

SYNTHESIS OF REGIONAL AGRICULTURAL RESEARCH NEEDS AND PRIORITIES FOR THE ASIA-PACIFIC REGION

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SYNTHESIS OF REGIONAL AGRICULTURAL RESEARCH NEEDS AND PRIORITIES IN THE ASIA-PACIFIC REGION

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1. Agricultural Research for Development

1.1 Research Focus

Agriculture, being based on renewable resources, has been and will continue to be the major source of socio-economic development in the most developing countries, including the developing countries in the Asia-Pacific region. The sector continues to be and will remain the prime contributor to food security, income generation, improved livelihoods, self-reliance, and overall prosperity in the region. Agricultural research has played very significant role over the past five decades in terms of growth and sustainability of this sector, help reducing poverty and improving overall welfare of people.

In general, investment in agricultural research has proven to be very attractive. It gives as much as 30% real rate of return per annum (Evenson et al. 1999). Many research successes have been achieved worldwide both in developed and developing countries. However, investment in agricultural research has been nowhere near the stipulated rate of 2 percent of agricultural gross domestic product. On the other hand it has been on decline in most of the developing countries in the Asia-Pacific region. Research resources have become scarce.

Under the environment of limited research resources and research capacity, it is important to optimise returns to research investment by focussing on high priority research agenda that has potential to make greater, wider, quicker and relevant development impacts. Such impacts need to address issues such as food security, income distribution, poverty alleviation, and rural development, and problems of less developed and neglected areas. Therefore, while developing priority research agenda, it is necessary to consider development issues at both macro and micro (local) levels within individual countries, and also to account for demand and supply parameters at the national and international levels.

1.2 Emerging Challenges

In the recent past the process of agricultural research for development has been more challenging, inclusive, consultative and participatory. Opportunities and options for research are identified jointly by different stakeholders with broader range of agenda and priorities. Increasingly, research is focusing on partnerships, multiple knowledge bases, innovation triggers and champions, reworking the existing stock of knowledge, institutional learning and capacity development, and social responsibility. Donors and research organizations are beginning to direct more support to building the capacity of local systems to generate, diffuse and use new

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technology; and recognizing that capacity development in the systems is the route to more effective impact from research investments (CGIAR Science Council 2005).

Research agenda must be prioritised based on the assessment of the needs of local communities in the overall complex environment and also on the assessment of gaps so that research programmes become focussed in generating high and relevant impacts on target populations. For an effective impact of research results, it is also crucial to seek involvement and participation of important stakeholders such as farming community, farmer organizations, NGOs, development workers, the private sector, processors, traders and consumers in developing research priorities and implementing research programmes. This participation is now not limited to the national boundaries but also encompasses regional and international dimensions.

2. Agricultural Research Priorities in the Asia-Pacific Region

2.1 The 2001 Research Priority Setting Exercise

As part of its mandated responsibility, the Asia-Pacific Association of Agricultural Research Institutions (APAARI) in collaboration with the Global Forum on Agricultural Research (GFAR), National Agricultural Research Systems (NARS), International Agricultural Research Centers (IARCs) and other stakeholders, has provided a platform for regional priority setting exercise based on the needs identified by the different stakeholders in the region. This initiative goes back to 1996 when APAARI undertook the research priority setting exercise in the Asia-Pacific region. This was followed by the first consultative exercise during 2001. This exercise had two phases. The first phase involved research priority setting exercise by the individual (three) sub-regions – South and West Asia, Southeast Asia and the Pacific. While in the second phase, an expert consultation on regional research priority setting was held in November 2001 to synthesise and aggregate research priorities in the Asia-Pacific region (APAARI 2001). The synthesised research priorities in the region and its three sub-regions are presented in Annex 1.

The 2001 regional priorities helped shaping up global perspectives and priorities for agricultural science and technology in making their contribution to meeting the Millennium Development Goals (MDGs). The regional priority areas were inputted into the Challenge Programmes initiated by the Consultative Group on International Agricultural Research (CGIAR). These also formed new research priorities as identified by the Science Council of CGIAR. The regional priorities and research needs assessment also resulted into the establishment of some regional programmes supported by donors and APAARI, namely the Asia-Pacific Consortium for Agricultural Biotechnology (APCoAB), the Asia-Pacific Regional Information System (APARIS), the Post-Harvest initiative, CLAN and INCANA. Based on these priorities, work is also in progress on Linking Farmers to Market Global Partnership Programme (GPP) facilitated by GFAR.

2.2 Sub-Regional Research Needs Assessments and Research Priorities (2004-2005)

Although a number of outcomes were accomplished, the 2001 priority setting exercise was of a limited value because a) priorities established were aggregate and broad and did not reflect micro (local level) needs; b) there was only a limited participation by the key stakeholders such as farmers, NGOs, farmer organizations, development workers, the private sector, traders and processors and consumers; and c) many of new and emerging issues and challenges were not reflected in these priorities.

Therefore, a second set of research priority setting exercise was undertaken in the three sub-regions of the Asia-Pacific region during 2004 and 2005. Three workshops – one in each sub-region - were conducted during 2004 and 2005 to review and validate the research needs identified during the 2001 exercise, identify gaps and prioritise research for respective sub-regions. The two main objectives were:

- to identify research needs based on gap analysis by national programmes in each of these sub-regions; and
- to synthesize research needs and priorities for the sub-regions and draw up a set of recommendations on research priorities that may influence the regional and global research agenda.

Annex 2 provides details of these workshops, including locations, host organisations, participating countries, and participating organisations. It may be noted that this exercise has a variable participation by various stakeholders such as farmers, NGOs, farmer organizations, development workers, the private sector, traders and processors and consumers. Participation by international research organizations and donors also varied among the sub-regions. The South and West Asia exercise involved a number of such organizations; the Southeast exercise attracted a reasonable participation while the Pacific region exercise did not have much.

3. Synthesis of the Previous Research Priorities

The purpose of this synthesis (exercise) was to critically examine the outputs of the three sub-regional research need assessments and priorities and identify high priority common research areas across these sub-regions, and also to highlight research areas that are specific to the individual sub-regions.

