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23-26 July 2002

International Rice Commission

Twentieth Session

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REPORT OF THE

INTERNATIONAL RICE COMMISSION

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TWENTIETH SESSION OF THE INTERNATIONAL RICE COMMISSION

Bangkok, Thailand, 23-26 July 2002

SUMMARY OF RECOMMENDATIONS MADE BY THE COMMISSION

Status of the World Rice Market in 2002

1. Rice production should continue to expand as the current consumption, which exceeds production, is not sustainable and may, before long, lead to surging world prices.

2. Rice-producing Member Countries should adopt policies with the least distorting effects on the world market.

3. Support to producers should be provided preferably by facilitating the transfer of technologies.

Biotechnology for rice breeding: progress and impact

4. FAO should increase capacity building in biotechnology, relevant to rice improvement, in developing countries and provide assistance in preparing bio-safety regulations.

Nutritional contribution of rice and impact of biotechnology and biodiversity in rice-consuming countries

5. Existing biodiversity of rice varieties and their nutritional composition needs to be explored before engaging in transgenics.

6. Nutrient content needs to be among the criteria in cultivar promotion.

7. Cultivar-specific nutrient analysis and data dissemination should be systematically undertaken.

Conservation and use of rice germplasm: an evolving paradigm under the international treaty of plant genetic resources for food and agriculture

8. Member Countries (if they have not already done so) should ratify, in the near future, the International Treaty on Plant Genetic Resources for Food and Agriculture.

9. Member Countries should provide full support to the funding of the Global Conservation Trust and ensure effective conservation and exchange of the International and National Plant Genetic Resources for Food and Agriculture.

10. FAO, in concert with National Programmes and relevant IARCs, should facilitate the assessment of plant breeding capacities in support of the Treaty and the Global Plan of Action on Plant Genetic Resources.

Genetic diversity in rice production: its past contribution and the potential of utilization for sustainable rice production

11. Genetic variability in released varieties should be increased and calls for greater use of existing genetic variability for diversified varietal/hybrid development.

12. Public investment for respective NARS and contribution to institutions dealing with rice should be intensified.

13. Solid partnerships should be encouraged to resolve issues related to easy access to genetic resources and patent protection.

The second generation of hybrid rice in China

14. FAO should organize training courses on breeding of super hybrid rice (e.g. second generation hybrid rice) which can outyield the existing rice hybrids by 15-20 percent.

15. Member Countries should strongly support and promote the development of super hybrid rice.

Progress and issues in development and use of hybrid rice in the tropics

16. IRRI and NARS should intensify their research efforts to develop hybrid varieties with acceptable grain quality using parental lines possessing higher out-crossing rates and thus resulting in higher seed yields.

17. NARS should identify improved management packages to maximize yield expression of hybrids.

18. Member Countries should consistently provide well-defined policies and a strong financial commitment for research in seed production and extension of hybrid rice while ensuring the effective coordination of the same.

19. IRRI, FAO, APSA and China should continue to work together to support NARS' efforts in technology generation, seed production and technology transfer for the development and use of hybrid rice.

Quality seed production in hybrid rice

20. Member Countries should encourage the private sector to be increasingly involved in F1 seed production.

21. For rapid and large-scale adoption of hybrid rice, the cost of hybrid-seed production should be reduced by increasing seed yield with CMS lines, which

have a high out-crossing rate, and by using less GA3 through combined use with alternates such as urea and other agro-chemicals.

The development and use of Integrated Crop Management for rice production

22. FAO and Member Countries should promote and develop RICM efforts through Farmers' Field Schools, following the effective approach, such as ***Ricecheck*** methods, to narrow the yield gap and enhance food security and economic wellbeing, based on the concepts of Rice Integrated Crop Management systems.

23. FAO and Member Countries should formulate policies to encourage incentives and support for the development and transfer of RICM.

Options for effective rice water management

24. The linkages between field, system and basin levels should be properly incorporated in the management of irrigation systems and adapt to the changing service needs of farmers.

25. Greater attention should be given to the design and operation of irrigation and drainage systems through a comprehensive re-training of irrigation experts.

26. Reforms should be implemented to promote a service orientation in the irrigation sector and allow an effective participation of farmers in the decision making on system performance and service objectives.

Economic and environmental impact of improved nitrogen management in Asian rice-farming systems

27. Current yield gaps should be bridged, through improved crop and nutrient management in favourable conditions, and liberating marginal lands, prone to degradation and environmental risks from cultivation, should receive greater attention in national action plans.

28. Country-wise and ecoregion-specific analysis of N use levels and N use efficiency should be evaluated to promote optimum management of N.

29. To facilitate deep placement of urea N, a simple and inexpensive applicator should be made available to farmers.

30. A firm commitment and provision of resources from all stakeholders (governments, the fertilizer sector, NGOs and international agencies) in transferring sound N management technologies, along with integrated crop management practices, through a bottom-up farmers' participatory approach, should be made to attain food security, maximize farmers' income and reduce environmental pollution on rice-based farming systems in Asia.

The need for improved weed management in rice

31. Policy makers need to pay more attention to the problems posed by weeds in rice as an important constraint affecting rice productivity. Support to weed research programmes and farmers' training on improved weed management in rice is required for further improvement of rice production.

32. Weed management in rice can only improve if farmers take into consideration the ecology of major weeds and interaction with rice. Elements of weed ecology (weed seed bank, behaviour of prevailing weeds, critical periods of weed competition and others) should be an essential part of the IPM curriculum in Farmers' Field Schools.

33. The potential risk of transfer of resistant trait from transgenic herbicide resistant rice to weedy rice has been recognised and farmers should be made aware of such a phenomenon.

Global integrated production and pest management development

34. Member Countries should support "resource-poor" research such as biological nitrogen fixation and other soil fertility management issues, locally produced pest management products and post-harvest processing.

35. Member Countries should support large-scale adult education programmes using mechanisms such as self-financed food security Field Schools that cover pre-planting to post-harvest topics, processing, marketing, savings and credit methods and other community-based programmes.

Recent initiatives on the availability and use of aquatic organisms in rice-based farming

36. Member Countries should promote sustainable development of aquatic biodiversity in rice-based ecosystems and policy decisions. Management measures should enhance the living aquatic resource base. In areas where wild fish are depleted, rice-fish farming should be considered as a means of enhancing food security and securing sustainable rural development.

37. Attention should be given to the nutritional contribution of aquatic organisms in the diet of rural people who produce or depend on rice.

An overview of rice post-harvest technology: use of small metallic silos for minimizing losses

38. Suitable technologies, such as a small metallic silos, should be widely promoted for reducing post-harvest losses.

39. Resources and policies should be adequate to promote appropriate rice drying, particularly in humid and tropical areas.

40. Member Countries should give priority to rice-processing technologies in order to add value and thereby increase income generation.

Challenges, innovation and change towards rice-based food security in Sub-Saharan Africa

41. WARDA should continue its commitment towards the development of NERICAs and related technologies, including the use of cheap phosphate and legumes in rotation with NERICAs. This will be accomplished through the support of the recently established African Rice Initiative (ARI).

42. WARDA should continue to develop and fine-tune the extension-led PVS (participatory variety selection) to expand the outcome of the research-led PVS to the national extension services, NGOs and large number of farmers. In addition a participatory plant breeding (PPB) approach will be developed to involve farmers during the early stages of WARDA's breeding programme to better respond to site-specific problems.

43. WARDA should continue its breeding efforts to develop high-yielding, short-duration cultivars with resistance to major African stresses, principally RYMV and AfRGM.

44. WARDA should continue to focus its attention on the lowland rice ecology with high potential for intensification and diversification. WARDA will continue its efforts on improved water control taking into account the major driving forces such as population pressure and market forces.

45. WARDA should continue to develop and extrapolate Integrated Rice Management (IRM) practices with special attention to adaptation to low and medium input lowland ecologies, including more efficient use of available resources, conservation of bio-diversity and keeping dependencies on external systems to a reasonable minimum.

46. WARDA should continue to develop and fine-tune a participatory learning and action research (PLAR) approach for IRM. PLAR is a social learning process that will lead to the development of a curriculum for farmer learning and facilitation of farmer learning.

47. WARDA should continue to assist in the set up and development of farmer networks and stakeholder platforms, including research on human and social capital development.

Rice development strategies for food security in Africa

48. Member Countries should foster alliances and dialogues among diverse stakeholders for shaping policy decisions and action plans with a shared

vision.

49. Member Countries should promote, *inter alia*, farmer-participatory research and extension, focusing especially on high-potential hydromorphics and inland swamps in order to address low yields and improve national food security. Sustainable and diverse systems such as rice-fish, rice-fish-vegetable, rice-legume, rice-vegetable and no-till rice rotation systems should be emphasized.

50. As upland rice will remain important for food security for some time, improved technologies such as the use of NERICA varieties and cropping systems that enhance soil fertility, such as rotations and associations with food legume and leguminous cover crops, should be promoted by Member Countries.

51. Member Countries should give special attention to promoting home and especially community-level post-harvest enterprises by facilitating training and access to threshers, mini-mills, silos, baggers, etc.; emphasizing opportunities to improve the roles and productivity of women in post-harvest activities is of great importance.

52. Member Countries should promote, when possible, community-based seed production of improved varieties and facilitate the effective marketing and distribution of seed with quality assurance processes and regulations. Women's groups should be fostered and supported to participate effectively in such initiatives.

