,578
				Guava	A	A	-	12.2	5,568
				Banana	A	A	-	2.7	2,436
				Cashewnut	A	A	A	8.1	408
				Citrus	B	A	-	2.9	2,436
				Pineapple	A	A	-	9.5	5,568
				Coconut	A	-	A		1,016
				Oilpalm	A	A	A	3.6	4,454
				Cocoa	A	A	A	2.2	719
				Rubber	B	A	A	0.6	318
				Coffee	B	A	A	0.4	204
				Tea	A	A	A	10.4	302
				Clove	B	A	A	1.1	72
				Tabacco	B	A	A	0.7	2,088
				Sugarcane	A	A	A	3.3	4,640
				Pepper	A	A	A	16.4	684
3	*	*	*	Maize	A	-	-		754
				Sorghum	A	-	A		870
				Groundnut	A	A	A	0.9	606
				Vegetable	A	A	A	13.8	4,106
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5									
6									
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR007

Code Number : PR007 Name of Scheme : Pdg. Melangit
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 1d

Irrigable area (ha) Main : 182 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	B	A	-	2.5	2,730
				Groundnut	A	A	A	0.9	475
				Vegetable	A	A	A	13.8	3,221
2	*	*	*	Durian/Mango	A	A	A	43.6	1,238
				Guava	A	A	-	12.2	4,368
				Banana	A	A	-	2.7	1,911
				Cashewnut	A	A	A	8.7	320
				Papaya	B	A	-	0.6	4,550
				Citrus	A	A	-	5.7	1,911
				Pineapple	A	A	-	9.5	4,368
				Coconut	A	-	A		797
				Oilpalm	A	A	A	3.6	3,494
				Cocoa	A	A	A	2.2	564
				Rubber	A	A	A	1.1	249
				Sago	C	-	A		1,638
				Coffee	A	A	A	0.7	160
				Tea	A	A	A	10.4	237
				Clove	A	A	A	2.3	56
				Tabacco	A	A	A	1.4	1,638
				Sugarcane	A	A	A	3.3	3,640
				Pepper	A	A	A	16.4	537
3	*	*	*	Maize	A	-	-		592
				Sorghum	A	-	A		683
				Ginger	B	A	-	2.5	2,730
				Groundnut	A	A	A	0.9	475
				Vegetable	A	A	A	13.8	3,221
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR008

Code Number : PR008 Name of Scheme : Alor Sena
State : Perlis District : Perlis
Type of Scheme : Gravity & Pump
Water source : Sufficient for double cropping
Soil series : 2t

Irrigable area (ha) Main : 169 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	A	A	-	5.0	2,535
				Groundnut	A	A	A	0.9	440
				Vegetable	A	A	A	13.8	2,992
2	*	*	*	Durian/Mango	C	A	A	11.0	1,150
				Guava	C	A	-	3.1	4,056
				Banana	C	A	A	0.7	1,776
				Cashewnut	A	A	A	8.7	298
				Papaya	A	A	-	1.2	4,225
				Citrus	A	A	A	5.7	1,776
				Pineapple	A	A	-	9.5	4,056
				Coconut	A	-	A		741
				Oilpalm	C	A	A	0.9	3,244
				Cocoa	C	A	A	0.6	524
				Rubber	A	A	A	1.1	232
				Coffee	A	A	A	0.7	148
				Tea	A	A	A	10.4	219
				Clove	A	A	A	2.3	52
				Tabacco	A	A	A	1.4	1,521
				Sugarcane	A	A	A	3.3	3,380
				Pepper	A	A	A	16.4	499
3	*	*	*	Maize	A	-	-		549
				Sorghum	A	-	A		634
				Ginger	A	A	-	5.0	2,535
				Groundnut	A	A	A	0.9	440
				Vegetable	A	A	A	13.8	2,992
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR009

Code Number : PR009 Name of Scheme : Bukit Tau
State : Perlis District : Perlis
Type of Scheme : Pump
Water source : Sufficient for double cropping
Soil series : 2t