The draft synthesis was shared with NGOs, farmer/producer organisations, and the private sector in the Asia-Pacific region for their comments, inputs and validation. Some of these feedbacks were consolidated to arrive at broadly agreed research needs that were common to the region and also that are specific to individual sub-regions. Specific emphasis was placed on identification of research needed based on the present gaps.

The consolidated synthesis was further presented at the workshop organised by APAARI on Synthesis of Regional Research Needs in the Asia-Pacific Region on 18-19 August 2006, in Bangkok. Thus the presentation became the basis for deliberations at the workshop. The ensuring deliberations and arising outcomes at the workshop further helped distilling further the research needs and deciding high priority areas for research and development programmes in the region. These outcomes have been presented in the proceedings of the workshop on the regional research needs.

The deliberations at the workshop and agreed programmes were intended to help building new partnerships in addressing the research gaps and needs, harmonization of the CGIAR Science Council and GFAR priorities to meet the MDGs, overcome any inter-sector imbalances (crops, livestock, fishery, forestry, etc.), and address any complimentary and subsidiary issues.

3.1 Synthesis Methodology

- Major effort was made to comprehend and specify the research areas from research needs that were identified and prioritized by the three sub-regions through their independently organized but uniformly framed workshops.
- This was done by considering research priorities identified by the countries participating at these workshops. There were 5 countries - Bangladesh, India, Iran, Nepal and Sri Lanka at the South and West Asia exercise; 8 countries - Cambodia, Indonesia, Laos, Myanmar, the Philippines, Singapore, Thailand, and Vietnam at the Southeast Asia Exercise; and 7 countries - Fiji, French Polynesia, New Caledonia, Papua New Guinea, Kiribati, Vanuatu, and Samoa at the Pacific Exercise (Annex 2).
- Also considered were the research priorities identified and summarised by various working groups formed during the sub-regional workshops. The South and West Asia workshop organised four working groups, each on the major four agro-ecosystems such as coastal, hill and mountains, irrigated, and rainfed /arid. Research priorities identified for these agro-ecosystems appeared to be relevant to other sub-regions. The Southeast Asia workshop worked through two working groups for groups of countries; one covering Indonesia, the Philippines, Singapore, and Thailand; while the other covering Cambodia, Laos, Myanmar, and Vietnam. While the Pacific workshop had only one group involving all the participants.
- Research priorities identified by CGIAR for the South and West Asia region were mostly thematic and appeared to be relevant to other sub-regions and therefore were included in the synthesis process.
- However, research priorities highlighted by specialized (commodity) international research organisations such as IRRI, ICRISAT, IWMI, and ILRI were not considered because their priorities were within their mandated areas of responsibilities and may be difficult to rationalise in the context of overall research and development issues. Furthermore, consideration of such priorities might create some degree of bias, as priorities of these organisations are available only for one sub-region, the South and West Asia and not other two sub-regions.
- It needs to be noted that some presentations and outcomes highlighted research considerations such as rural poverty, demand-driven technology, and globalisation. While others highlighted the research objectives such as food security, people empowerment, and protecting environment. Also pointed out in the outcomes of these workshops were research and development strategies and some suggested collaboration/co-operation activities. These are not the research areas and therefore were not considered.
- Many of the priority research areas identified by the sub-regional exercises, though named differently, are focused on same or similar research and development issues. These therefore needed to be aggregated and specified for the common understanding and synthesis purposes. All such specified research areas as categorised in seven research themes and eleven sub-themes are given in Table 1. The key words and phrases provide the overall scope of these research themes and research areas.

- Further suggestions and comments were received during the synthesis workshop held in Bangkok in August. These suggestions were also considered to arrive at the synthesis as presented in the next section.

3.2 Feedback from On-line Consultations

The initial draft document was circulated by the APAARI Secretariat to key stakeholders, including farmer organizations, NGOs, IARCs, NARS, and some international organizations. By the end of second week of August 2006, a few feedbacks were received. These responses are discussed and reflected as below.

1. The Executive Secretary of APPARI provided valuable suggestions with respect to coverage, focus, potential, etc. of the research priority setting exercise undertaken by APAARI. These suggestions significantly improved the synthesis work.
2. The Indian Council of Agricultural Research (ICAR) in India suggested additional areas based on emerging needs and issues. These included the resource conservation technologies, soil nutrient balance, land use planning, market predictions and intelligence and energy generation and use in agriculture.
3. YPARD suggested that the involvement and engagement of young agriculture professionals (researchers) be considered as high priority in all the processes of R &D, including planning. Obviously, this would also require identifying agricultural higher education as a priority research area.
4. A suggestion from the International Rice Research Institute (IRRI) was that biotechnology should be treated as an independent area of thrust rather than being clubbed with Genetic Resources. This is because biotechnology has applications in many other areas such as NRM, food processing, post-harvest, etc.
5. The Asian NGO Coalition for Agrarian Reform and Rural Development (ANGOC) suggested priority research areas including natural resource management, land reform and resource rights, statistical tools and methods, research approaches, research institutions, policy, poverty reduction studies, rural enterprise and markets, and solidarity enterprises. By comparing research priorities identified in the draft synthesis and ANGOC suggestions, ANGOC indicated that the synthesised priorities were heavy on bio-physical and technical aspects and were thin on social aspects. Specific areas they suggested included poverty reduction strategies, land reform, research investment, voices of the poor, indigenous knowledge and IPR.
6. CIRAD in France provided very comprehensive comments, suggesting that this exercise needed to highlight the enormous challenges of the next 50 years, faced by the World and more particularly by countries of the Asia Pacific region. The comments were supported by the following facts: 1) three billion people some 50 years ago were helped through green revolution practices which have now reached its limits; 2) currently the environmental problems becoming enormous and the agricultural production becoming relatively costly to farmers, especially with subsidies being removed; 3) serious threats existed to biodiversity, biosphere eco-systems, and forest lands couple with climate

change and desertification; and 4) additional three billion people needed to be fed over the next 50 years, with some 520 million people in the region without access to adequate food, meaning a need for doubling of food world food supply. Therefore, there is a need for new agricultural systems called eco-agriculture, adapted to each specific region and country and viable in the context of globalization, mainly through research and development.