53. Member Countries should promote establishment of farmer organization and facilitate their diverse programmes through mechanisms for joint planning, information exchange and self-funding.

54. FAO should promote the exchange of information through its diverse normative activities and facilitate technology exchanges within the region and from outside the region.

55. WARDA and FAO should jointly promote NERICA and other improved varieties throughout Africa.

56. The IRC should expand its role in sensitizing bilateral and multi-lateral donors to support land and water development programmes in African Member Countries.

New rice technologies and challenges for food security in Asia and the Pacific

57. Research and development of rice technologies should take into consideration the development stage of national economies.

58. Initiatives such as improved quality, organic agriculture and genetically modified rice should be supported within these various development contexts.

59. FAO should coordinate a study on social acceptability of genetically modified rice in Member Countries.

60. FAO should urge Member Countries to strengthen infrastructure for biotechnology research in rice in the public sector and integrate upstream biotechnology research with downstream research on breeding of improved varieties.

Strategies to sustain and enhance Asia-Pacific rice production

61. Integrated crop management for the rice crop and the farming system should be used to maintain and build on the gains in yields made to date and by expanding IPM programmes, yield gap bridging and use of farmer participatory methodology, such as the ***Ricecheck*** system.

62. Conventional breeding, including biotechnological techniques, should be used to increase rice yield potential and improve grain quality.

63. Water use efficiency, sound soil and nutrient management practices, and other practices that can reduce greenhouse gas emissions, should be encouraged to minimize the impact of rice farming practices on the environment.

64. Appropriate funding should be provided to support the three above-mentioned strategies to achieve their goals.

Strategy for sustainable rice production in Latin American and the Caribbean

65. The yield gap is apparent in all irrigated rice production areas, and bridging the yield gap represents the most immediate opportunity for increasing rice production in the LAC. Priority, therefore, should be given to the development of human capacity and expertise on the development and transfer of Rice Integrated Crop Management for improving productivity, reducing costs and minimizing environmental pollution.

66. Support should be given to the development of self-taxation systems among producers and processors to generate funds for rice research and technology transfer, especially on RICM.

67. Resources should be pooled among countries for the generation of improved genetic materials and assistance in crop management; especially via FLAR (Latin America Fund for Irrigated Rice).

68. Rice should be classified as a sensitive commodity.

Recommendations presented by Member Countries of the Near East

69. The International Rice Commission, FAO and other institutions should provide support to the building/training of manpower and expertise in the

fields of hybrid rice production and integrated crop management through the following activities:

a) Provide continued support to the building/training of manpower and expertise on hybrid rice production technology and rice integrated crop management system whereby Egypt takes the lead institution in these technical areas.
b) Organize an Expert Consultation in the year 2003 on the transfer of hybrid rice technology and the rice integrated crop management system for food security in the Near Eastern countries.

70. Member Countries should promote variety improvement, industrial rice processing for rice grain quality, rice milling and eating/nutritional quality to improve rice trade and marketing in the world.

Other Matters

71. The Commission confirmed its support to the efforts of Member Countries and FAO with a view to having the United Nations declare the Year 2004 as the International Year of Rice.

1. INTRODUCTION

The Twentieth Session of the International Rice Commission was convened at the United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP) in Bangkok, Thailand, from 23 to 26 July 2002. The Meeting was jointly organized by the Ministry of Agriculture and Cooperatives of Thailand and FAO.

The Session was attended by 58 delegates from 27 Member Countries of the Commission, 5 observers from 2 FAO Member Countries, and 28 participants from UN international and regional organizations.

The list of Members of the Commission (Appendix A) and the list of delegates and observers (Appendix B) are attached hereto.

2. WELCOME ADDRESS AND FAO STATEMENT

The welcome address was delivered by Mr. Pramoj Raksarart, Deputy Permanent Secretary, Ministry of Agriculture and Cooperatives of Thailand.

FAO's Statement was delivered by Mr. R. B. Singh, Assistant Director-General of the Regional Office for Asia and the Pacific, on behalf of the Director-General of FAO.

Thailand's welcome address and FAO's Statement (Appendixes C and D) are attached hereto.

3. ADOPTION OF THE AGENDA

The Provisional Agenda (Appendix E) is attached hereto.

4. ELECTION OF THE CHAIRPERSON AND VICE-CHAIRPERSON

The Commission elected Mr. Pramoj Raksarart, Deputy Permanent Secretary, Ministry of Agriculture and Cooperatives of Thailand as the Chairperson of the Commission; Mr. Nelson Larrea Lora from Peru as the First Vice-Chairperson; and Mr. Mamadou Lo from Senegal as the Second Vice-Chairperson.

5. KEYNOTE ADDRESS AND THE IRC EXECUTIVE SECRETARY'S REPORT

The Keynote Address was given by Mr. Mahmoud Solh, the Chairperson of the IRC Steering Committee and Director of the Plant Production and Protection Division, FAO (Appendix F).

The Report on the implementation of the Commission's 19th Session recommendations was presented by Mr. Dat Van Tran, IRC Executive Secretary. (Appendix G).

6. RICE IN THE WORLD'S TRADE

6.1. Status of the world rice market in 2002

The Commission noted (Document IRC:02/7E) the following:

After a two-year decline, the 2002 global rice production, which is expected to reach an equivalent of 598 million tonnes of paddy, is on the rise. The international rice trade forecast is 25 million tonnes in 2002; if achieved, this would be the second highest level on record. This figure reflects significant imports by Indonesia and, to a smaller extent, China. Although global consumption has exceeded production over the last years, prices in 2001 are the lowest in a decade.

Despite the opening of a large preferential tariff quota, following its accession to WTO, China's imports in 2002 are forecasted to remain relatively small. Other major policy developments in 2002 include the passing of a new US Farm Bill, a proposed reform of the Common Agricultural Policy of the European Union, and the Thailand's initiative for a common export strategy to support prices.

The Commission recommended the following:

6.1.1. Rice production should continue to expand as the current consumption, which exceeds production, is not sustainable and may, before long, lead to surging world prices.

6.1.2. Rice-producing Member Countries should adopt policies with the least distorting effects on the world market.

6.1.3. Support to producers should be provided preferably by facilitating the transfer of technologies.

7. PROGRESS IN RICE GENETIC IMPROVEMENT FOR FOOD SECURITY

7.1. Biotechnology for rice breeding: progress and impact

The Commission noted (Document IRC:02/8E) the following:

Determining factors, such as increasing yield potential and productivity by overcoming biotic and abiotic stresses, improving grain quality and increasing the efficiency of new breeding and development technologies, continue to be significant challenges.

In fact, many biotechnological techniques are being used to develop improved varieties, with greater resistance to a range of biotic and abiotic stresses, superior grain quality and water use efficiency. The integration of biotechnological tools with conventional breeding methods offers new opportunities to increase productivity and sustainability, achieve food security and improve the nutritional quality of rice.

The Commission recommended the following:

7.1.1 FAO should increase capacity building in biotechnology, relevant to rice improvement, in developing countries and provide assistance in preparing bio-safety regulations.

7.2. Nutritional contribution of rice and impact of biotechnology and biodiversity in rice-consuming countries

The Commission noted (Document IRC:02/10E) the following:

Rice provides 27 percent of the dietary energy requirements, 20 percent of dietary protein and 3 percent of dietary fat in 33 developing countries. It also supplies significant amounts of thiamin, riboflavin, niacin and zinc to diets. This contribution can be enhanced by a combination of agronomic practices, traditional breeding and genetic modification, fortification and education on nutrition.

The Commission recommended the following:

7.2.1 Existing biodiversity of rice varieties and their nutritional composition needs to be explored before engaging in transgenics.
7.2.2. Nutrient content needs to be among the criteria in cultivar promotion.
7.2.3. Cultivar-specific nutrient analysis and data dissemination should be systematically undertaken.

7.3. Conservation and use of rice germplasm: an evolving paradigm under the international treaty of plant genetic resources for food and agriculture

The Commission noted (Document IRC:02/11E) the following:

Rice germplasm is stored in a wide range of national and international collections, including the International Rice Genebank Collection at IRRI. This diverse germplasm is of great importance for future increases in productivity. There are a number of constraints to the free and open access of this material, such as the legislation on intellectual property rights. However, the International Network for Genetic Evaluation of Rice (INGER) is benefiting national programmes in the sharing of improved germplasm.

The International Treaty on Plant Genetic Resources for Food and Agriculture can overcome some of the constraints relating to access and exchange and facilitate the

process of dissemination. There is a great need for international cooperation to support the objectives of the Global Plan of Action.

The Commission recommended the following:

7.3.1. Member Countries (if they have not already done so) should ratify, in the near future, the International Treaty on Plant Genetic Resources for Food and Agriculture.
7.3.2. Member Countries should provide full support to the funding of the Global Conservation Trust and ensure effective conservation and exchange of the International and National Plant Genetic Resources for Food and Agriculture.
7.3.3. FAO, in concert with National Programmes and relevant IARCs, should facilitate the assessment of plant breeding capacities in support of the Treaty and the Global Plan of Action on Plant Genetic Resources.

7.4. Genetic diversity in rice production: its past contribution and the potential of utilization for sustainable rice production

The Commission noted (Document IRC:02/12E) the following:

Over four decades of rice breeding - during which yield potential and productivity have increased - has eroded the genetic diversity of rice varieties. A review of accessions in gene banks, and those used in commercial varieties, has indicated that the potential of the genetic diversity has not been adequately utilized, particularly in some national breeding programmes. To optimize this potential, the latest biotechnological methods can be employed in conjunction with conventional rice breeding programmes.