Irrigable area (ha) Main : 94 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	A	A	-	5.0	1,410
				Groundnut	A	A	A	0.9	245
				Vegetable	A	A	A	13.8	1,664
2	*	*	*	Durian/Mango	C	A	A	11.0	639
				Guava	C	A	-	3.1	2,256
				Banana	C	A	A	0.7	987
				Cashewnut	A	A	A	8.7	165
				Papaya	A	A	-	1.2	2,350
				Citrus	A	A	A	5.7	987
				Pineapple	A	A	-	9.5	2,256
				Coconut	A	-	A		412
				Oilpalm	C	A	A	0.9	1,805
				Cocoa	C	A	A	0.6	291
				Rubber	A	A	A	1.1	129
				Coffee	A	A	A	0.7	83
				Tea	A	A	A	10.4	122
				Clove	A	A	A	2.3	29
				Tabacco	A	A	A	1.4	846
				Sugarcane	A	A	A	3.3	1,880
				Pepper	A	A	A	16.4	277
3	*	*	*	Maize	A	-	-		306
				Sorghum	A	-	A		353
				Ginger	A	A	-	5.0	1,410
				Groundnut	A	A	A	0.9	245
				Vegetable	A	A	A	13.8	1,664
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR010

Code Number : PR010 Name of Scheme : Kubang Badak
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2d

Irrigable area (ha) Main : 73 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Groundnut	A	A	A	0.9	191
				Vegetable	A	A	A	13.8	1,292
2	*	*	*	Durian/Mango	A	A	A	43.6	496
				Guava	A	A	-	12.2	1,752
				Banana	A	A	A	2.7	767
				Cashewnut	A	A	A	8.7	128
				Citrus	B	A	A	2.9	767
				Pineapple	A	A	-	9.5	1,752
				Coconut	A	-	A		320
				Oilpalm	A	A	A	3.6	1,402
				Cocoa	A	A	A	2.2	226
				Rubber	B	A	A	0.6	100
				Coffee	B	A	A	0.4	64
				Tea	A	A	A	10.4	95
				Clove	B	A	A	1.1	23
				Tabacco	B	A	A	0.7	657
				Sugarcane	A	A	A	3.3	1,460
				Pepper	A	A	A	16.4	215
3	*	*	*	Maize	A	-	-		237
				Sorghum	A	-	A		274
				Groundnut	A	A	A	0.9	191
				Vegetable	A	A	A	13.8	1,292
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR011

Code Number : PR011 Name of Scheme : Kg. Belukar
State : Perlis District : Perlis
Type of Scheme : Pump
Water source : Sufficient for double cropping
Soil series : 3d(t)

Irrigable area (ha) Main : 70 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Vegetable	B	A	A	6.9	1,239
2	*	*	*	Coconut	B	-	A		307
				Sago	A	-	A		630
3	*	*	*	Vegetable	B	A	A	6.9	1,239
4	*	*	*	Fodder grasses	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, *profitability, marketability and invest performance (B/C > 1).*
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
\- : Not suitable

Crop Diversification Potential for PR012

Code Number : PR012 Name of Scheme : Kg. Darat/Tok Daboi
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2DnT

Irrigable area (ha) Main : 405 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	C	A	-		6,075
				Groundnut	C	A	A		1,057
				Vegetable	C	A	-		7,169
2	*	*	*	Durian/Mango	C	A	-	11.0	2,754
				Guava	C	A	-	3.1	9,720
				Banana	C	A	-	0.7	4,253
				Cashewnut	C	A	A		713
				Papaya	C	A	-		10,125
				Citrus	C	A	-		4,253
				Pineapple	C	A	-	0.5	9,720
				Coconut	A	-	A		1,774
				Oilpalm	C	A	A	0.9	7,776
				Cocoa	C	A	A	0.6	1,256
				Rubber	C	A	A		555
				Coffee	C	A	A		356
				Tea	C	A	A		527
				Clove	C	A	A		126
				Tabacco	C	A	A		3,645
				Sugarcane	C	A	A		8,100
				Pepper	C	A	A		1,195
3	*	*	*	Maize	C	-	-		1,316
				Sorghum	C	-	A		1,519
				Ginger	C	A	-		6,075
				Groundnut	C	A	A		1,057
				Vegetable	C	A	-		7,169
4	*	*	*	Fodder grasses	C	-	A		
				Pasture	C	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*						
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
\- : Not suitable

Crop Diversification Potential for PR013

Code Number : PR013 Name of Scheme : Sg. Repoh
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2t