To address the above situation, CIRAD suggested three research priority sets, which could be customized for each specific sub-region and each country according to the local situation and site conditions. These were: 1) the sustainable approach of agricultural production, 2) the sustainable management of natural resources and environment, 3) the quality and biosafety of agricultural products. CIRAD further suggested that priority generic research themes for each of the above three priority sets.

- 1) Under the sustainable approach of agricultural production the themes suggested are:
 - a) Integrated management of cultivated ecosystems including agroforestry models, agroecology techniques, integrated pest and diseases management,
 - b) Improvement of plant varieties and local animal species, through appropriate breeding, marker assisted selection, functional genomics,
 - c) Integrated management of water resources in the ecosystems,
 - d) Methods for proper organization, for efficient management and of conflict negotiation among stakeholders (including multi agent systems),
 - e) Representation of farming systems integrating economical, social and ecological data through modelling and geographic information systems (GIS), and
 - f) Regulation modalities of commodity chains and markets at national, regional and international levels.
- 2) Under the sustainable management of natural resources and environment the themes suggested are:
 - a) the role of agriculture and forestry in the carbon cycle (Carbon sequestration),
 - b) the knowledge on tropical and subtropical biological resources in order to better manage and control biological diversity,
 - c) the management of soil (biological process, use of suitable permanent cover crops), the fight against erosion, against agricultural pollutions (agricultural solid and water wastes), and against desertification,
 - d) the prevention and treatment of health risks from plant and animal origins, especially emerging diseases, and
 - e) the sustainable management of forest landscapes.
- 3) Under the quality and bio-safety of agricultural products, the suggested themes are:
 - a) Agricultural, biological, technological and socio-economical factors of agrifood quality from production to post harvest and processing and to consumers,
 - b) Development of tools for trace ability, for risk management in the quality control process, and
 - c) Methods of elaborating and controlling quality adapted to tropical conditions and definition of quality standards and regulations.

3.3 Synthesis of Regional and Sub-regional Research Priorities

By using the best possible comprehension of the available information, the synthesis exercise identified 85 research areas, which are specific to the context of research and development issues, agro-ecologies, commodities, disciplines, and some policy and cross cutting issues. These areas are categorized into main research themes and sub-themes as given in Annex 3 (Base synthesis of agricultural research needs and priorities for the Asia-Pacific region: 2004- 05 priority setting exercise).

This exercise was taken further to identify research areas that are common to all the sub-regions of the Asia-Pacific region. This has given 40 areas common to all the regions (Table 2). All main themes and sub-themes have some common research areas across the sub-regions.

Besides understanding of the common areas, it was also important to know common research priority areas among any two of the three sub-regions. The outcome of this exercise is given in Table 3. There are as many as 13 common research areas among the South and West Asia, and the Southeast Asia, 3 common research areas among the South and West Asia, and the Pacific. While the Southeast Asia and the Pacific region do not share any area. Furthermore, there are typical research issues and areas that are specific only to the individual sub-regions. Such specific areas are isolated and given in Table 4. The South and West Asia region has 16 specific areas in, while the Southeast Asia and the Pacific regions have 6 specific and typical research areas each.

4. High Priority Research Needs

As part of the synthesis exercise, an attempt was also made to identify high priority research and development issues from those arising as common and specific issues. These are presented in Tables 5, 6 and 7,

5. Limitations and Qualifications of the Synthesis

- Any limitations of sub-regional research priority setting exercises, in terms of coverage of geographical areas, degree of consultations with stakeholders, gap analysis, etc., remain limitations of this synthesis. For instance, the Southeast and Pacific sub-regional exercises did not have adequate representations by the private sector, farmer organizations, NGOs, traders, and other stakeholders. Similarly, gap analysis was not explicitly done and expressed in the final outcomes of the sub-regional workshops, except by the Pacific sub-region. These limitations were recognized, considered and addressed during the on-line consultations with the other key stakeholders and by the synthesis workshop held in August 2006.
- In the process of specifying research areas and identifying the common areas for the purposes of this synthesis, adequate care was taken to maintain as many originally named research areas as possible. Where possible and obvious, some research areas were re-specified and aggregated. This aggregation process may have resulted in losing some information. Therefore, it has been suggested that information available from individual countries and sub-regions be kept intact for planning and implementation of R&D programmes at disaggregate levels such as agro-ecological zones within a country, national level, and sub-regional levels.

6. Towards Development of Research and Development Programmes

The advanced draft of synthesis of research needs and priorities for the Asia-Pacific region was presented at the workshop on the Synthesis of Regional Research Needs and Priorities, held from 18-19 August 2006 in Bangkok. The workshop also included a number of presentations by various stakeholders such as IARCs, NGOs, farmer organizations, and the private sector. All these presentation were discussed and deliberated through working groups for each of the three sub-regions – the South and West Asia, the Southeast Asia and the Pacific. The outcomes of these deliberations in terms of summarized research priorities, regional research priorities in short to medium terms, and anticipatory research priorities have been reported in the proceedings of the August workshop. These outcomes also allowed the workshop to develop roadmap suggesting future course of actions by various stakeholders to design and implement collaborative research and development projects/ programmes for implementation at the regional and sub-regional and national levels.

Table 1. Specification of research areas as categorized into research themes and sub-themes: synthesis of agricultural research priorities for the Asia-Pacific Region

