

INDICATIVE PRIORITIES FOR ACIAR PROJECTS: CAMBODIA CROPS SECTOR

Priorities for collaborative agricultural research for development between Australia and Cambodia were discussed on 5-6 February 2008 in Phnom Penh at a workshop meetings between ACIAR, AusAID and representatives of the National Ministries of Agriculture, Forestry and Fisheries; Water Resources and Meteorology and Commerce; Provincial Departments of Agriculture and Water Resources and Meteorology; universities and agricultural colleges; non-government organisations and other donors active in the agricultural sector.

ACIAR will use them as a framework for collaborative research for development activities over the next four year period, subject to further advice and information from Cambodia and alignment with the Australia-Cambodia (Whole-of-Government) development cooperation strategy that is currently under development. Effort was made to align agreed priorities with the "Strategy for Agriculture and Water 2006-2010" to contribute towards reaching the goals set by the Royal Government of Cambodia for the Agriculture and Water sector in the National Strategic Development Plan for 2006-2010. These priorities are expressed by participants at the consultation at a particular point in time and are not to be considered as officially-sanctioned priorities of the Royal Government of Cambodia (RGC). Proponents of collaborative research projects should initially approach the relevant ACIAR Research Program Manager.

ACIAR's strategy in Cambodia will continue to have two thrusts. Firstly, it supports applied research and development to underpin agricultural diversification, particularly into non-rice field and horticultural crops, and into ruminant livestock. Secondly, it supports research that aims to increase and secure the productivity of rice-based farming systems. As markets develop in Cambodia, ACIAR will place greater emphasis on research to underpin the development of suitable supply chains. The scope of the priority setting-workshop was limited to establishing priorities for research cooperation in production, protection, processing and marketing of field and horticultural crops, including related water and soil management issues.

It was agreed to strengthen the emphasis on technical and marketing research to support the transformation of Cambodian farming from subsistence production for household food security to increasing engagement with markets, with a geographic focus for the ACIAR program on the lowland floodplain provinces and the upland provinces of Battambang and Pailin. ACIAR and Cambodian research agencies will involve a wider range of partners such as provincial government agencies, extension departments, farmer groups, the private sector and non-government organisations during the development and implementation of projects. We will consult with the RGC and donors to seek synergies with other programs, and link closely with AusAID-funded programs. In the early stages of implementation, programs will synthesise information from previous relevant projects and analyse lessons from related initiatives. Processes for technical data management, dissemination of results and monitoring and evaluation will be mutually agreed at the project design stage. Agreed thematic areas for cooperation are shown under four headings:

Soils and Irrigation

Major issues requiring research

Suitability of soils for particular cropping enterprises in areas targeted for irrigation system development or rehabilitation, and application of techniques to enhance organic matter status and consequent soil water relations.

- Synthesis of data on availability of water resources (quality of ground water and overall supply) and long term climatic data to enable best-practice decision-making on siting and management of irrigation schemes
- Surface management of soils in rainfed systems to enhance water and nutrient use efficiency
- Assessment of alternative business and institutional models for water user groups
- Improved on-farm management of water in irrigated and rainfed systems
- Soil suitability studies for upland crop production, including classification
- Economic and sustainable water management in profitable recession rice production schemes

Suitability of soils for particular cropping enterprises in areas targeted for irrigation system development or rehabilitation

Siting of irrigation projects needs to be based on water availability, land suitability and market access for the crops that will be introduced as a response to irrigation. In general, soils capable of being irrigated in Cambodia have low nutrient and organic matter status.

Studies are needed of *in situ* techniques to enhance organic matter status and consequent soil water relations. These include use of non-legume and legume crop residues, animal manures and by-products from agricultural processing, so that the structure and water holding capacity of soils that would otherwise be unsuitable for irrigation can be improved. Interaction between soil organic matter, fertiliser and water addition is the key to enhancing water use efficiency. Research on surface cover management will also enable improved water use efficiency and weed control. Outcomes of this program will be directed through MOWRAM to improve planning and profitable use of water resources and PDA for crop production and technology extension. It would be integrated with other analyses on the economics and performance of gravitational versus pumped irrigation schemes.