The Commission recommended the following:

7.4.1 Genetic variability in released varieties should be increased and calls for greater use of existing genetic variability for diversified varietal/hybrid development.
7.4.2 Public investment for respective NARS and contribution to institutions dealing with rice should be intensified.
7.4.3 Solid partnerships should be encouraged to resolve issues related to easy access to genetic resources and patent protection.

7.5. The second generation of hybrid rice in China

The Commission noted (Document IRC:02/13E) the following:

Yields of three-line varieties have plateauxed and the "WA" type of CMS is vulnerable to biotic and abiotic stresses. In efforts to further exploit heterosis and strengthen yield potential in rice, the two-line method (PGMS and TGMS systems) - using inter-specific (indica/japonica) hybrids - is being developed.

Advanced large-scale evaluation of two-line interspecific hybrids has shown that these super hybrids can outyield the best three-line and inter-varietal hybrids by about 20 percent. A pioneer line, P64S/9311, averaged above 10.5 t/ha in large-scale evaluations, and over 9 t/ha over 1.44 million ha in 2000 and 2001 seasons. The current programme is developing second-phase super hybrids to yield over 12 t/ha commercially, which is 15 percent above the pioneer super hybrids. Second-phase super hybrids should be a reality by 2005.

In the future, the one-line method or apomixis system and distant hybrids (with genes from other species or genera) offer further increases in yield potential.

The Commission recommended the following:

7.5.1 FAO should organize training courses on breeding of super hybrid rice (e.g. second generation hybrid rice) which can outyield the existing rice hybrids by 15-20 percent.

7.5.2 Member Countries should strongly support and promote the development of super hybrid rice.

7.6. Progress and issues in development and use of hybrid rice in the tropics

The Commission noted (Document IRC:02/14E) the following:

IRRI has dedicated itself to hybrid rice since 1979. Efforts to increase cytoplasmic diversity in CMS three-line hybrids continues. Two new TGMS system lines for producing two-line hybrids have shown stable pollen sterility. Seed production technology for hybrids is being developed by public and private enterprises to improve efficiency and to evaluate purity.

The IRRI-AsBD hybrid rice project in collaboration with FAO, Asia Pacific Seed Association and China has had a significant impact in developing hybrid technology in Bangladesh, India, Indonesia, the Philippines, Sri Lanka and Viet Nam, and has been extended to 2004. Since 1998, hybrid rice has been commercialized in Bangladesh, India Indonesia, the Philippines and Viet Nam. In 2001 about 700 000 ha of hybrid rice have been planted outside China.

The Commission recommended the following:

7.6.1 IRRI and AsDB should intensify their research efforts to develop hybrid varieties with acceptable grain quality using parental lines possessing higher out-crossing rates and thus resulting in higher seed yields.

7.6.2 NARS should identify improved management packages to maximize yield expression of hybrids.

7.6.3 Member Countries should consistently provide well-defined policies and a strong financial commitment for research in seed production and extension of hybrid rice while ensuring the effective coordination of the same.

7.6.4 IRRI, FAO, APSA and China should continue to work together to support NARS' efforts in technology generation, seed production and technology transfer for the development and use of hybrid rice.

7.7. Quality seed production in hybrid rice

The Commission noted (Document IRC:02/15E) the following:

The production of quality seed, at an economical price, is an important issue in the successful development of hybrid rice. In hybrid seed production, particular attention needs to be given to methods used for nursery sowing, transplanting, ratio of female and male parents, flowering synchronization, GA3 application, supplementary pollination and roguing techniques.

The Commission recommended the following:

7.7.1 Member Countries should encourage the private sector to be increasingly involved in F1 seed production.

7.7.2 For rapid and large-scale adoption of hybrid rice, the cost of hybrid-seed production should be reduced by increasing seed yield with CMS lines, which have a high out-crossing rate, and by using less GA3 through combined use with alternates such as urea and other agro-chemicals.

8. PROGRESS IN INTEGRATED MANAGEMENT FOR SUSTAINABLE RICE PRODUCTION

8.1. The development and use of Integrated Crop Management for rice production

The Commission noted (Document 02/16E) the following:

Narrowing yield gap, to meet the needs of the global community, can contribute significantly to further increase rice production. The Rice Integrated Crop Management (RICM) has been instrumental in optimizing management practices and technology, with regard to yield increase and better grain quality while protecting the environment.

RICM has become increasingly popular in many countries. The Australian ***Ricecheck*** technology transfer programme is one of the most successful examples. The integrated ***Ricecheck*** addresses key management factors based on Best Management Practices (BMPs) which derive from farmers' experience and research. This programme provides both input recommendations (what farmers needs to do – the practices) and output recommendations (what the farmer is trying to achieve – the results). It is the combined

affects of outputs such as plant stand, pest control, and nitrogen response that determine the outcome in final yield, grain quality and environment. ***Ricecheck*** uses the output targets as benchmarks against farmers' management performance, crop growth and yield for comparison and evaluation. In this way strengths and weaknesses can be identified and improved in the following crop. In Australia, farmer discussion groups are encouraged to provide a forum that facilitates farmer participation in a collaborative learning environment.

The Commission recommended the following:

8.1.1 Promote and develop RICM efforts through Farmers' Field Schools, following the effective approach, such as ***Ricecheck*** methods, to narrow the yield gap and enhance food security and economic wellbeing, based on the concepts of Rice Integrated Crop Management systems.

8.1.2 FAO and member countries should formulate policies to encourage incentives and support for the development and transfer of RICM.

8.2. Options for effective rice water management

The Commission noted (Document IRC:02/17E) the following:

Effective water management strategies and activities must be based on the hydro-ecological conditions of the environment in which rice is produced. Water management must be reviewed at the field, system and basin levels. The effects of supply and demand management, as well as the impact on the environment, should be considered.

Integrated rice water management must be seen in the broader basin-wide context, in conjunction with thorough assessment and planning processes. Decision making on water allocation must be made on economic, technical, social and legal grounds and should consider the needs of the non-rice sectors as well. Water use and productivity indicators should be used as a means of assessing effectiveness. The socio-economic context of rice-producing communities, together with their technical and managerial capacities, should also be taken into consideration.

The Commission recommended the following:

8.2.1 The linkages between field, system and basin levels should be properly incorporated in the management of irrigation systems and adapt to the changing service needs of farmers.

8.2.2 Greater attention should be given to the design and operation of irrigation and drainage systems through a comprehensive re-training of irrigation experts.

8.2.3 Reforms should be implemented to promote a service orientation in the irrigation sector and allow an effective participation of farmers in the decision making on system performance and service objectives.

8.3. Economic and environmental impact of improved nitrogen management in Asian rice-farming systems

The Commission noted (IRC:02/18E) the following:

The projected rice demand/production of 694 million tonnes by 2030 lies well within the production potential of Asian countries.

An increased use of plant nutrients, to support yield and production targets, is imperative. However, from economic and environmental considerations, the current nutrient use efficiency, especially that of nitrogen (N) is very low (35 percent, i.e. 9.6 million tonnes of N with a value of about US$ 3 000 million lost to the environment). Well-tested technologies, such as the use of N responsive varieties, optimum plant population, more number of split applications based on N colour charts and/or deep placement of super granules, optimum combination of organic and inorganic sources along with an integrated soil, crop and water management, can easily improve N efficiency from an average of 35 to 50 percent.

The Commission recommended the following:

8.3.1 Current yield gaps should be bridged, through improved crop and nutrient management in favourable conditions, and liberating marginal lands, prone to degradation and environmental risks from cultivation, should receive greater attention in national action plans.

8.3.2 Country-wise and ecoregion-specific analysis of N use levels and N use efficiency should be evaluated to promote optimum management of N.

8.3.3 To facilitate deep placement of urea N, a simple and inexpensive applicator should be made available to farmers.

8.3.4 A firm commitment and provision of resources from all stakeholders (governments, the fertilizer sector, NGOs and international agencies) in transferring sound N management technologies, along with integrated crop management practices, through a bottom-up farmers' participatory approach, should be made to attain food security, maximize farmers' income and reduce environmental pollution on rice-based farming systems in Asia.

8.4. The need for improved weed management in rice

The Commission noted (Document IRC:02/19E) the following:

Current major weed problems in rice are *Echinochloa* spp and red/weedy rice mainly in direct seeded rice and herbicide resistant weeds, particularly *Echinochloa* spp to propanil. An integrated approach to weed management (IWM) should be developed using weed ecology studies of the weed seed bank, population dynamics and biological characteristics, competitive and/or allelopathic rice cultivars, and green manure crops.

Chemical weed control should be part of IWM, but herbicide resistance in weeds should be seen as a serious potential problem. Labelling of herbicide with their mode of action would help farmers manage resistance. There are potential risks with herbicide resistant transgenic rices to possibly transferring an exotic trait to weedy rice. Weed management in rice is important and weed research and extension programmes are part of improving rice production.

The Commission recommended the following:

8.4.1 Policy makers need to pay more attention to the problems posed by weeds in rice as an important constraint affecting rice productivity. Support to weed research programmes and farmers' training on improved weed management in rice is required for further improvement of rice production.