Research Themes and Sub Themes	Research Areas	Key Words Specifying Research Areas and Sub Themes
1. Natural Resources Management		
1.1 Land, Soil, Climate and Water Management	Developing viable options for shifting cultivation	Land, water, soils and climatic resources management practices and options to manage, improve and develop the land resource base in the overall context of broader agro-ecosystems.
	Avoiding seawater ingress, water pollution and coral reef destruction in coastal agro-ecosystems	
	Water quantity and quality issues in irrigated ecosystems	
	Land restoration in degraded areas, especially affected by mining	
	Maintaining soil health and soil fertility in coastal agro-ecosystems	
	Management of soil degradation in irrigated ecosystems	
	Improvement of soil health and fertility in rained/arid ecosystems	
1.2 Integrated Watershed Management	Watershed management in catchment areas	Natural resource management and use in an integrated way, especially rainwater, soil nutrients, sunlight and other natural resources in natural watershed areas and catchments for optimal production of agricultural systems and commodities.
	Rainwater harvesting and management of ground water in coastal agro-ecosystems	
	Assessment of watershed as functional unit in hills and mountains	
	Harvesting of surface runoff on a watershed basis in rainfed/arid ecosystems	
1.3 Integrated Management	Integrated NRM, PM, CM and agro-ecology, including policy issues	Integrated natural resources management, pest and crop management through various practices (use of fertilizers, pesticides, other inputs) and enterprises (crops, livestock, tree) so as to develop and use of resources.
	Atoll resources management	
2. Genetic Resources and Biodiversity		
	Germplasm collection, conservation and use of crop biodiversity	Collection, conservation (in situ, ex situ, in vitro), characterisation, evaluation, management, dissemination, exchange of plant and animal genetic resources/agro-biodiversity for food and agriculture, including natural biodiversity useful to agriculture (like micro-organisms, insects, etc.)
	Enhancing and augmentation of germplasm through genetic improvement, identifying new sources of resistance and creation of new parental lines	
	Enhance and sustain the use of forest biodiversity	
	Biodiversity of natural systems including microbial	
	Enhance and sustain the conservation and use of animal biodiversity	
	Manage and sustain fisheries genetic resources	

Table 1. Specification of research areas as categorized into research themes and sub-themes: synthesis of agricultural research priorities for the Asia-Pacific Region (Continued)		
Research Themes and Sub Themes	Research Areas	Key Words Specifying Research Areas and Sub Themes
3. Biotechnology		
	Identifying new sources of resistance to biotic and a-biotic stresses for individual species/systems through biotechnology	Enhancement and expansion of genetic resources and biodiversity for current and potential use by using available genetic resources, including wild genetic resources, and by applying conventional and modern methods of plant breeding including advanced methods of biotechnology.
	Biotechnology research in crops, animals and fisheries	
	Construction of new genes in crops	
	New diagnostic tools and vaccines for animal diseases	
	Livestock genetic improvement	
4. Enterprise Improvement		
4.1 Systems Improvement	Coconut based cropping system in coastal agro-ecosystems	Improvement in and through integrated systems involving crops, livestock, agro-forestry, social forestry, fisheries, aquaculture and various on-farm and off-farm activities to increase overall productivity and production and to minimise losses from pests and diseases and other biotic and a-biotic factors in various agro-eco systems. These include rational use of pest and crop management practices, husbandry methods, optimal use of various resources, inputs and activities so as to get optimal outputs.
	Integrated crop production technologies	
	Intensification of crop production systems	
	Integrated crop and livestock systems	
	Agricultural systems for drought-prone areas	
	Agro-forestry and community forestry systems	
	Diversification (on farm and off farm) activities in all ecosystems	
	Improvement and management of aquaculture systems	
	Fisheries enterprise and mangroves in coastal agro-ecosystems	
	Up-scaling the use of integrated pest, disease and crop management	
	Improving small farm viability	
	Livestock feed formulation and feeding systems	
	Zoonoses - monitoring, surveillance and management	
4.2 Commodity Improvement	Improvement of high value, low volume and low weight locally produced (horticultural, food and medicinal plants) and commodity value chains in hills/mountains	Improvement and development of specific commodities such as crops and livestock species, through husbandry techniques/practices and value adding to increase productivity and improve quality/value on a sustainable basis. These include optimum use of various resources, inputs and activities, and genetic improvement by applying conventional and modern methods of breeding, and biotechnology for specific commodities and purposes.
	Improvement (breeding) of commercially important and under-utilised crops	
	Crop management and organic production system	
	Resistant varieties for extreme environments	

Table 1. Specification of research areas as categorized into research themes and sub-themes: synthesis of agricultural research priorities for the Asia-Pacific Region (Continued)

Research Themes and Sub Themes	Research Areas	Key Words Specifying Research Areas and Sub Themes
5. Post-Harvest, Value Adding and Food Safety		
	Value adding, profitability, food safety and quality through processing and other means to agriculture, fisheries and forest products	Including post-harvest, down stream processing, preservation, storage, transportation, packaging, product quality and food safety requirements for market oriented products.
6. Policy and Institutions		
6.1 Policy issues	Food safety, food quality, GMOs, biotechnology, market changes Post-harvest value addition and processing Food procurement / pricing in irrigated ecosystems Input price distortions in rainfed/arid ecosystems Processing, cold chain, anchorage and landing facilities in coastal agro-ecosystems Participatory irrigation management in irrigated ecosystems Credit support to fishermen in coastal agro-ecosystems Review, change, and validate policies in hills and mountains Emerging R&D issues for disaster induced agriculture, fisheries and forestry Extension systems and research-extension interface in coastal agro-ecosystems Alternative livelihood opportunities and safety net mechanisms in rainfed/arid ecosystems	Research and analysis of policies and implications in various areas of research and development so as to improve, modify, change, and develop appropriate policies for effective R&D impacts.
6.2 Institutional reform	Institutional development and change management Identification of institutions and programmes in hills and mountains Sustainable financing mechanisms Recognition and harnessing of traditional knowledge and practice Increasing outreach of financial services in rural areas Collective action in rainfed/arid ecosystems Suitable public-private partnerships in rainfed/arid ecosystems	Analysis and assessment of institutional arrangements and mechanisms so as to bring in institutional changes and reforms to help improve institutional performance supporting and developing agriculture in specific focussed areas.