Synthesis of data on availability of water resources (quality of ground water and overall supply) and long term climatic data to enable best-practice decision-making on siting and management of irrigation schemes

This is not strictly a researchable issue but the *ad hoc* nature of collection and collation of climatic data in Cambodia is major limitation to good planning, and a more formalized system needs to be developed. Before any irrigation scheme should be set up or rehabilitated it is necessary to have knowledge of the volume of surface water and ground water (including discharge and recharge), that is available for irrigation. This should include spatial distribution of the available water resources. The quality of this water and its suitability for irrigation also needs to be determined. Once data is available and systems have been rehabilitated, the data needs to be collated and delivered to water user groups. They need to be trained how to use this information to assist with farm planning and management. Links with JICA programs should be developed.

Surface management of soils in rainfed systems to enhance water and nutrient use efficiency

A significant factor behind the low yields of rice and other field crops in Cambodia is poor soil fertility. *In situ* soil amendment techniques (including the use of non-legume and legume crop

residues, animal manures and by-products from agricultural processing) are required to enhance organic matter status and consequent soil water relations. The interaction between soil organic matter and nutrient additions on soil structure and water availability are the key to the sustainable use of non-irrigated soils. The outcomes of this study would be directed to the PDA and farmer field schools for improved crop production and technology extension.

Improved on-farm management of water in irrigated and rainfed systems

This priority area addresses both irrigated and rainfed agriculture. As irrigation schemes are rehabilitated, there is a need to work with water user groups on how to extract most value - in a sustainable manner - from the water including assessment of timing, delivery method and allocation options. The overwhelming majority of Cambodian crop production remains rainfed, yet opportunities for smallholders in harvesting rain and runoff water and reducing evaporation are currently poorly addressed. There is a need to examine the social and economic acceptability of different approaches to capture and conserve the largest amount of water on small farms (e.g. in small ponds and wells) and research on surface cover management to improve water use efficiency and weed control. Demonstrations of different water delivery methods (e.g. bucket, furrow, drip) will be made and integrated with ongoing work on irrigation scheduling and water budgeting for vegetable crops and on the role of additional water on options for intensification and diversification of lowland rice systems. .

Upland soil capability studies, including classification and suitability

This information is necessary for upland cropping areas to develop sustainable and profitable land use practices (including soil erosion) to commence the value added chain, by linking land use suitability to crops and to markets. Soil capability analyses were done for lowland areas under the AusAID-funded CIAP program, and for one district per province in each of three provinces under ACIAR project LWR/2001/050 to new upland agricultural areas, and the results extended through the CAAEP program. Apart from being used in farmer field schools, NGO programs and other extension programs, information from these studies would advise the government land allocation schemes via extension packages and potentially provision of the most appropriate crop seeds to the new settlers.

Rice breeding, production, handling and marketing

Major issues requiring research

- Varieties and robust production systems for direct-seeded rice
- Breeding and agronomy of rice varieties for irrigated dry-season production
- Development of recession rice production systems
- Economic and technical studies to assess opportunities for by-product processing from rice
- Identification and recommendation of appropriate rice varieties for different soil types and agroecological zones to optimise yields and production margins
- Assessment of the impact of long-term chemical and organic fertilizer use on rice yield, quality and soil properties
- Crop management practices to reduce water loss and maintain soil health such as stubble retention and reduced tillage

Varieties and robust production systems for direct-seeded rice

Increasing labour shortages in Cambodia and the low returns to labour from transplanting have stimulated an increase in direct seeding systems for rice production. This requires:

- the development and release of new varieties that withstand drought stress at the seedling stage, have early vigour to compete against weeds and maximise water use efficiency;
- the development of robust production systems to reduce risk under either rainfed or irrigated conditions;
- simple tools for direct seeding tools and affordable machinery for direct seeding that is suitable for use by small farmers.