8.4.2 Weed management in rice can only improve if farmers take into consideration the ecology of major weeds and interaction with rice. Elements of weed ecology (weed seed bank, behaviour of prevailing weeds, critical periods of weed competition and others) should be an essential part of the IPM curriculum in Farmers' Field Schools.

8.4.3 The potential risk of transfer of resistant trait of from transgenic herbicide resistant rice to weedy rice has been recognised and farmers should be made aware of such a phenomenon.

8.5. Global integrated production and pest management development

The Commission noted (Document IRC:02/20E) the following:

Ecological understanding of rice field ecosystems and large-scale educational programmes, using Farmers' Field Schools (adult group based methods), are well established in Asian and West African countries. Farmers involved in these programmes are making better use of inputs in terms of timing and value and, as a result, gaining higher yields and profits. The Farmers' Field School process, however, has had recent advances in East Africa with self-financing mechanisms using the Farmers'Field School to raise operational funds. This innovation will allow rapid and sustainable large-scale educational dissemination programmes. Rice ecosystem level interventions are now being added to the education processes to include areas such as rice-fish-vegetable methods, rice-legume or rice-vegetable diversified systems and wider management issues such as soil fertility management, water management and post-harvest handling and processing. Rice programmes should be linked to livelihood issues such as HIV/AIDS, nutritional development and community-based programmes.

The Commission recommended the following:

8.5.1 Member Countries should support "resource-poor" research such as biological nitrogen fixation and other soil fertility management issues, locally produced pest management products and post-harvest processing.

8.5.2 Member Countries should support large-scale adult education programmes using mechanisms such as self-financed food security Field Schools that cover pre-planting to post-harvest topics, processing, marketing, savings and credit methods and other community-based programmes.

8.6. Recent initiatives on the availability and use of aquatic organisms in rice-based farming

The Commission noted (Document IRC:02/21E) the following:

Studies to collect and document information on the living aquatic resources, their availability and use patterns by rice farmers have been initiated by the FAO Inland Water Resources and Aquaculture Service in Cambodia, China, Laos and Viet Nam. The aquatic biodiversity in rice was found to be rich and diverse and performs not only important ecosystem functions but also serves as the major source of protein and essential fatty acids and hence is essential for a balanced diet of rural people.

Aquatic organisms are collected from rice-based ecosystems on a daily basis in the rainy season. More than 100 aquatic species (fish, reptiles, amphibians, crustaceans, molluscs, insects and plants) were identified in farmers'own catch. However, this biodiversity is under threat from pesticide use, destruction of flooded forest habitat and illegal fishing tools. Managing resources with a more holistic view will be important. The findings of the studies have relevance for other rice growing regions of the world.

The Commission recommended the following:

8.6.1 Member Countries should promote sustainable development of aquatic biodiversity in rice-based ecosystems and policy decisions. Management measures should enhance the living aquatic resource base. In areas where wild fish are depleted, rice-fish farming should be considered as a means of enhancing food security and securing sustainable rural development.

8.6.2 Attention should be given to the nutritional contribution of aquatic organisms in the diet of rural people who produce or depend on rice.

8.7. An overview of rice post-harvest technology: use of small metallic silos for minimizing losses

The Commission noted (Document IRC:02/22E) the following:

There is a need for an efficient and effective post-harvest system, concurrent with efforts to increase production, particularly for small-and-medium-scale rice farmers. Losses occur at all stages of post-production operations, i.e. threshing, drying, cleaning and storage. Current losses in developing countries, mostly in Asia, are estimated at 14-16 percent during post-harvest operations, of which 4-6 percent is during storage.

FAO is promoting a small metallic silo for storage, which has been adopted by about 2 million farm households in Central America. The drying operation, considered a critical area of loss, also needs to be addressed.

The Commission recommended the following:

8.7.1 Suitable technologies, such as a small metallic silos, should be widely promoted for reducing post-harvest losses.
8.7.2 Resources and policies should be adequate to promote appropriate rice drying, particularly in humid and tropical areas.
8.7.3 Member Countries should give priority to rice-processing technologies in order to add value and thereby increase income generation.

9. REGIONAL STRATEGIES ON RICE PRODUCTION

9.1 Challenges, innovation and change towards rice-based food security in Sub-Saharan Africa

The Commission noted (Document IRC:02/24E) the following:

Rice demand in Sub-Saharan Africa is rapidly increasing with imports running at about 4 million tonnes per year, or about half of the consumption needs. WARDA's New Rice for Africa (NERICA) shows promise to enhance rice yields and cropping intensity. Experience in Guinea and Côte d'Ivoire demonstrates that participatory varietal selection and community-based seed production systems, combined with improved crop rotations and integrated soil fertility management, can stabilize the upland ecosystem and reduce slash-and-burn practices.

In the irrigated ecosystem, the scope for increased production by surface area expansion is limited, whilst potential exists to increase yields by narrowing the yield gap. Integrated crop management offers opportunities for yield improvement rather than single-issue focussed extension. Training of extension agents and pilot farmers will expedite rapid adoption.

The potential for area expansion in the rainfed lowland ecology is huge, where considerable capacity also exists to increase cropping intensity and yields that are currently limited by sub-optimal management and poor water control.

The Commission recommended the following:

9.1.1. WARDA should continue its commitment towards the development of NERICAs and related technologies, including the use of cheap phosphate and legumes in rotation with NERICAs. This will be accomplished through the support of the recently established African Rice Initiative (ARI).

9.1.2. WARDA should continue to develop and fine-tune the extension-led PVS (participatory variety selection) to expand the outcome of the research-led PVS to the national extension services, NGOs and large number of farmers. In addition a participatory plant breeding (PPB) approach will be developed to involve farmers during the early stages of WARDA's breeding programme to better respond to site-specific problems.

9.1.3. WARDA should continue its breeding efforts to develop high-yielding, short-duration cultivars with resistance to major African stresses, principally RYMV and AfRGM.

9.1.4. WARDA should continue to focus its attention on the lowland rice ecology with high potential for intensification and diversification. WARDA will continue its efforts on improved water control taking into account the major driving forces such as population pressure and market forces.

9.1.5. WARDA should continue to develop and extrapolate Integrated Rice Management (IRM) practices with special attention to adaptation to low and medium input lowland ecologies, including more efficient use of available resources, conservation of bio-diversity and keeping dependencies on external systems to a reasonable minimum.

9.1.6. WARDA should continue to develop and fine-tune a participatory learning and action research (PLAR) approach for IRM. PLAR is a social learning process that will lead to the development of a curriculum for farmer learning and facilitation of farmer learning.

9.1.7. WARDA should continue to assist in the set up and development of farmer networks and stakeholder platforms, including research on human and social capital development.

9.2 Rice development strategies for food security in Africa

The Commission noted (Document IRC:02/25E) the following:

Africa produces an average of 16.7 million tonnes of paddy per year (1987-1997) from 7.6 million hectares for an average yield of only 2.2 t/ha,. compared to global average of 3.4 t/ha. Low productivity results primarily from rice being grown extensively (55 percent) in low-potential rainfed-upland systems, and from sub-optimal crop management. Rice consumption is expanding rapidly currently reaching 11 million tonnes per year, of which about 34 percent is imported. West and East Africa account for 56 percent and 25 percent of the production, respectively. Of the five main agro-ecosystems, i.e. rainfed-uplands; hydromorphics (rainfed lowlands); mangrove swamp; inland swamp; and irrigated, the hydromorphics and inland swamps hold the greatest potential for increasing both productivity and production.

Strategies to address low productivity, to enhance the livelihoods of rice producers and processors, and to ensure that low-cost, high-quality rice is available for all consumers, are incorporated into the more specific recommendations below. The strategies and recommendations must embrace and be consistent with broad sustainable agriculture and rural development goals. These also assume increasing provision of improved

infrastructure such as roads, electricity, human services, and agro-services (inputs, efficient research and extension, micro-finance with savings and credit, market access, etc.), especially in areas with favourable ecologies for rice production.

The Commission recommended the following:

9.2.1 Member Countries should foster alliances and dialogues among diverse stakeholders for shaping policy decisions and action plans with a shared vision.

9.2.2 Member Countries should promote, *inter alia*, farmer-participatory research and extension, focusing especially on high-potential hydromorphics and inland swamps in order to address low yields and improve national food security. Sustainable and diverse systems such as rice-fish, rice-fish-vegetable, rice-legume, rice-vegetable and no-till rice rotation systems should be emphasized.

9.2.3 As upland rice will remain important for food security for some time, improved technologies such as the use of NERICA varieties and cropping systems that enhance soil fertility, such as rotations and associations with food legume and leguminous cover crops, should be promoted by Member Countries.

9.2.4 Member Countries should give special attention to promoting home and especially community-level post-harvest enterprises by facilitating training and access to threshers, mini-mills, silos, baggers, etc.; emphasizing opportunities to improve the roles and productivity of women in post-harvest activities is of great importance.

9.2.5 Member Countries should promote, when possible, community-based seed production of improved varieties and facilitate the effective marketing and distribution of seed with quality assurance processes and regulations. Womens' groups should be fostered and supported to participate effectively in such initiatives.

9.2.6 Member Countries should promote establishment of farmer organization and facilitate their diverse programmes through mechanisms for joint planning, information exchange and self-funding.

9.2.7 FAO should promote the exchange of information through its diverse normative activities and facilitate technology exchanges within the region and from outside the region.