Table 1. Specification of research areas as categorized into research themes and sub-themes: synthesis of agricultural research priorities for the Asia-Pacific Region (Continued)

Research Themes and Sub Themes	Research Areas	Key Words Specifying Research Areas and Sub Themes
7. Cross-cutting		
7.1 Research Issue	<p>Monitoring and socio-economics impact assessment of technology transfer/adoption</p> <p>Development of new research tools (biotechnology and genomics)</p> <p>Farm tools and selective agricultural mechanisation</p> <p>Biotechnology research in crops, animals and fisheries</p> <p>Identifying and mapping of poverty areas</p> <p>Markets, marketing systems and enterprise development in both domestic and international markets</p> <p>Research with better and stronger impact in and on systems</p> <p>Poverty reduction studies and strategies</p> <p>Land reforms</p> <p>Research investment</p> <p>Voices of the poor</p> <p>Research with better and stronger impact in and on systems</p>	Cross-cutting research issues in the areas of monitoring, impact assessment, research tools, and techniques, mechanisation, market studies, research and information resource bases, etc.
7.2 Capacity Development	<p>Pest and disease surveillance, monitoring and border control</p> <p>Supply chain analysis (improving market access)</p> <p>Addressing R&D issues of rural women and ethnic groups</p> <p>Interdisciplinary, multi-sectoral and participatory R&D activities</p> <p>Monitoring, evaluation and impact assessment</p> <p>Building the organization and management capacity of NARS</p> <p>Building capacity in trade, outlook, market intelligence and IPR issues</p> <p>Enhancing community-based knowledge management capacity</p> <p>Entrepreneurial development of farmers and fisherfolk</p>	Capacity development (assessment, training, methods, processes, arrangements, etc.) for effective R&D activities, including targeted to specific groups.
7.3 Information, Communication and Technology Transfer	<p>Information, communication technology, knowledge management and exchange</p> <p>Development of new information and communication tools/techniques</p>	Development, use and management of information and communication technologies/ tools, and management and exchange/sharing of information and knowledge.
7.4 Allied areas	<p>Participation of people in linking NRM with enterprise improvement</p> <p>Tourism and mountain handicrafts in hills and mountains</p>	Closely related and complementary activities and actions to help developing agriculture.

Table 2. Synthesized research needs and priorities common for the three Asia-Pacific (South and West Asia, Southeast Asia and the Pacific) regions: 2004- 05 priority setting exercise

Research Themes and Sub Themes	Research Areas	
1. Natural Resources Management		
1.1 Land, Soil, Climate and Water Management	1	Maintaining soil health and soil fertility in coastal agro-ecosystems
1.2 Integrated Watershed Management	2	Watershed management in catchment areas
1.3 Integrated Management	3	Integrated NRM, PM, CM and agro-ecology, including policy issues
2. Genetic Resources and Biodiversity		
	4	Germplasm collection, conservation and use of crop biodiversity
	5	Enhancing and augmentation of germplasm through genetic improvement, identifying new sources of resistance and creation of new parental lines
	6	Enhance and sustain the use of forest biodiversity
	7	Biodiversity of natural systems including microbial
3. Biotechnology		
	8	Identifying new sources of resistance to biotic and a-biotic stresses for individual species/systems through biotechnology
	9	Biotechnology research in crops, animals and fisheries
4. Enterprise Improvement		
4.1 Systems Improvement	10	Coconut based cropping system in coastal agro-ecosystems
	11	Integrated crop production technologies
	12	Agro-forestry and community forestry systems
	13	Fisheries enterprise and mangroves in coastal agro-ecosystems
	14	Up-scaling the use of integrated pest, disease and crop management
	15	Improving small farm viability
4.2 Commodity Improvement	16	Improvement of high value, low volume and low weight locally produced (horticultural, food and medicinal plants) and commodity value chains in hills/mountains
5. Post-Harvest, Value Adding and Food Safety		
	17	Value adding, profitability, food safety and quality through processing and other means to agriculture, fisheries and forest products
6. Policy and Institutions		
6.1 Policy issues	18	Post-harvest value addition and processing
	19	Extension systems and research-extension interface in coastal agro-ecosystems

Table 2. Synthesized research needs and priorities common for the three Asia-Pacific (South and West Asia, Southeast Asia and the Pacific) regions: 2004- 05 priority setting exercise (Continued)

Research Themes and Sub Themes	Research Areas	
6.2 Institutional reform	20	Sustainable financing mechanisms
	21	Recognition and harnessing of traditional knowledge and practice
	22	Increasing outreach of financial services in rural areas
	23	Collective action in rainfed/arid ecosystems
	24	Suitable public-private partnerships in rainfed/arid ecosystems
7. Cross-cutting		
7.1 Research Issue	25	Monitoring and socio-economics impact assessment of technology transfer/adoption
	26	Development of new research tools (biotechnology and genomics)
	27	Identifying and mapping of poverty areas
	28	Markets, marketing systems and enterprise development in both domestic and international markets
	29	Research with better and stronger impact in and on systems
	30	Poverty reduction studies and strategies
	31	Land reforms
	32	Research investment
	33	Voices of the poor
	34	Research with better and stronger impact in and on systems
7.2 Capacity Development	35	Building the organization and management capacity of NARS
	36	Building capacity in trade, outlook, market intelligence and IPR issues
7.3 Information, Communication and Technology Transfer	37	Information, communication technology, knowledge management and exchange
	38	Development of new information and communication tools/techniques
7.4 Allied areas	39	Participation of people in linking NRM with enterprise improvement
	40	Tourism and mountain handicrafts in hills and mountains

Table 3. Synthesized research needs and priorities common for two of the three regions: 2004- 05 priority setting exercise

Research Themes and Sub Themes	Research Sub-Themes	Research Areas	
1. South and West Asia, and Southeast Asia			
3. Biotechnology			
		1	Construction of new genes in crops
		2	New diagnostic tools and vaccines for animal diseases
4. Enterprise Improvement			
	4.1 Systems Improvement	3	Integrated crop and livestock systems
		4	Diversification (on farm and off farm) activities in all ecosystems
6. Policy and Institutions			
	6.1 Policy issues	5	Food safety, food quality, GMOs, biotechnology, market changes
		6	Food procurement / pricing in irrigated ecosystems
		7	Processing, cold chain, anchorage and landing facilities in coastal agro-ecosystems
		8	Participatory irrigation management in irrigated ecosystems
		9	Emerging R&D issues for disaster induced agriculture, fisheries and forestry
	6.2 Institutional reform	10	Institutional development and change management
7. Cross-cutting			
	7.1 Research Issue	11	Biotechnology research in crops, animals and fisheries
	7.2 Capacity Development	12	Addressing R&D issues of rural women and ethnic groups
		13	Interdisciplinary, multi-sectoral and participatory R&D activities
2. South and West Asia, and the Pacific			
4. Enterprise Improvement			
	4.1 Systems Improvement	1	Improvement and management of aquaculture systems
		2	Livestock feed formulation and feeding systems
7. Cross-cutting			
	7.1 Research Issue	3	Farm tools and selective agricultural mechanisation