Breeding and agronomy of rice varieties for irrigated dry-season production

Increasing pressure on existing land and increased access to irrigation in lowland Cambodia means that there will be increased demand for dry season rice production under irrigation. This requires a shift from the earlier focus at CARDI on rainfed lowland rice to new research on improved varieties and management practices for dry season irrigated production. The higher inputs used in these crops involve greater risk, and research addressing tillage and land levelling to enable better water and weed control is required to increase and stabilise the overall profitability of production. In recent years, the main rice surplus exported from Cambodia has been low quality commodity rice, shipped for re-export by Vietnam at a time when their export demand was high but pests and climatic problems decreased Vietnamese production. As these issues are resolved, and Cambodian production increases, greater flexibility seeking the most profitable export options are required, and this means that breeding and production packages for production of modern irrigated rice varieties of higher quality are required.

Development of recession rice production systems

Recession rice systems (rice produced in the moist, fertile silty areas that are left as water bodies such as the Tonle Sap Lake recede in the early dry season) are accounting for an increasing proportion of rice production in Cambodia. They typically produce high-yields from varieties that are comparatively low in processing quality. Farmers are experimenting with approaches such as impoundment of receding waters to provide late-season irrigation of recession rice and enable irrigation of high value vegetable crops. In developing water impoundments, careful attention needs to be paid to potential environmental impacts of increasing rice production in these fragile areas and of appropriate siting of impoundments. At sites where rice production is sustainable, new varieties and agronomy approaches are required to raise the quality of the rice and better select post-rice crops that are in market demand and agronomically feasible.

Economic and technical studies to assess opportunities for by-product processing from rice

As rice production increases there may be markets for rice by-products will be required. Following on from a thorough market analyses to identify opportunities, technology adaptation with SMEs to produce a range of products is required. Products may include bran oil and compressed logs from rice husk as an alternative for firewood or kerosene for household use. Incorporation of straw into soils is not always possible and burning of straw has a number of

negative environmental effects. Cost-effective options for use in livestock feed could be explored.

Non-rice field crops

The focus is on annual crops which support agro-industry, particularly maize, soyabean and cassava, with less emphasis on peanut, mungbean and sesame.

Major issues requiring research

- Selection and agronomic performance of maize varieties resistant to downy mildew and stalk rot (including identification of suitable growth locations and planting time windows)
- Selection and agronomic performance of soybean varieties with improved pest (insects and termites) and disease (yellow mosaic virus, root rot) resistance
- Assessment of suitable environmental and soil conditions for reducing the risk of early wet season soybean production (prior to rice)
- Introduction of agronomically-adapted cassava varieties suitable for food and processing applications, including land preparation and soil nutrient management
- Field level water management
- Improved returns from field crop marketing to value chain actors
 - Establishing advantages and disadvantages of different farmer group institutional models and trading power relationships along the value chain
 - Optimal policies for group establishment and sustainable involvement in microfinance systems
 - Identify effectiveness of different formal processes for formal communication/ interaction between chain members
 - Understanding customer requirements to match quality, volume and timing needs of domestic and international market with production cycles
- Synthesis and dissemination of government regulations and standards for field and horticultural crop seed and cropping inputs to meet requirements of domestic markets and trading partners.
- Development and dissemination of simple systems for consistent supply of seed for open-pollinated crops such as soybean

Crop production technical support for farmers growing maize, soybean and cassava

Demand for maize, soybean and cassava is increasing rapidly, in particular from Thailand, Vietnam and China. There is a need to disseminate appropriate production technologies and current knowledge to farmers so they can meet this demand; and also to maximise crop productivity and profitability. Issues requiring research specific commodities include:

- For maize, establishment of planting times for upland and Mekong River sites, and selection of varieties resistant to downy mildew and stalk rot.