Irrigable area (ha) Main : 272 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	A	A	-	5.0	4,080
				Groundnut	A	A	A	0.9	710
				Vegetable	A	A	-	13.8	4,814
2	*	*	*	Durian/Mango	C	A	-	11.0	1,850
				Guava	C	A	-	3.1	6,528
				Banana	C	A	-	0.7	2,856
				Cashewnut	A	A	A	8.7	479
				Papaya	A	A	-	1.2	6,800
				Citrus	A	A	-	5.7	2,856
				Pineapple	A	A	-	9.5	6,528
				Coconut	A	-	A		1,191
				Oilpalm	C	A	A	0.9	5,222
				Cocoa	C	A	A	0.6	843
				Rubber	A	A	A	1.1	373
				Coffee	A	A	A	0.7	239
				Tea	A	A	A	10.4	354
				Clove	A	A	A	2.3	84
				Tabacco	A	A	A	1.4	2,448
				Sugarcane	A	A	A	3.3	5,440
				Pepper	A	A	A	16.4	802
3	*	*	*	Maize	A	-	-		884
				Sorghum	A	-	A		1,020
				Ginger	A	A	-	5.0	4,080
				Groundnut	A	A	A	0.9	710
				Vegetable	A	A	-	13.8	4,814
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR014

Code Number : PR014 Name of Scheme : Titi Tinggi
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2dt

Irrigable area (ha) Main : 165 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	B	A	-	2.5	2,475
				Groundnut	A	A	A	0.9	431
				Vegetable	A	A	A	13.8	2,921
2	*	*	*	*Durian/Mango*	C	A	A	11.0	1,122
				Guava	C	A	-	3.1	3,960
				Banana	C	A	-	0.7	1,733
				Cashewnut	A	A	A	8.7	290
				Papaya	B	A	-	0.6	4,125
				Citrus	B	A	-	2.9	1,733
				Pineapple	A	A	-	9.5	3,960
				Coconut	A	-	A		723
				Oilpalm	C	A	A	0.9	3,168
				Cocoa	C	A	A	0.6	512
				Rubber	B	A	A	0.6	226
				Sago	C	-	A		1,485
				Coffee	A	A	A	0.7	145
				Tea	A	A	A	10.4	215
				Clove	B	A	A	1.1	51
				Tabacco	B	A	A	0.7	1,485
				Sugarcane	A	A	A	3.3	3,300
				Pepper	A	A	A	16.4	487
3	*	*	*	Maize	A	-	-		536
				Sorghum	A	-	A		619
				Ginger	B	A	-	2.5	2,475
				Groundnut	A	A	A	0.9	431
				Vegetable	A	A	A	13.8	2,921
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR015

Code Number : PR015 Name of Scheme : Pdg. Siding
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2d

Irrigable area (ha) Main : 297 Off : 297
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Groundnut	A	A	A	0.9	775
				Vegetable	A	A	-	13.8	5,257
2	*	*	*	Durian/Mango	A	A	-	43.6	2,020
				Guava	A	A	-	12.2	7,128
				Banana	A	A	-	2.7	3,119
				Cashewnut	A	A	A	8.7	523
				Citrus	B	A	-	2.9	3,119
				Pineapple	A	A	-	9.5	7,128
				Coconut	A	-	A		1,301
				Oilpalm	A	A	A	3.6	5,702
				Cocoa	A	A	A	2.2	921
				Rubber	B	A	A	0.6	407
				Coffee	B	A	A	0.4	261
				Tea	A	A	A	10.4	386
				Clove	B	A	A	1.1	92
				Tabacco	B	A	A	0.7	2,673
				Sugarcane	A	A	A	3.3	5,940
				Pepper	A	A	A	16.4	876
3	*	*	*	Maize	A	-	-		965
				Sorghum	A	-	A		1,114
				Groundnut	A	A	A	0.9	775
				Vegetable	A	A	-	13.8	5,257
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR016

Code Number : PR016 Name of Scheme : Kok Klang
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2dt