9.2.8 WARDA and FAO should jointly promote NERICA and other improved varieties throughout Africa.

9.2.9 The IRC should expand its role in sensitizing bilateral and multi-lateral donors to support land and water development programmes in African Member Countries.

9.3 New rice technologies and challenges for food security in Asia and the Pacific

The Commission noted (Document IRC:02/26E) the following:

Many factors will affect the ability of Asia to sustain favourable food balances and improve food security at the beginning of the 21st century. The benefits of a full utilization of new and developing technologies, and the liberalization and globalization of

agricultural trade will be enhanced by reduction in demand as a result of progress in population control, growing urbanization, and low and declining elasticity in demand. This will be offset to some extent by a deceleration in the growth of rice production as a result of an increasing shortage in land, water and labour in the irrigated ecosystem, which may be compensated by the increased yield potential of up to 35 percent from improved plant architecture and hybrid breeding.

The distribution of food from land surplus developed countries to low income food-deficit countries may be limited, unless economic growth succeeds in generating productive employment and effective demand that in turn depends upon increasing the productivity of agriculture. The production problems of rainfed ecosystems, which account for over half the world's rice land, need to be addressed by the development of appropriate technologies.

Dramatic advances in biotechnology have increased the probability of research success in improving productivity and the nutrient quality of rice grain. Governments should develop infrastructure and regulatory framework for the evaluation, adaptation and marketing of biotechnology products, and impartially assess the benefits and risks of biotechnology.

The Commission recommended the following:

9.3.1 Research and development of rice technologies should take into consideration the development stage of national economies.

9.3.2 Initiatives such as improved quality, organic agriculture and genetically modified rice should be supported within these various development contexts.

9.3.3 FAO should coordinate a study on social acceptability of genetically modified rice in Member Countries.

9.3.4 FAO should urge Member Countries to strengthen infrastructure for biotechnology research in rice in the public sector and integrate upstream biotechnology research with downstream research on breeding of improved varieties.

9.4 Strategies to sustain and enhance Asia-Pacific rice production

The Commission noted (Document IRC:02/27E) the following:

Rice, to support three billion rice consumers, is grown on 140 million hectares or 28 percent of the region's arable land. Production on the same land area must increase by some 40 percent over the next 30 years. Crop failures during this time, particularly in a succession of years, will affect not only the food supply of Asia but also the economic stability of the world.

Strategies to increase and sustain rice productivity include: increase yields by better management; increase varietal yield and quality potentials; and minimize negative environmental impacts. These strategies will be more effective if the organizational and

institutional arrangements facilitate and encourage interaction and cooperation amongst the agencies and individuals involved.

The Commission recommended the following:

9.4.1 Integrated crop management for the rice crop and the farming system should be used to maintain and build on the gains in yields made to date and by expanding IPM programmes, yield gap bridging and use of farmer participatory methodology, such as the ***Ricecheck*** system.

9.4.2 Conventional breeding, including biotechnological techniques, should be used to increase rice yield potential and improve grain quality.

9.4.3 Water use efficiency, sound soil and nutrient management practices, and other practices that can reduce greenhouse gas emissions, should be encouraged to minimize the impact of rice farming practices on the environment.

9.4.4 Appropriate funding should be provided to support the three above-mentioned strategies to achieve their goals.

9.5 Strategy for sustainable rice production in Latin American and The Caribbean

The Commission noted (Document IRC:02/28E) the following:

Rice consumption in the Caribbean and Latin America (LAC) in 2001 exceeded 15 million tonnes (milled basis). The net deficit was nearly 1 million tonnes. Central America and the Caribbean have an annual demand of over 3 million tonnes, of which only 50 percent is produced locally. South America has an annual rice demand of 12.2 million tonnes and produces a surplus of approximately of 600 000 tonnes.

Rice production in Central America suffers from the low and unstable production in the upland ecology. In South America, the rice area has declined by 1 percent per annum over the last decade due mainly to the decline in upland rice in Brazil, whilst production has increased by nearly 3 percent per annum. Despite the use of modern varieties of high yield potential, productivity remains far below potential.

The strategy for improving rice production in the LAC focuses on better adapted high yielding varieties and Improved Crop Management practices to utilize this potential. This will require an integrated research and technology transfer, which has been largely abandoned in the LAC by the public sector. FLAR, the Latin American Irrigated Rice Fund, has been developed to assist national grower associations in this transition.

The Commission recommended the following:

9.5.1 The yield gap is apparent in all irrigated rice production areas, and bridging the yield gap represents the most immediate opportunity for increasing rice production in the LAC. Priority, therefore, should be given to the development of human capacity and expertise on the development and transfer of Rice Integrated

Crop Management for improving productivity, reducing costs and minimizing environmental pollution.

9.5.2 Support should be given to the development of self-taxation systems among producers and processors to generate funds for rice research and technology transfer, especially on RICM.

9.5.3 Resources should be pooled among countries for the generation of improved genetic materials and assistance in crop management; especially via FLAR (Latin America Fund for Irrigated Rice).

9.5.4 Rice should be classified as a sensitive commodity.

9.6 Recommendations presented by Member Countries of the Near East

The delegates from Member Countries of the Near East region, who participated at the 20th Session of the International Rice Commission (Egypt, Iran and Pakistan), acknowledged the following:

- Rice is an essential food crop in the region, i.e. Egypt, Iran, Iraq, Morocco, Pakistan and Turkey.
- Hybrid rice technology and the Rice Integrated Crop Management system are crucial to sustainable rice production and food security in the region.
- The region lacks manpower and expertise in the above-mentioned fields.
- The Egyptian rice programme on hybrid rice and rice management is the most advanced in the region..

Taking the above into consideration, Member Countries recommended the following:

9.6.1 The International Rice Commission, FAO and other institutions should provide support to the building/training of manpower and expertise in the fields of hybrid rice production and integrated crop management through the following activities:

a) Provide continued support to the building/training of manpower and expertise on hybrid rice production technology and rice integrated crop management system whereby Egypt takes the lead institution in these technical areas.

b) Organize an Expert Consultation in the year 2003 on the transfer of hybrid rice technology and the rice integrated crop management system for food security in the Near Eastern countries.

9.6.2 Member Countries should promote variety improvement, industrial rice processing for rice grain quality, rice milling and eating/nutritional quality to improve rice trade and marketing in the world.

10. COUNTRY STATEMENTS

The following Countries delivered statements related to their national rice programmes, with emphasis on issues and opportunities for rice development:

10.1 AFRICA

10.1.1 **Congo, Democratic Republic:** About 655 867 tonnes of milled rice is consumed yearly in the country and the present rice production could provide about 50 percent of this quantity. Upland rice production systems are dominant, although the country has large areas of inland swamps and riverine land that are suitable for the development of rainfed lowland and irrigated rice areas with simple and low cost technologies. The infrastructures support the rice production in many places in the country, however, they have been greatly damaged during the civil war. In the short term, national strategy to raise rice production should give priority to the improvement of water control in inland swamp and riverine rice production, which is located in the vicinity of major urban centers, where infrastructures are still in existence and serviceable. In longer terms, the strategy calls for the gradual stabilization of upland rice production systems, the continued expansion of inland swamp development for rice-based production systems and the improvement of infrastructures for input supply and marketing of products in major rice-producing zones.

10.1.2 **Côte D' Ivoire:** Rice production in the country is carried out under different systems. Considerable efforts have been made to promote the development of inland swamps and irrigated rice production, but large rice areas are still under upland systems. The "Projet National Riz" or National Rice Project has recently given priority to the transfer of NERICA rice varieties to improve the productivity and income of upland rice farmers. Intitial results appear to be promising. However, more time is required to quantify the real impact of the adoption of NERICA varieties on national rice production.

10.1.3 **Guinea:** Rice is the staple food of the population providing about 45 percent of daily food energy. Rice production systems are very diversified and dominated by upland systems, which occupied 65 percent of the harvested area. During the 1996-2000 period, rice production growth rate was about 5.9 percent per year. Regardless of the efforts of research and extension service, rice yields in the country are still low due to physical and socio-economic constraints. The Government has set the objective to double rice production by 2005 through the active transfer of improved technologies, the increase in the development of inland swamps for rice production and, the building of rural road networks and the partnership among research, extension and professional associations or groups.

10.1.4 **Egypt:** Rice is an important food crop and rice production greatly contributes to national food self-sufficiency and generates substantial incomes through export.

The rice yield in the country is the world's second highest. An appropriate government policy, a dynamic research and extension service and the full participation of farmers were the principal factors behind the significant achievement of rice production during the last 20 years. Priorities of the current rice research and development programme include the development and adoption of early maturing and high yielding varieties, through both conventional and hybrid rice breeding, and rice integrated crop management systems with the objective of saving water from rice production for sustainable economic development.

10.1.5 **Madagascar:** Rice production, the harvested area and yields in the country have been stagnant for the past five years. Although rice production in the country is dominated by lowland systems, its yield is low due to the application of low production inputs, especially fertilizers, and adequate technologies. There is an urgent need for the establishment of an appropriate policy to support the adoption of improved technologies developed by national research systems for improving the productivity of rice production in the country. The national rice intensification programme should be based on the advantages in different rice production zones with priority on zones with high potential.

10.1.6 **Mali:** Irrigated rice has become the strategic crop to the national objective of food self-sufficiency. The contribution of rice production to national food crop production has increased from 15 percent during the 1980s to 25 percent since 1997. In 1999 the national rice production was estimated to be around 600 000 tonnes; covering about 80 to 90 percent of local demand. Irrigated rice production has become a cash crop to many farmers. The irrigated rice area, at present, covers only about 18 percent of the potential irrigable land area of more than 2 million ha. The Government has formulated a national strategy that provides incentive to the investment to development, management and maintenance of irrigated schemes for rice production.