- For upland and lowland soybean are pest (insects and termites) and disease (yellow mosaic virus and root rot) management, and assessment of soybean in rotation sown prior to rice.
- For cassava, suitable varieties, land preparation, soil nutrient management and processing technologies.

Marketing innovations that will enhance efficiency and effectiveness along value-chains

Marketing infrastructure, institutional arrangements and information flow are critically important for efficient functioning of value chains. For annual crops, key issues include:

- Farmer marketing groups, because they can help coordinate the procurement of inputs and marketing and increase farmer trading power. Research is needed on best options for their establishment (what works and why) and models for delivering micro-finance.
- Marketing networks are important because they encourage better flow of product information to farmers (quality and quantity), as well as enabling development of better relationships and communication along the supply chain. R&D is needed on effective communication methods (eg SMS, meetings, agricultural field days) for Cambodian conditions.
- Understanding customer demand enables matching quality needs of the market with production activities. Market chain analysis for maize, soybean, and cassava is critical from both domestic and international perspectives.

Delivering consistent supply of quality seed for crop production

Farmers need assurance of seed quality and availability at the right time for sowing. For farmer-saved open-pollinated varieties, farmers need to understand how to maintain seed quality for the next season (including harvest and clean storage requirements). In addition they also need to understand factors affecting seed quality such as trueness to type (or purity), freedom from seed borne diseases, germination ability (germination rate at farm level), and cleanliness (free from weeds and trash).

Implementing government regulations and standards from a domestic and international perspective

Understanding domestic and international regulations, standards and certification requirements (for seeds, pesticides, chemicals, and SPS issues) are important for potential impacts on illegal traffic, restricting export and import access, protection from poor quality 'input' products, and meeting customer demands. A critical requirement is the analysis, synthesis, and dissemination of domestic and international regulations and standards, particularly of Cambodia's trading partners.

Horticulture

Priority Crops for the domestic market include

- vegetables (leafy vegetables, chilli, crucifers, tomato),
- fruits (mango, papaya, rambutan, durian, banana), and
- black pepper other potential new herb and spice products.

For the export market, priority crops include

- chilli, black pepper and fruits (mango, papaya, rambutan and durian).

Major issues requiring research

- Understanding domestic market needs (including matching seasonal supply to demand)
- Development and dissemination of crop-specific technology information packages, and research into alternate extension and information delivery models for traders and producers
- Economics of out of season vegetable production, including through protected cropping and containerised vegetable production systems
- Low cost vegetable postharvest handling technologies to reduce losses and maintain product quality, including low-cost packaging materials and simple techniques for temperature management and options to establish shorter supply chains
- Options for more functional input supply chains
- Analysis of suitability of different soil types and on-farm water management and locations (access to markets, labour availability, local disease and pest pressures) for production of different vegetable species and varieties

Understanding domestic market needs (including matching seasonal supply to demand)

Supply of fresh fruit and vegetables to markets in Cambodia is constrained on one hand by a lack of production in the wet seasons and low productivity, but on the other hand by reduced yield and quality problems in the dry season. During some periods, oversupply of some fruit and vegetable types to the local markets results in low prices and poor returns to both growers and traders. Competition of local product with imported product, which is often of superior quality can also result in poor returns to Cambodian growers and lack of effectiveness of the whole value chain. Marketing and economic research is required to analyse the local value chains for a range of Cambodian fruit and vegetable products. This information would be used to develop strategies and trial interventions to ensure reliability of supply, to better match seasonal supply and demand and to develop production and marketing strategies for the Cambodian fruit and vegetable industries.

Economics of out of season vegetable production, including through protected cropping and containerised vegetable production systems

Out-of-season vegetable production (during the very wet and very dry months) offers local growers the potential to produce crops during periods of low supply, when prices are high. A range of agronomic systems (e.g. protected cropping, irrigated production systems, containerised production systems) are available and may be adapted for use in Cambodia. Realisation of the potential of these modified production systems depends very much on the cost-efficiency of the modifications and anticipated market returns. Economic analysis of these systems under Cambodian conditions is necessary to allow further decision making on implementation by growers.