Irrigable area (ha) Main : 56 Off : 56
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	B	A	-	2.5	840
				Groundnut	A	A	A	0.9	146
				Vegetable	A	A	A	13.8	991
2	*	*	*	Durian/Mango	C	A	A	11.0	381
				Guava	C	A	-	3.1	1,344
				Banana	C	A	A	0.7	588
				Cashewnut	A	A	A	8.7	99
				Papaya	B	A	-	0.6	1,400
				Citrus	B	A	A	2.9	588
				Pineapple	A	A	-	9.5	1,344
				Coconut	A	-	A		245
				Oilpalm	C	A	A	0.9	1,075
				Cocoa	C	A	A	0.6	174
				Rubber	B	A	A	0.6	77
				Sago	C	-	A		504
				Coffee	A	A	A	0.7	49
				Tea	A	A	A	10.4	73
				Clove	B	A	A	1.1	17
				Tabacco	B	A	A	0.7	504
				Sugarcane	A	A	A	3.3	1,120
				Pepper	A	A	A	16.4	165
3	*	*	*	Maize	A	-	-		182
				Sorghum	A	-	A		210
				Ginger	B	A	-	2.5	840
				Groundnut	A	A	A	0.9	146
				Vegetable	A	A	A	13.8	991
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR017

Code Number : PR017 Name of Scheme : Kuala Tunggang
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2d

Irrigable area (ha) Main : 146 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Groundnut	A	A	A	0.9	381
				Vegetable	A	A	A	13.8	2,584
2	*	*	*	Durian/Mango	A	A	A	43.6	993
				Guava	A	A	-	12.2	3,504
				Banana	A	A	-	2.7	1,533
				Cashewnut	A	A	A	8.7	257
				Citrus	B	A	-	2.9	1,533
				Pineapple	A	A	-	9.5	3,504
				Coconut	A	-	A		639
				Oilpalm	A	A	A	3.6	2,803
				Cocoa	A	A	A	2.2	453
				Rubber	B	A	A	0.6	200
				Coffee	B	A	A	0.4	128
				Tea	A	A	A	10.4	190
				Clove	B	A	A	1.1	45
				Tabacco	B	A	A	0.7	1,314
				Sugarcane	A	A	A	3.3	2,920
				Pepper	A	A	A	16.4	431
3	*	*	*	Maize	A	-	-		475
				Sorghum	A	-	A		548
				Groundnut	A	A	A	0.9	381
				Vegetable	A	A	A	13.8	2,584
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR018

Code Number : PR018 Name of Scheme : Alor Melaka
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2d

Irrigable area (ha) Main : 209 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Groundnut	A	A	A	0.9	545
				Vegetable	A	A	A	13.8	3,699
2	*	*	*	Durian/Mango	A	A	-	43.6	1,421
				Guava	A	A	-	12.2	5,016
				Banana	A	A	-	2.7	2,195
				Cashewnut	A	A	A	8.7	368
				Citrus	B	A	-	2.9	2,195
				Pineapple	A	A	-	9.5	5,016
				Coconut	A	-	A		915
				Oilpalm	A	A	A	3.6	4,013
				Cocoa	A	A	A	2.2	648
				Rubber	B	A	A	0.6	286
				Coffee	B	A	A	0.4	184
				Tea	A	A	A	10.4	272
				Clove	B	A	A	1.1	65
				Tabacco	B	A	A	0.7	1,881
				Sugarcane	A	A	A	3.3	4,180
				Pepper	A	A	A	16.4	617
3	*	*	*	Maize	A	-	-		679
				Sorghum	A	-	A		784
				Groundnut	A	A	A	0.9	545
				Vegetable	A	A	A	13.8	3,699
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR019

Code Number : PR019 Name of Scheme : Sg. Santan
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2d

Irrigable area (ha) Main : 510 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Groundnut	A	A	A	0.9	1,331
				Vegetable	A	A	-	13.8	9,027
2	*	*	*	Durian/Mango	A	A	-	43.6	3,468
				Guava	A	A	-	12.2	12,240
				Banana	A	A	-	2.7	5,355
				Cashewnut	A	A	A	8.7	897
				Citrus	B	A	-	2.9	5,355
				Pineapple	A	A	-	9.5	12,240
				Coconut	A	-	A		2,234
				Oilpalm	A	A	A	3.6	9,792
				Cocoa	A	A	A	2.2	1,581
				Rubber	B	A	A	0.6	698
				Coffee	B	A	A	0.4	449
				Tea	A	A	A	10.4	663
				Clove	B	A	A	1.1	158
				Tabacco	B	A	A	0.7	4,590
				Sugarcane	A	A	A	3.3	10,200
				Pepper	A	A	A	16.4	1,505
3	*	*	*	Maize	A	-	-		1,658
				Sorghum	A	-	A		1,913
				Groundnut	A	A	A	0.9	1,331
				Vegetable	A	A	-	13.8	9,027
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR020