Table 4. Synthesized research needs and priorities specific to individual sub-regions: 2004 - 05 priority setting exercise

Research Themes and Sub Themes	Research Areas	
1. South and West Asia		
1. Natural Resources Management		
1.1 Land, Soil, Climate and Water Management	1	Avoiding seawater ingress, water pollution and coral reef destruction in coastal agro-ecosystems
	2	Water quantity and quality issues in irrigated ecosystems
	3	Management of soil degradation in irrigated ecosystems
	4	Improvement of soil health and fertility in rained/arid ecosystems
1.2 Integrated Watershed Management	5	Rainwater harvesting and management of ground water in coastal agro-ecosystems
	6	Assessment of watershed as functional unit in hills and mountains
	7	Harvesting of surface runoff on a watershed basis in rainfed/arid ecosystems
4. Enterprise Improvement		
4.1 Systems Improvement	8	Intensification of crop production systems
	9	Agricultural systems for drought-prone areas
4.2 Commodity Improvement	10	Improvement (breeding) of commercially important and under-utilised crops
	11	Resistant varieties for extreme environments
6. Policy and Institutions		
6.1 Policy issues	12	Input price distortions in rainfed/arid ecosystems
	13	Credit support to fishermen in coastal agro-ecosystems
	14	Review, change, and validate policies in hills and mountains
	15	Alternative livelihood opportunities and safety net mechanisms in rainfed/arid ecosystems
6.2 Institutional reform	16	Identification of institutions and programmes in hills and mountains
2. Southeast Asia		
1. Natural Resources Management		
1.1 Land, Soil, Climate and Water Management	1	Developing viable options for shifting cultivation
2. Genetic Resources and Biodiversity		
	2	Enhance and sustain the conservation and use of animal biodiversity
7. Cross-cutting		
7.2 Capacity Development	3	Supply chain analysis (improving market access)
	4	Monitoring, evaluation and impact assessment
	5	Enhancing community-based knowledge management capacity
	6	Entrepreneurial development of farmers and fisherfolk
3. The Pacific		
1. Natural Resources Management		
1.1 Land, Soil, Climate and Water Management	1	Land restoration in degraded areas, especially affected by mining
1.3 Integrated Management	2	Atoll resources management

Table 4. Synthesized research needs and priorities specific to individual sub-regions: 2004 - 05 priority setting exercise (Continued)

Research Themes and Sub Themes	Research Areas	
2. Genetic Resources and Biodiversity		
	3	Manage and sustain fisheries genetic resources
4. Enterprise Improvement		
4.1 Systems Improvement	4	Zoonoses - monitoring, surveillance and management
4.2 Commodity Improvement	5	Crop management and organic production system
7. Cross-cutting		
7.2 Capacity Development	6	Pest and disease surveillance, monitoring and border control

Table 5. High priority common research needs in the Asia-Pacific Region

Research areas	
1	Integrated NRM, PM, CM and agro-ecology, including policy issues
2	Germplasm collection, conservation and use of crop biodiversity
3	Identifying new sources of resistance to biotic and a-biotic stresses for individual species/systems; and Enhancing and augmentation of germplasm through genetic improvement
4	Integrated crop production technologies; and agro-forestry and community forestry systems
5	Up-scaling the use of integrated pest, disease and crop management
6	Improvement of high value, low volume and low weight locally produced (horticultural, food and medicinal plants) and commodity value chains in hills/mountains
7	Value adding, profitability, food safety and quality through processing and other means to agriculture, fisheries and forest products
8	Monitoring and socio-economics impact assessment of technology transfer/adoption
9	Markets, marketing systems and enterprise development in both domestic and international markets
10	Information, communication technology, knowledge management and exchange; and Development of new information and communication tools/techniques

Table 6. High priority common research needs in two of the three sub-regions

Research areas	
South and West Asia and Southeast Asia	
1	Food safety, food quality, GMOs, biotechnology, market changes
2	Emerging R&D issues for disaster induced agriculture, fisheries and forestry
3	Interdisciplinary, multi-sectoral and participatory R&D activities
South and West Asia and the Pacific	
1	Improvement and management of aquaculture systems
2	Livestock feed formulation and feeding systems

Table 7. High priority research needs specific to individual Sub-Regions

Research Areas	
South and West Asia	
1	Management of soil degradation in irrigated ecosystems
2	Assessment of watershed as functional unit in hills and mountains; and Harvesting of surface runoff on a watershed basis in rainfed/arid ecosystems
3	Improvement (breeding) of commercially important and under-utilized crops
4	Alternative livelihood opportunities and safety net mechanisms in rainfed / arid ecosystems
Southeast Asia	
1	Enhance and sustain the conservation and use of animal biodiversity
2	Supply chain analysis (improving market access)
3	Entrepreneurial development of farmers and fisher-folk
The Pacific	
1	Atoll resources management
2	Crop management and organic production system
3	Pest and disease surveillance, monitoring and border control

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Acronyms and Abbreviations

ACIAR	Australian Centre for International Agricultural Research
ANGOC	Asian NGO Coalition
APAARI	Asia-Pacific Association of Agricultural Research Institutions
APARIS	Asia-Pacific Regional Information System
APCoAB	Asia-Pacific Consortium for Agricultural Biotechnology
AVRDC	Asian Vegetable Research and Development Centre
CGIAR	Consultative Group on International Agricultural Research
CIP	International Potato Centre
DFID	Department for International Development
FAO	Food and Agriculture Organization
GDP	Gross Domestic product
GFAR	Global Forum on Agricultural Research
GPP	Global Partnership Programme
IAC	Institut Agronomique neo-Caledonien
IARCs	International Agricultural Research Centers
ICIMOD	International Centre for Integrated Mountain Development
ICM	Integrated Crop Management
ICRAF	International Centre for Research in Agro-forestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ILRI	International Livestock Research Institute
IPGRI	International Plant Genetic Resources Institute
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research
IWMI	International Water Management Institute
MDGs	Millennium Development Goals
NARS	National Agricultural Research Systems
NGO	Non Governmental Organizations
NRM	Natural Resource Management
PICTs	Pacific Island Countries and Territories
POPACA	Project of Organization of Agricultural Producers for Associative Trading project in Vanuatu funded by EU and France.
SEARCA	SEAMEO Southeast Asia Regional Centre for Graduate Study and Research in Agriculture
SECURA	SECURA International Corporation
SPC	Secretariat of the South Pacific Community
WTO	World Trade Organization