10.1.7 **Mozambique:** The national rice requirement stands at 300 000 tonnes but national production could provide only 120 000 tonnes. Before 1970 the country produced enough rice to meet the internal demand and even exported part of its rice thanks to the existence of the Rice Development Fund. The manpower and expertise in rice research and development has been drastically reduced after 20-years of civil war. Similarly the input supply, the road networks and the marketing systems have been severely damaged. The country, however, has a number of existing irrigated schemes which are located around major urban centers and large rainfed rice areas with favourable rainfall and water resources. The realistic improvement in rice production in the country, however, calls for appropriate policy and strategy that promotes gradual but steady building of manpower and expertise in rice research and development, stepwise rehabilitation of existing irrigated rice schemes with built-in credit and input supply and output marketing systems, and the development and extension of simple water control devices for rainfed rice production. The re-creation of a Rice Development Fund

is highly recommended to support these activities.

10.1.8 **Nigeria:** Regardless of progress made in rice production during the last few years, Nigeria has to import large quantities of rice to satisfy domestic demands. The potential rice land in the country is about 4.6 million hectares, of which 1.6 million hectares was cultivated in 2000. Rice yield in the country is still low due to biotic and abiotic constraints, inadequate extension services, deficiency in input supply, poor marketing systems and especially the inconsistency in policy. Recently the Federal Government of Nigeria has established a Special Rice Programme. This Programme has received a funding support from the Government of Japan for the survey of a potential production area, training of rice producers and processors and the procurement of inputs such as pesticides, machinery and seed production. Recently, the Government imposed a 100 percent import duty on rice and promoted the development of rice farmers' associations.

10.1.9 **Senegal:** The country still has to import large quantities of rice to meet local demands, regardless of governmental efforts to increase the national production. Since 1997, the Government has chosen to renew the agricultural production through the development of an annual programme aimed at consolidating and strengthening the achievements already obtained. However, the rice sector in the country still faces a number of constraints which are specific to each production zone. For rice production in the Valley of Senegal, SAED has elaborated a programme with short-to-medium term objectives of obtaining a production of 230 000 tonnes of milled rice from 60 000 ha or 45 percent of the national demand.

10.2 ASIA

10.2.1 **Bangladesh**: A land of 130 million people is now at the door of food (rice) self-sufficiency. However, this scenario may be jeopardised if either population growth is not further reduced or rice production per area is not boosted up. Concerted efforts to develop new high yielding rice varieties as well as fine tuning of production technologies under unfavourable ecosystems need to be emphasised. Ways and means to mitigate yield gap between farmer's field and researcher's field will be determined. Strengthening of research – extension – farmer linkage to accelerate the dissemination of upcoming technologies to the users will be further intensified.

10.2.2 **China**: Rice has a remarkable status in food crops and national economy. At present, major food crops have been over-produced in certain periods and regions in China. Thus, the rice area, especially the early-season rice has decreased year by year because of (1) the people's diverse need for food crops, (2) continuous dropping down of rice price in the market, (3) less profit from rice production by farmers, and (4) the changes of cropping systems. After joining WTO, China will face new risks on food security. The increase in importing foodstuff will threaten

the development of rice production in the country.

10.2.3 **India**: Rice is one of the major food crops to provide national food security in India and constitutes 41 percent of total production of food grains in the country. However, its rice productivity is still lower than in Japan, China, and Republic of Korea. The Government has paid high attention to resource conservation and the adoption of latest production technologies, particularly hybrid rice cultivation. Crop diversification is also being considered to divert some of low productive areas of rice to oilseeds and pulses in upland ecology. Production of rice for national food security, buffer stocking and exportable surplus, especially basmati rice is the main objective contained in the National Agricultural Policy of the Indian Government.

10.2.4 **Malaysia**: The rice industry in Malaysia is not competitive and its production cost is high compared to other rice-producing countries even within the ASEAN region. Thus, the objectives of the rice industry under the Third National Agricultural Policy (1998-2010) are to (i) ensure a self-sufficient level of at least 65 percent; (ii) increase production of a higher quality, speciality and fragrant rice; and (iii) maintain a strategic quantity of rice stockpile.

10.2.5 **Nepal**: Rice is the staple food of the Nepalese people, providing more than 50 percent of the total calorie requirement. An agricultural perspective plan has given top priority to rice crop for ensuring food security and enhancing economic growth. It has envisaged that by 2020, rice production must increase over 6 million tonnes to meet the growing population's demands. The Government will focus on increased rice productivity, closing yield gap, reducing harvest and post-harvest losses, improving water management in irrigated areas, more efficient tapping of ground water potential of Terai and marketing of agricultural inputs and outputs.

10.2.6 **Pakistan**: The country has focused on the production of basmati rice for export. Basmati rice produced in the "kalar" tract of Punjab Pakistan has special quality parameters viz; long fine slender grains, pleasant and exquisite aroma, sweet taste, soft texture, delicate curvature and extra elongation with least breadth wise swelling on cooking. However, the actual yield is low from 1.9 to 2.7 t/ha due to low availability of quality seed, low plant population, Zn deficiency, delayed transplanting, imbalanced use of fertilizers, weeds, pest occurrence and post-harvest losses.

10.2.7 **The Philippines:** Rice production has steadily increased since 1995 as a result of growth in both harvesting areas and yields. The production increase, however, is not adequate to cover the growing population's demands. The country still has to import a substantial quantity of rice to satisfy the local consumption. Regardless of its performance, rice yield in the country is still low. The Government has given priority to narrowing the yield gap and the adoption of hybrid rice to raise the rice yield and production. A boost in rice production in the Philippines also

requires the promotion of development of area-specific integrated crop management systems. An increase in funding support to agricultural research, development and extension is still needed and should be addressed through advocacy or provision of loans/grants.

10.2.8 **Thailand**: The world's largest rice exporter. Thai rice export is mainly focused on high grain quality, accounting for an average 30 percent of the world rice export. According to the Thailand National Economic and Social Development Plan (1999-2003), the strategies of crop research and development has focused and emphasized on the improvement of yield and profits. The grain quality and the environmental issues have been included.

10.2.9 **Viet Nam**: Rice production in Vietnam has successfully increased due to three main factors: (1) incentive policies, (2) improvement of water management, (3) varietal improvement. Vietnam has become rice exporter in the world since 1989. Successful rice production has significantly contributed to political rest, economic development, food security, in addition to birth control policy of the country. Toward 2010, paddy production under different scenarios varies from 30 to 36 million tonnes, depending on the interventions by the Government. Viet Nam will continue to export from about 2 to 4 million tonnes of milled rice, while focusing on a combination of interventions in improving efficiency, reducing post-harvest losses and stabilizing rice price. About 300 000 ha of rice area will be converted to other crops and aquaculture, based on the demands of domestic and international markets.

10.3 LATIN AMERICA

10.3.1 **Ecuador:** Since 1992, the harvested rice area in the country has increased about 5.8 percent annually, which is higher than the population growth rate. While the production of other cereals has been decreasing, rice production is increasing and becoming more profitable. It is estimated that rice production and processing benefit about 11 percent of the economically active population in the agricultural sector of the country. About 95 percent of national production is concentrated in the Guayas, Los Rios and Manabi provinces. Improved rice varieties INIAP 11, 12 and 14 have been widely planted. However, the yield potential of rice varieties has been stagnated and it has been difficult to improve through conventional breeding. The national rice research institute (INIAP) has begun the development of hybrid rice. Low F1 seed yield and the difficulty in maintaining the purity of the parental lines are still the major constraints to the adoption of hybrid rice in the country.

10.3.2 **Guyana:** The Guyana rice industry contributes directly and indirectly to the well-being of more than 750 000 people in Guyana. The industry has a socio-economic and sometimes political dimension. Therefore, the Government has provided continuous support to its research and development and has created linkages to policy for sustainable production. Over the last decade the rice yield increased

from 2.6 tonnes to 4.0 tonnes/ha due to the development and adoption of disease resistant and high yielding varieties. Recently the Government has formulated a Strategic Plan for the rice industry to support the land titling and distribution, strengthening of research and development and proper extension.

10.3.3 **Peru:** The National Rice Programme was created in 1968 with a mandate to make the country self-sufficient in rice and since 1987 the Regional and National Committees of rice producers have been subsequently organized. These programmes have led the country to being almost self-sufficient in rice, as rice importation was reduced from 418 333 tonnes in 1992 to only 62 643 tonnes in 2001, regardless of the variability of droughts and floods. During the last 10 years rice harvested areas have nearly doubled, while the rice production increased from only 0.8 to 1.9 million tonnes. This created a pressure on internal prices of rice. The country needs to define a new policy for Research and Technology Transfer and should provide funding support to these activities to assure sustainable rice self-sufficiency.

11. OTHER MATTERS

11.1 The Commission recognized the importance of rice for world food security and poverty alleviation of population, and confirmed its support to the efforts of Member Countries and FAO with a view to having the United Nations declare the Year 2004 as the International Year of Rice.

11.2 The observers from China and Côte d'Ivoire expressed their interest to become the members of the Commission.

11.3 Mr. Tailai Lu, Senior Project Manager of the Common Fund for Commodities, thanked FAO for its invitation and also expressed his congratulations to the Commission's successful meeting.