Code Number : PR020 Name of Scheme : Pdg. Telela
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2d

Irrigable area (ha) Main : 324 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Groundnut	A	A	A	0.9	843
				Vegetable	A	A	-	13.8	5,717
2	*	*	*	Durian/Mango	A	A	-	43.6	2,196
				Guava	A	A	-	12.2	7,752
				Banana	A	A	-	2.7	3,392
				Cashewnut	A	A	A	8.7	568
				Citrus	B	A	-	2.9	3,392
				Pineapple	A	A	-	9.5	7,752
				Coconut	A	-	A		1,415
				Oilpalm	A	A	A	3.6	6,202
				Cocoa	A	A	A	2.2	1,001
				Rubber	B	A	A	0.6	443
				Coffee	B	A	A	0.4	284
				Tea	A	A	A	10.4	420
				Clove	B	A	A	1.1	100
				Tabacco	B	A	A	0.7	2,907
				Sugarcane	A	A	A	3.3	6,460
				Pepper	A	A	A	16.4	953
3	*	*	*	Maize	A	-	-		1,050
				Sorghum	A	-	A		1,211
				Groundnut	A	A	A	0.9	843
				Vegetable	A	A	-	13.8	5,717
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR021

Code Number : PR021 Name of Scheme : Kg. Parit
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Limited to single cropping
Soil series : 2DnT

Irrigable area (ha) Main : 153 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Ginger	C	A	-		2,295
				Groundnut	C	A	A		400
				Vegetable	C	A	A		2,708
2	*	*	*	Durian/Mango	C	A	A	11.0	1,040
				Guava	C	A	-	3.1	3,672
				Banana	C	A	-	0.7	1,607
				Cashewnut	C	A	A		269
				Papaya	C	A	-		3,825
				Citrus	C	A	-		1,607
				Pineapple	C	A	-	0.5	3,672
				Coconut	A	-	A		670
				Oilpalm	C	A	A	0.9	2,938
				Cocoa	C	A	A	0.6	474
				Rubber	C	A	A		210
				Coffee	C	A	A		135
				Tea	C	A	A		199
				Clove	C	A	A		48
				Tabacco	C	A	A		1,377
				Sugarcane	C	A	A		3,060
				Pepper	C	A	A		452
3	*	*	*	Maize	C	-	-		498
				Sorghum	C	-	A		574
				Ginger	C	A	-		2,295
				Groundnut	C	A	A		400
				Vegetable	C	A	A		2,708
4	*	*	*	Fodder grasses	C	-	A		
				Pasture	C	-	A		
5									
6									
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

Crop Diversification Potential for PR022

Code Number : PR022 Name of Scheme : Sg.Siran/Jln.Abi/Kurong Batang
State : Perlis District : Perlis
Type of Scheme : Gravity
Water source : Sufficient for double cropping
Soil series : 2d

Irrigable area (ha) Main : 104 Off : 0
Trafficability of farm machinery : Good
Paddy planting for last 3 years : More than 50% of irrigable area

Category	Step 1	Step 2	Step 3		Step 4	Step 5	Step 6	Step 7 (B/C)	Production (ton)
1	*	*	*	Groundnut	A	A	A	0.9	271
				Vegetable	A	A	A	13.8	1,841
2	*	*	*	Durian/Mango	A	A	A	43.6	707
				Guava	A	A	-	12.2	2,496
				Banana	A	A	A	2.7	1,092
				Cashewnut	A	A	A	8.7	183
				Citrus	B	A	A	2.9	1,092
				Pineapple	A	A	-	9.5	2,496
				Coconut	A	-	A		456
				Oilpalm	A	A	A	3.6	1,997
				Cocoa	A	A	A	2.2	322
				Rubber	B	A	A	0.6	142
				Coffee	B	A	A	0.4	92
				Tea	A	A	A	10.4	135
				Clove	B	A	A	1.1	32
				Tabacco	B	A	A	0.7	936
				Sugarcane	A	A	A	3.3	2,080
				Pepper	A	A	A	16.4	307
3	*	*	*	Maize	A	-	-		338
				Sorghum	A	-	A		390
				Groundnut	A	A	A	0.9	271
				Vegetable	A	A	A	13.8	1,841
4	*	*	*	Fodder grasses	A	-	A		
				Pasture	A	-	A		
5	*	*	*			A	-	2.0	
6	*	*	*		A	A	A		
7	*	*	*		*	*	*		
8									