**Annex 1. Synthesized research priorities for the Asia Region and its three sub-regions:
2001 priority setting exercise**

Area of Research Focus		All Regions	South & West Asia	South east Asia	The Pacific
1. Natural Resources Management					
1.1	Integrated NRM and Integrated Crop Management (ICM)/(IPM)	√			
1.2	Policy development and institutional issues related to NRM		√		
1.3	Watershed management	√			
1.4	Land management and soil fertility	√			
1.5	Rehabilitation of degraded and marginal lands		√		
2. Genetic Resources and Agrobiodiversity Conservation					
2.1	PGR conservation and improvement	√			
2.2	Livestock selection and improvement (includes fisheries)				√
2.3	Microbial functional agrobiodiversity		√	√	
2.4	Bio safety issues/policy/GMOs/IPRs			√	
3. Commodity Chain Development (linking farmers to markets)					
3.1	Commercialisation, marketing and trade	√			
3.2	Policy—international agreements	√			
3.3	Input/supply and demand analysis (industry and macro level)				√
3.4	Production and marketing economic analysis (firm/farm and micro level)	√			
3.5	Value adding	√			
3.6	Competitiveness	√			
3.7	Product/quality improvement and standards	√			
3.8	Quarantine and bio safety			√	√
4. Meeting the Protein Demand of a Growing Population (Animal)					
4.1	Feed resources: fish, poultry, ruminants and non ruminants (forage, pasture, fodder, grain, constituted feedstock and crop residues)	√			
4.2	Disease management (poultry, ruminants, non ruminants, aquaculture)		√		√
4.3	Production systems (crop/livestock, aquaculture, mariculture)	√			
4.4	Waste management and by product utilization				√
5. Meeting the Protein Demand of a Growing Population (Plants)					
5.1	Grain legume productivity improvement		√		√
5.2	Legumes in farming systems	√			
5.3	Quality and nutrition improvement (human)			√	√

**Annex 1. Synthesized research priorities for the Asia Region and its three sub-regions:
2001 priority setting exercise (Continued)**

Area of Research Focus		All Regions	South & West Asia	South east Asia	The Pacific
5.4	Food safety: aflatoxins and anti nutrition factors				√
6. Tree and Forest Management for Landholders					
6.1	Natural forest management				√
❖	Harvesting regime and regeneration				√
❖	Cutting cycle analysis				√
6.2	Forest plantation, productivity and health				√
6.3	Agro forestry in production systems				√
7. Cross Cutting Issue: Information Management for Agriculture Development					
7.1	Packaging, access and use: research, methodologies and modalities	√			
8. Cross Cutting Issue: Capacity Building					
8.1	Human Resources Development	√			
❖	Research management, stakeholder management	√			
❖	Technology transfer facilitation	√			
8.2	Institutional development	√			
8.3	Research policy development	√			
❖	Food insecurity and poverty mapping		√	√	

Annex 2. Details of sub-regional workshops on research needs assessment and agricultural priorities

Details	Sub-regions		
	South and West Asia	Southeast Asia	The Pacific
Workshop dates	7-8 October 2004	27-28 October 2005	3-6 October 2005
Location	ICRISAT, India	IRRI, Philippines	SPC, New Caledonia
Host Organisation	ICRISAT	IRRI	IAC, New Caledonia
Countries participated	5	8	7
	India	Cambodia	Fiji
	Sri Lanka	Indonesia	French Polynesia
	Bangladesh	Laos	New Caledonia
	Nepal	Myanmar	Papua New Guinea
	Iran	The Philippines	Kiribati
		Singapore	Vanuatu
		Thailand	Samoa
		Vietnam	
International and Regional Organisations	AVRDC CIP	AVRDC ICRAF	SPC POPACA
	IFPRI	IFPRI	
	ICIMOD	ISNAR	
	ILRI	ILRI	
	IPGRI	IPGRI	
	IRRI	IRRI	
	IWMI	FAO	
	ACIAR	ACIAR	
	ICRSAT	SEARCA	
	APAARI	APAARI	APAARI
	DFID		
Universities	Agri. Universities		
	Research Institutions		
Farmer Associations	Farmer Organisations		
NGOs/Private Sector	NGOs	ANGOC	
	Private Sector	Biotechnology Coalition – Philippines	
		ICDAI	
		SECURA International Corporation	
		Angat-Laguna	

**Annex 3. Base synthesis of agricultural research needs and priorities for the Asia-Pacific region: 2004- 05
priority setting exercise**

Research Themes and Sub Themes	Research Areas		All Sub Regions	South and West Asia	South-east Asia	The Pacific
1. Natural Resources Management						
1.1 Land, Soil, Climate and Water Management	1	Developing viable options for shifting cultivation			✓	
		Avoiding seawater ingress, water pollution and coral reef destruction in coastal agro-ecosystems		✓		
	3	Water quantity and quality issues in irrigated ecosystems		✓		
	4	Land restoration in degraded areas, especially affected by mining				✓
	5	Maintaining soil health and soil fertility in coastal agro-ecosystems	✓			
	6	Management of soil degradation in irrigated ecosystems		✓		
	7	Improvement of soil health and fertility in rained/arid ecosystems		✓		
1.2 Integrated Watershed Management	8	Watershed management in catchment areas	✓			
	9	Rainwater harvesting and management of ground water in coastal agro-ecosystems		✓		
	10	Assessment of watershed as functional unit in hills and mountains		✓		
	11	Harvesting of surface runoff on a watershed basis in rainfed/arid ecosystems		✓		
1.3 Integrated Management	12	Integrated NRM, PM, CM and agro-ecology, including policy issues	✓			
	13	Atoll resources management				✓
2. Genetic Resources and Biodiversity						
	14	Germplasm collection, conservation and use of crop biodiversity	✓			
	15	Enhancing and augmentation of germplasm through genetic improvement, identifying new sources of resistance and creation of new parental lines	✓			
	16	Enhance and sustain the use of forest biodiversity	✓			
	17	Biodiversity of natural systems including microbial	✓			
	18	Enhance and sustain the conservation and use of animal biodiversity			✓	
	19	Manage and sustain fisheries genetic resources				✓