12. DATE AND PLACE OF THE NEXT SESSION

The Commission expressed appreciation of the invitation extended by the delegation of Peru for hosting the 21st Session in 2006. This proposal was applauded by the Commission. The final decision as to the exact date and place shall be taken by the Director-General of FAO, in consultation with the Government of the Member Country concerned.

13. ADOPTION OF THE REPORT

The Commission unanimously adopted the Report of the meeting.

14. CLOSING OF THE SESSION

This Closing Session was co-chaired by Mr. Sutep Limthongkul, on behalf of the Deputy Permanent Secretary, Ministry of Agriculture and Cooperatives of Thailand and Mr. Mahmoud Solh, Chairperson of the IRC Steering Committee, on behalf of the Director-General of FAO. The Co-Chairpersons expressed sincere thanks to the Government and people of Thailand for kind offer to host the 20th Session of the IRC and felicitated the delegates and observers for laudable contributions they had made towards the success of the Session. The 20th Session of the International Rice Commission was closed by the Co-Chairpersons.

APPENDIX A

LIST OF MEMBERS OF THE COMMISSION

Australia
Bangladesh
Benin
Brazil
Burkina Faso
Cambodia
Cameroon
Chad
Colombia
Congo, Dem. Rep.
Cuba
Dominican Rep.
Ecuador
Egypt
France
Gambia
Ghana
Greece
Guatemala
Guinea
Guyana
Haiti
Hungary
India
Indonesia
Iran, Islamic Rep.
Italy
Japan
Kenya
Korea, Rep.
Lao People's Dem. Rep.
Liberia
Madagascar
Malaysia
Mali
Mauritania
Mexico
Mozambique
Myanmar
Nepal
Netherlands
Nicaragua
Nigeria
Pakistan
Panama
Paraguay
Peru
Philippines
Portugal
Rwanda
Senegal
Sierra Leone
Sri Lanka
Suriname
Thailand
Turkey
United Kingdom
United States of America
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APPENDIX B

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APPENDIX C

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Mr. Chairman,
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Ladies and Gentlemen,

It is a great pleasure for me to be present at the opening ceremony of "The Twentieth Session of the International Rice Commission" and share with you my thoughts on "Rice for Food Security".

More than half of the world's population depends on rice as their major daily source of calories and protein and four-fifths of the world's rice is produced and consumed by small-scale farmers in low-income developing countries. Two billion people in Asia alone derive 80 percent of their calorie intake from rice, and thus the importance of this crop, in relation to food security and socio-economic stability, is self-evident.

In many countries rice accompanies every meal, and it is an integral part of religious ceremonies, festivals and holidays. In high-income countries in the Near East, Europe and North America, its consumption is becoming increasingly popular because its is a healthy and tasty food.

PERSPECTIVES

- *Overcoming hunger, poverty and malnutrition is a major challenge for many countries because of land scarcity and depleted water resources.*
- *The intensification of rice production needs to be adjusted in order to preserve the natural resources and the environment.*

This Session is an important opportunity to promote national rice programmes through an extensive interaction among breeders, seed producers, extension workers, senior rice scientists, policy makers and senior government officials, at national and regional levels. New links, exchange of ideas, observations and discussions will be a source of inspiration to all involved in our present and future work.

I trust that the next four days of the Session will prove fruitful and provide an excellent forum to discuss past, present and future aspects of our mutual interest in "Rice for Food Security".

I now declare the meeting open and wish it every success.

Thank you.

APPENDIX D

FAO STATEMENT

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Mr. Chairman,
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Ladies and Gentlemen,

On behalf of the Director-General of the Food and Agriculture Organization of the United Nations (FAO), I wish to welcome you to the Twentieth Session of the International Rice Commission.

First of all, I would like to take this opportunity to thank the Government of Thailand for hosting this Session.

The Fourth FAO Conference, held in 1948, approved the establishment of the International Rice Commission (IRC). The purpose of the Commission is to promote cooperative action amongst Member Countries in matters relating to the production, conservation, distribution and consumption of rice. The membership of the IRC is open to all Member States and Associate Members of FAO. Presently, 61 nations are Members of the IRC, representing all continents and including large and small rice-producing and/or consuming countries.

The IRC reviews scientific, technical and economic matters relating to rice, and it also promotes and coordinates rice research and development work. The Commission reports to Member States and to the Director-General of FAO on appropriate action to be taken in furthering its objectives. Every four years, a session is organized by the IRC to provide its members with the opportunity to review the emerging issues and achievements relating to rice production, and to assess how national programmes could best respond to the arising challenges. The Nineteenth Session was held in Cairo, Egypt in 1998. It is most befitting that the 20th Session, the first of this Millennium, is being held in Thailand which continues to be the world's leading rice exporter.

As you are aware, more than four-fifths of the world's rice is produced and consumed by small-scale farmers in low-income and developing countries. The Asia-Pacific Region of the FAO System houses most of them, who year after year - and every year - produce about 90 percent of the world's rice – thus anchoring the global food security. In 2000, more than half of the world's population depended on rice as their major daily source of calories and protein. The amount of rice consumed by each of these people ranges from 100 to 240 kg per year.

The increase in the world rice production during the Green Revolution has resulted in more rice being available for consumption despite the continued increase in population. During the past four decades, the unit cost of rice production decreased by 30 percent while rice price decreased by more than 40 percent - thus greatly helping to lessen hunger and poverty and helping enhance and sustain livelihoods. This has led to the belief in the total success of the Freedom-From-Hunger-Campaign of the 1960s. However, there are about 800 million people in the world today who are still suffering from malnutrition. Hunger reduces people's potential to work, hinders children's learning capacity, and leads people into a vicious cycle of poverty. The theme of the 20th Session, therefore, is ***Rice for Food Security***.

Mr. Chairman,

Security and sustainability of rice-based livelihoods is fundamental to the world's food security. The World Food Summit (WFS), convened in November 1996 in Rome, called for coordinated global action to secure food security for the world's population. The WFS: *five years later*, held from 10 to 13 June 2002 in Rome, renewed global commitment made in the Rome Declaration at the first Summit to accelerate the implementation of the WFS Plan of Action. Increasing rice production and distribution would undoubtedly contribute to the implementation of the WFS Plan of Action

However, in some corners there are increasing concerns about the ability of rice production to meet popular demand in the near future. The Expert Consultation on *"Technological Evolution and Impact for Sustainable Rice Production in Asia and the Pacific"*, held in Bangkok in 1996, reported the stagnation of rice yield in many Asian countries. Also, the **intensification of rice production,** if not pursued scientifically and appropriately, has sometimes caused considerable damage to the environment and natural resources, including the building up of salinity/alkalinity, and water pollution and health hazards caused by excessive use of agro-chemicals. In the past, the contribution of lowland rice to greenhouse gas emissions has been unjustifiably overstated. Concern about genetic erosion in rice production is also increasing.

Fortunately, technological options for sustainable rice production are available. Further yield increases could be achieved with new generations of varieties, including hybrid rice, new super plant types and transgenic rice. Innovations in rice integrated crop management (RICM) could improve the efficiency of input utilization and reduce the risk of environmental pollution and production costs. Labour-productivity enhancement is expected to be achieved with new generations of agricultural machinery, whilst innovative harvest and post-harvest technologies could reduce the post-harvest losses. Increased accessibility to information on innovations and production factors, through modern communication systems, could expedite technology adoption. New successful experiences of bridging rice yield gaps, such as the ***Ricecheck*** approach, if adopted widely, would significantly enhance rice productivity and production.

The prevailing decline in the world's rice prices due to bumper crops during the last few years should not lead to mistaken complacency. On the one hand the declining price of this vital commodity has greatly helped to alleviate poverty and hunger in many cities of the world, but on the other hand it has caused hardship to rice

producers. In this context, as globalization progresses, the world community needs to provide safety nets for the world's vulnerable rice smallholders.

Moreover, the world's rice production today has suffered from the lack of investment in irrigation development and research work. The decline in the development of irrigation infrastructures has slowed down the adoption of high yielding varieties and improved crop management techniques. Similarly, the substantial decrease in public investment in rice research is troublesome since the difficulty of sustaining the growth of rice productivity has increased as yield has advanced. Water will be the scarcest resource in the years ahead, and the relation between water and rice will occupy the centre of the stage in enhancing and sustaining the rice-based system.

In view of all the above considerations, the challenges to national and international rice research and development programmes today are two folds, i.e.:

- How to render rice production technologies efficient and at the same time compatible with the limited resources of poor farmers, while being environmentally friendly and sustainable?

- How to design rice and rice-based production systems that fit into the socio-economic environments, especially where the participation of women is dominant, and that are capable of reducing risks of rural poverty?

Experience gained from FAO's Special Programme for Food Security has clearly shown that these aims are achievable as long as there is active and full participation of all stakeholders involved in rice research and development. I have no doubt this Commission will deliberate on such new issues and opportunities in the course of the next few days.

Mr. Chairman,
Distinguished Delegates,
Ladies and Gentlemen,

The hungry child cannot wait. His bones and sinews are being formed today. We cannot tell him tomorrow. "His name is Today".