NOTE Underline : Crops with highest potential (Class A) in terms of crop suitability, profitability, marketability and invest performance (B/C > 1).
* : Potential categories
A : Suitable
B : Marginal suitable due to lack of drainage facilities
C : Marginal suitable due to limited factors other than drainage conditions
- : Not suitable

100°

100°30'

101°

Feasibility Study on Rationalization and Crop Di
in Non-granary Irrigated Areas in Malay

Location of Non-granary Irrigat

Perlis

THAILAND

PERLIS

KUBANG PASU

PADANGTERAP

MADA PROJECT AREA

6°30'

N

R. Jejawi
R. Temenggong
R. Bahru
R. Kechor
R. Korok
R. Perlis
R. Giam
R. Arau
R. Seriab
R. Jorong
R. Kuar
R. Kubang Rotan
R. Bukit
R. Kedah
R. Padang Kerbau
R. Lampam
R. Laka
R. Pering
R. Durian Burong
R. Ahning
R. Kuak
R. Pdg Sona
R. Kahing
R. Jahit
R. Bong
R. Mong Gajah
R. Pedu
R. Bt. Pinang
R. Teliang
R. Bahoi

List of Scheme

Code	Name
Perlis	
PR001	Ban Seberang Ramai
PR002	Ban Bukit Tok Poh
PR003	Ban Wang Bintong
PR004	Tali Air Bt. Pahat Kanan
PR005	Sg. Siran
PR006	Alur Baroh
PR007	Pdg. Melangit
PR008	Alor Sena
PR009	Bukit Tau
PR010	Kubang Badak
PR011	Kg. Belukar
PR012	Kg. Darat/Tok Daboi
PR013	Sg. Repoh
PR014	Titi Tinggi
PR015	Pdg. Siding
PR016	Kok Klang
PR017	Kuala Tunggang
PR018	Alor Melaka
PR019	Sg. Santan
PR020	Pdg. Telela
PR021	Kg. Parit
PR022	Sg.Siran/Jln.Abi/Kurong Batang

100°30'

101°

Feasibility Study on Rationalization and Crop Diversification
in Non-granary Irrigated Areas in Malaysia

Location of Non-granary Irrigation Scheme

Perlis

THAILAND

PERLIS

KUBANG PASU

PADANGTERAP

DA PROJECT AREA

R. Jejawi
R. Temenggong
R. Bahru
R. Kechor
R. Korok
R. Perlis
R. Kok Gua
R. Seriab
R. Gial
R. Arau
R. Pering
R. Laka
R. Perlis
R. Kuar
R. Kubang Rotan
R. A. Bukit
R. Keddah
R. Padang Kerbau
R. Lampam
R. Durian Burong
R. Ahning
R. Kuak
R. Pdg Sona
R. Kah Ing
R. Jahit
R. Bong
R. Mong Gajah
R. Bt. Pinang
R. Pedu
R. Teliang
R. Bahoi
R. Kawi

6°30'

List of Scheme

Code	Name	Irrigable area (ha)	
		Main season	Off season
Perlis			
PR001	Ban Seberang Ramal	323	0
PR002	Ban Bukit Tok Poh	25	0
PR003	Ban Wang Bintong	246	0
PR004	Tali Air Bt. Pahat Kanan	38	0
PR005	Sg. Siran	122	122
PR006	Alur Baroh	232	0
PR007	Pdg. Melangit	182	0
PR008	Alor Sena	169	0
PR009	Bukit Tau	94	0
PR010	Kubang Badak	73	0
PR011	Kg. Belukar	70	0
PR012	Kg. Darat/Tok Daboi	405	0
PR013	Sg. Repoh	272	0
PR014	Titi Tinggi	165	0
PR015	Pdg. Siding	297	297
PR016	Kok Klang	56	56
PR017	Kuala Tunggang	146	0
PR018	Alor Melaka	209	0
PR019	Sg. Santan	510	0
PR020	Pdg. Telela	324	0
PR021	Kg. Parit	153	0
PR022	Sg.Siran/Jln.Abi/Kurong Batang	104	0

PR020	Kg. Pulau Tekam
PR021	Kg. Parit
PR022	Sg.Siran/Jln.Abi/Kurong Batang

N

MADA PROJECT AREA

100°45' 100°

6°30' P. LANGKAWI 6°30'