**Annex 3. Base synthesis of agricultural research needs and priorities for the Asia-Pacific region: 2004- 05
priority setting exercise (Continued)**

Research Themes and Sub Themes	Research Areas		All Sub Regions	South and West Asia	South-east Asia	The Pacific
3. Biotechnology						
	20	Identifying new sources of resistance to biotic and a-biotic stresses for individual species/systems through biotechnology	✓			
	21	Biotechnology research in crops, animals and fisheries	✓			
	22	Construction of new genes in crops		✓	✓	
	23	New diagnostic tools and vaccines for animal diseases		✓	✓	
	24	Livestock genetic improvement		✓		✓
4. Enterprise Improvement						
4.1 Systems Improvement	25	Coconut based cropping system in coastal agro-ecosystems	✓			
	26	Integrated crop production technologies	✓			
	27	Intensification of crop production systems		✓		
	28	Integrated crop and livestock systems		✓	✓	
	29	Agricultural systems for drought-prone areas		✓		
	30	Agro-forestry and community forestry systems	✓			
	31	Diversification (on-farm and off-farm) activities in all ecosystems		✓	✓	
	32	Improvement and management of aquaculture systems		✓		✓
	33	Fisheries enterprise and mangroves in coastal agro-ecosystems	✓			
	34	Up-scaling the use of integrated pest, disease and crop management	✓			
	35	Improving small farm viability	✓			
	36	Livestock feed formulation and feeding systems		✓		✓
	37	Zoonoses - monitoring, surveillance and management				✓
4.2 Commodity Improvement	38	Improvement of high value, low volume and low weight locally produced (horticultural, food and medicinal plants) and commodity value chains in hills/mountains	✓			
	39	Improvement (breeding) of commercially important and under-utilised crops		✓		
	40	Crop management and organic production system				✓
	41	Resistant varieties for extreme environments		✓		

**Annex 3. Base synthesis of agricultural research needs and priorities for the Asia-Pacific region: 2004- 05
priority setting exercise (Continued)**

Research Themes and Sub Themes	Research Areas		All Sub Regions	South and West Asia	South-east Asia	The Pacific
5. Post-Harvest, Value Adding and Food Safety						
	42	Value adding, profitability, food safety and quality through processing and other means to agriculture, fisheries and forest products	✓			
6. Policy and Institutions						
6.1 Policy issues	43	Food safety, food quality, GMOs, biotechnology, market changes		✓	✓	
	44	Post-harvest value addition and processing	✓			
	45	Food procurement / pricing in irrigated ecosystems		✓	✓	
	46	Input price distortions in rainfed/arid ecosystems		✓		
	47	Processing, cold chain, anchorage and landing facilities in coastal agro-ecosystems		✓	✓	
	48	Participatory irrigation management in irrigated ecosystems		✓	✓	
	49	Credit support to fishermen in coastal agro-ecosystems		✓		
	50	Review, change, and validate policies in hills and mountains		✓		
	51	Emerging R&D issues for disaster induced agriculture, fisheries and forestry		✓	✓	
	52	Extension systems and research-extension interface in coastal agro-ecosystems	✓			
	53	Alternative livelihood opportunities and safety net mechanisms in rainfed/arid ecosystems		✓		
6.2 Institutional reform	54	Institutional development and change management		✓	✓	
	55	Identification of institutions and programmes in hills and mountains		✓		
	56	Sustainable financing mechanisms	✓			
	57	Recognition and harnessing of traditional knowledge and practice	✓			
	58	Increasing outreach of financial services in rural areas	✓			
	59	Collective action in rainfed/arid ecosystems	✓			
	60	Suitable public-private partnerships in rainfed/arid ecosystems	✓			

**Annex 3. Base synthesis of agricultural research needs and priorities for the Asia-Pacific region: 2004- 05
priority setting exercise (Continued)**

Research Themes and Sub Themes	Research Areas		All Sub Regions	South and West Asia	South-east Asia	The Pacific
7. Cross-cutting						
7.1 Research Issue	61	Monitoring and socio-economics impact assessment of technology transfer/adoption	✓			
	62	Development of new research tools (biotechnology and genomics)	✓			
	63	Farm tools and selective agricultural mechanisation		✓		✓
	64	Biotechnology research in crops, animals and fisheries		✓	✓	
	65	Identifying and mapping of poverty areas	✓			
	66	Markets, marketing systems and enterprise development in both domestic and international markets	✓			
	67	Research with better and stronger impact in and on systems	✓			
	68	Poverty reduction studies and strategies	✓			
	69	Land reforms	✓			
	70	Research investment	✓			
	71	Voices of the poor	✓			
	72	Research with better and stronger impact in and on systems	✓			
7.2 Capacity Development	73	Pest and disease surveillance, monitoring and border control				✓
	74	Supply chain analysis (improving market access)			✓	
	75	Addressing R&D issues of rural women and ethnic groups		✓	✓	
	76	Interdisciplinary, multi-sectoral and participatory R&D activities		✓	✓	
	77	Monitoring, evaluation and impact assessment		✓	✓	
	78	Building the organization and management capacity of NARS	✓			
	79	Building capacity in trade, outlook, market intelligence and IPR issues	✓			
	80	Enhancing community-based knowledge management capacity			✓	
	81	Entrepreneurial development of farmers and fisherfolk			✓	
7.3 Information, Communication and Technology Transfer	82	Information, communication technology, knowledge management and exchange	✓			
	83	Development of new information and communication tools/techniques	✓			
7.4 Allied areas	84	Participation of people in linking NRM with enterprise improvement	✓			
	85	Tourism and mountain handicrafts in hills and mountains	✓			