Development and dissemination of crop-specific technology information packages, and research into alternate extension and information delivery models for traders and producers

Information on crop production technology is available for a wide range of crops in Cambodia. The uptake of this information and implementation of these packages is constrained by inadequate extension and delivery systems. Research is required to better understand the constraints and issues associated with current delivery models, to identify and develop strategies to overcome barriers to adoption and to develop alternative extension delivery models. Some gaps have been identified in existing crop production technology packages and adaptive R&D will be required to fill these (e.g. new and superior varieties, crop-specific pest and disease control, nutrition, irrigation and water management).

Low cost fruit and vegetable postharvest handling technologies to reduce losses and maintain product quality, including low-cost packaging materials and simple techniques for temperature management and options to establish shorter supply chains

Postharvest losses and product quality are still major problems in domestic fruit and vegetable production in Cambodia. Major issues are the length and complexity of the supply chains, poorly designed and inappropriate packaging, poor harvesting practices, inappropriate varieties and poor temperate management of product. Research is required on suitable varieties for domestic and export markets (based on customers' needs); temperature management, including pre-cooling options; packaging; transport and storage infrastructure and relationships between supply chain partners. In some cases, establishment of shorter supply chains for perishable products may be possible to preserve product quality.

Options for more functional input supply chains

One of the current constraints to consistent supply of high quality fruit and vegetables is access to seed and other inputs (e.g. fertilizers). In the case of vegetable seed, local selections are often of poor quality. With vegetables, farmer selection and saving of open-pollinated crop seeds inevitably leads to disease-infected seed and inferior seed quality. Currently, seed of superior varieties is not available in reliable quantities and the distribution of this input is limited. Cambodia has the lowest use of fertilisers in Asia due to high costs and inefficient supply chains. Information is often lacking for appropriate and optimal use of fertilisers and agrochemicals by farmers (often the labels are not in Khmer language, or substitutes may be used). Research is needed to further understand the constraints within the current supply chains for crop production inputs and to develop strategies to overcome these. Researchable issues include economic analysis of different supply strategies; assessing the technical and economic feasibility of seed production in Cambodia and enabling policies to provide better access to inputs such as fertiliser and pesticides, and to make greater participation by the commercial sector attractive.

Analysis of suitability of different soil types and on-farm water management and locations (access to markets, labour availability, local disease and pest pressures) for production of different vegetable species and varieties

Development of fruit and vegetable production in Cambodia has occurred without due consideration of access to markets, labour availability, pests and diseases, microclimate and

seasonal suitability. For example, much of Cambodia's best vegetable land becomes inundated during the wet season for 3-5 months of the year. This waterlogging results in loss of soils structure and organic matter. Attempts to produce vegetables in less flood-prone areas have often resulted in failure due to inadequate consideration of production, environmental, marketing and economic factors. In addition, some Cambodian government departments are encouraging the development of areas of crop specialisation to allow regional labelling and identity marketing of horticultural products, without sufficient analysis of the agroecological suitability of the districts for production of the target crop or analysis of comparative advantage in the marketplace. Economic, marketing, production and agro-ecological R&D is needed to underpin the move to regional specialisation and the development of new areas for horticultural production.

Development of Good Agricultural Practice (GAP) Standards

This is not a researchable issue but is important in the development of value chains for export horticultural crops. The introduction of GAP standards will be a pre-requisite for export products from Cambodia to most major markets within ASEAN by 2012. There is currently no national Cambodian GAP system and a poor understanding of GAP principles within Cambodia so development of standards, capacity, infrastructure and human resource is needed. Traceability and the ability to assess whether produce for the export or local markets have excessive pesticide or other residues is lacking at present (although a new JICA project will address this). No direct researchable issues emerge immediately from this constraint, but GAP provides a framework for research and development in other areas to underpin the development and implementation of Cambodian national GAP standards.