6°15' 6°15'

P. DAYANG BUNTING

SCALE 0 10 20 km

100°45' 100°

STRAIT OF

YAN

KOTA SETAR

PADANGTERAP

KUALA MUDA

SIK

BALING

UTARA

R. Kuar
R. Kubang Rotan
R. Kedah
R. Pendang
R. Sala
R. Padang Kerbau
R. Tiang Gerap
R. Lampam
R. Pdg Sona
R. Kah Ing
R. Janit
R. Bong
R. Bt. Pinang
R. Pedu
R. Mong Gajah
R. Tellang
R. Bahoi
R. Merbok Kechil
R. Merbok
R. Petani
R. Muda
R. Tembak
R. Tas
R. Limau
R. Pegang
R. Batu Hampar
R. Tebal
R. Weng
R. Siong
R. Lasor
R. Ketil
R. Kupang
R. Sedim

053 057 058 059 061 060 051 052 065 064 063 075 062 049 045 069 068 066 067 040 037 038 041 036 039 042 044 033 035 043 017 001 015 008 020 046 050 047 048 032 027 034 024 021 029 023 022 031 028 025

PR020	Pdg. Telela	324	0
PR021	Kg. Parit	153	0
PR022	Sg.Siran/Jln.Abi/Kurong Batang	104	0

ADA PROJECT AREA

KOTA SETAR

YAN

PADANGTERAP

KUALA MUDA

SIK

KEDAH

BALING

UTARA

R. Kuar
R. Kubang Rotan
R. Bukit
R. Kedah
R. Pendang
R. Padang Kerbau
R. Lampam
R. Sala
R. Bt. Pinang
R. Pdg Sona
R. Kah Ing
R. Jahit
R. Bong
R. Mong Gajah
R. Pedu
R. Teliang
R. Bahoi
R. Kawi
R. Langkar
R. Baho
R. Lasor
R. Weng
R. Batu Hampar
R. Tebal
R. Siong
R. Merbok Kechil
R. Merbok
R. Petani
R. Muda
R. Tembak
R. Tas
R. Limau
R. Pegang
R. Ketil
R. Kupang
R. Sedim
R. Lereh

053 057 058 059 061 060 051 052 065 064 063 075 062 049 045 046 050 047 048 032 027 069 068 066 067 040 037 038 041 036 039 042 044 035 043 033 017 015 001 008 020 034 021 024 029 230 031 028 025

100° 6°30' 6°15' 6° 100°

KAWI

AYANG
RTING

20 km

AIT OF

P. DAYANG BUNTING

SCALE
0 10 20 km

100°45' 100°

STRAIT OF MELAKA

5° 30'

KUALA MUDA

UTARA

TENGAH

SELATAN

BALING

KULIM

BANDAR BAHARU

P. PINANG

PERAK

R. Merbok
R. Merbok Kechil
R. Petani
R. Muda
R. Tembak
R. Tas
R. Limau
R. Pegang
R. Ketil
R. Kupang
R. Kereh
R. Sedim
R. Petai
R. Jarak
R. Derhaka
R. Tebak
R. Juru
R. Junjong
R. Siputeh
R. Jejawi
R. Tengah
R. Kechil
R. Dingin
R. Serak
R. Kerian

SCALE
0 10 20 30 km

LEGEND
Internat
State E
Distric
River
Main R
Railway
City /
Irrigati

100° 100°30' 101°

AYANG
ITING

20 km

100°

KUALA MUDA

UTARA

TENGAH

SELATAN

BALING

KULIM

BANDAR BAHARU

PERAK

P. PINANG

STRAIT OF MELAKA

R. Merbok

R. Merbok Kechil

R. Petani

R. Muda

R. Tembak

R. Tas

R. Limau

R. Pegang

R. Ketil

R. Kupang

R. Sedim

R. Kerem

R. Petai

R. Derhaka

R. Tebak

R. Jarak

R. Juru

R. Junjong

R. Siputeh

R. Jejawi

R. Tengah

R. Kechil

R. Kerian

R. Dingin

R. Serak

R. Kerian

5°30'

100°30'

101°

SCALE

10 20 30 km

LEGEND

- International Boundary
- State Boundary
- District Boundary
- River
- Main Road
- Railway
- City / Town
- Irrigation Area