Maintaining the productivity and efficiency of rice-based production systems is too large a task for any single country, institution or organization to handle individually. The global research and development community, its policy makers especially, need to focus attention on the role that rice can play in providing food security and poverty alleviation. With a view to raising awareness amongst all stakeholders concerned, I am pleased to inform you that in November 2001 the FAO Conference adopted the Resolution of the International Year of Rice proposed by the delegation of the Philippines. The Resolution requested the Director-General of FAO to transmit this Resolution to the Secretary-General of the United Nations with a view to having the UN declare the year 2004 as the **International Year of Rice.** I am sure you will share our hope that this campaign will lead to the declaration of 2004 as International Year of Rice.

I wish you a successful Session and thank you for your kind attention.

APPENDIX E

PROVISIONAL AGENDA OF THE TWENTIETH SESSION

1. Election of Chairperson and Vice-Chairpersons
2. Adoption of Agenda
3. Welcome Address
4. FAO Statement
5. Keynote Address
6. Executive Secretary's Report
7. Rice in the World's Trade
8. Progress in Rice Genetic Improvement for Food Security
9. Progress in Integrated Management for Sustainable Rice Production
10. Regional Strategies on Rice Production: Africa, Asia and the Pacific and Latin America and the Caribbean
11. Country Statements
12. Date and Place of the Next Session
13. Adoption of the Report
14. Closing of the Session

APPENDIX F

KEYNOTE ADDRESS: ISSUES AND CHALLENGES IN RICE TECHNOLOGICAL DEVELOPMENT FOR SUSTAINABLE FOOD SECURITY (SUMMARY)

Mahmoud Solh
Director, Plant Production and Protection Division, FAO
and
Chairperson of the IRC Steering Committee

Rice is the most important food crop with more than 90 percent of global production and consumption occurring in developing countries. Since the 19th Session of the International Rice Commission (IRC) held in Cairo, Egypt in 1998, there have been numerous developments that have profound impacts on the global rice industry. During 1997 through 1999, production exceeded consumption resulting in the accumulation of large stocks. In contrast, during the last two years, global consumption exceed production causing withdraw from global stocks. Reports emerged in the early 1990s, forecasting a pending rice crisis due to the deceleration in growth of world rice production. Recent analysis, however, do not support the concept of a pending rice crisis. Rice demand in year 2030 is projected to be approximately 533 million tonnes of milled rice or approximately 750 million tonnes of paddy rice. This is significantly less than earlier projections but still a considerable quantity of rice will be required to meet future needs.

Several emerging issues may hinder the ability to meet future rice needs. The growth in rice yields has decelerated during the 1990s. The yield potential of IR8 is still the highest among the high yielding varieties (HYV) released for rice production in tropical climate areas. Also, there is considerable information indicating declining yields/productivity in 28 million hectares of irrigated rice under intensive cultivation. In the 1980s, brown plant hopper heavily damaged IR 36, which was grown on approximately 13 million ha in Asia. Currently, IR 64 occupies 10 million ha or about 15 percent of all irrigated rice land and about 95 percent of hybrid rice varieties under production (nearly 17 million ha) originated from the same "wild abortive" A source of cytoplasmic male sterility. The present genetic uniformity of HYVs and hybrids may lead the crop to being vulnerable to outbreaks of insect pests and diseases. The relatively low nutritional quality of rice is another concern, especially in areas where rice consumption is very high. Rice is the main source of energy and is an important source of protein providing substantial amounts of the recommended nutrient uptake of zinc and niacin. However, rice is very low in calcium, iron, thiamin and riboflavin and nearly devoid of beta-carotene.

In-terms of resources, there is an increasing competition for land and water from industrialization and urbanization. Irrigated rice is cultivated annually on about half of the total area planted to rice, but is responsible for approximately 75 percent of total rice production. Irrigated rice production is particularly vulnerable to emerging environmental regulations due to the excessive use of irrigation water, indiscriminate

use of pesticides and inefficient use of fertilizers. Flooded rice is a major source of methane, nitrous oxide and ammonia emissions and carbon dioxide is emitted during burning of crop residue.

Historically most governments in the major rice producing and consuming countries developed policies that maintain stable paddy price for consumers in urban centers and provide subsidies to rice farmers. The governmental supports, however, are expensive. Also, policies to support the rice sector are limited by commitments under the Uruguay Round on Agriculture and structural adjustment programmes. Finally, there are a plethora of institutional and policy factors that will require significant changes if future needs are to be fulfilled.

Fortunately there are available technologies and systems that could be developed further and deployed for solving the earlier-mentioned issues to support sustainable increase in rice production to address future needs. Hybrid rice is the most significant technology since the identification of dwarf-plant types. Hybrid varieties have consistently shown a 15-20-percent increase in yield compared to conventionally bred varieties. In China, hybrid rice was cultivated on approximately 16 million hectares. During the last decade FAO has assisted many Asian countries in the development and use of hybrid rice. In 2001/02, it was estimated that about 800 000 ha of hybrid rice were planted in Asian countries outside of China, such as Viet Nam, India, Philippines, and Bangladesh. In spite of these advances, there are several factors that have tempered the widespread adoption of hybrids. Seed production is the most formidable obstacle to the spread of hybrids and the persistent low yield of hybrid seed production suggests the need for the breeding of new CMS lines with high ability to maintain the pollen sterility and high out-crossing rate as well as the improvement in manpower and expertise in F1 seed production.

The concept of "New Plant Types" (NPT) was first developed by IRRI in the early 1990s with the stated goal of identifying NPTs with yield potential of 12-13 t/ha. Recently, the work in the development of C4 rice plants is being carried out at several institutions in the world and in West Africa, WARDA developed NERICA varieties (New Rice for Africa), based on crosses between *O. sativa* and *O. glaberrima*. However, more efforts are still needed to bring these new rice varieties to farmers' fields. Biotechnology has rapidly been developed in the recent past. Biotechnological tools have also been used in rice varietal improvement. There is, however, a need for concerned authorities to critically evaluate the bio-safety of the use of the transgenic rice in order to avoid undesirable effects on rice production, food security, human health and the environment.

While the development of new generation of rice varieties through genetic improvement may take time, sustainable increased rice production could get immediate push by narrowing the yield gap. Most existing high yielding varieties have genetic yield potentials of approximately 10 t/ha. Under excellent management in farmers' field these varieties frequently produce 7-8 t/ha, but average yield by producers is about half this amount. Results from on-farm field studies showed that the yield gap in the developing world was approximately 2.7 t/ha and the yield gap is most apparent in the irrigated ecology. Bridging the yield gap in the irrigated rice areas alone could provide an increase in production of approximately 130 million tonnes.

Limitations in crop management do not exist in isolation but are interlinked. For example, increased seedling vigor from the use of high quality seeds will not affect yield if the crop is inadequately fertilized. Similarly, the crop cannot respond to improve fertility if weeds are permitted to compete. These examples illustrate the importance of developing an integrated approach. However, many of these limitations are often addressed as single issues, resulting in programmes such as Integrated Nutrient Management, Integrated Pest Management, and Integrated Water Management. Results obtained by a number of national and regional rice programmes during the 1990s have showed that when crop management constraints are integrated into a unified technology transfer programme rapid progress can be made. The Expert Consultation of 2000 recommended the development and use of Rice Integrated Crop Management systems to narrow the yield gap in irrigated rice production. The experiences gained from the Green Revolution indicated that raising productivity is effective in raising farmer's income.

Large percentages of produced rice are still lost during post-harvest processes. Sun drying is the most common method and provides little control over the rate of drying. Much of the grain is either dried in the field in windrows or spread out on surfaces (roadsides) after threshing. Additional losses in the milling process are caused by inadequate technical performance of milling equipment. The introduction of improved implements and technologies for post-harvest and processing operations as well as the breeding of rice varieties with tolerance to delayed harvesting could reduce these losses, thus increase the net output of rice production and farmers' incomes.

Recently, results of FAO field projects during the 1990s have demonstrated the potential contribution of the diversification of rice production systems as means of increasing farmers' incomes. However, food security is the primary concern of the majority of farmers. Farmers would be willing to undertake diversification only when rice production could provide adequate food for their family. Increasing the productivity of rice production, therefore, is a requirement for successful promotion of crop diversification.

In summary, the situation of global rice production is still manageable, but meeting future demand requires actions to address the current yield stagnation and reversing the declining trend in productivity, to narrow the yield gap in irrigated rice and to reduce post-harvest losses. The development and transfer of new rice technologies to support above actions, however, should be productive, efficient and cost effective. They should also produce less pollution to the environment, while provide more income and better livelihoods to farmers.

APPENDIX G

SUMMARY REPORT OF THE EXECUTIVE SECRETARY OF THE INTERNATIONAL RICE COMMISSION (IRC)

Dat Van Tran, Executive Secretary
and
Members of the IRC Steering Committee [1]

Over the last four years, the Commission's Secretariat has made considerable progress in many areas relating to rice. In collaboration with the FAO Regional Offices, IARCs and NARS, the Secretariat organized and/or supported the organization of two expert consultations on rice productivity in Thailand (1999) and in Italy (2000); six meetings of the IRC Steering Committee at FAO Headquarters; and seven regional workshops and meetings on rice technologies and strategy in Romania (1999), Brazil (1999), Turkey (2000), Senegal (2001), Viet Nam (2001), Ghana (2002) and Italy (2002).

A Memorandum of Understanding (MOU) was signed by FAO and IRRI in 1999 to support the International Task Force on Hybrid Rice (INTAFOHR) and another MOU was signed by FAO and WARDA in 2002 to promote Rapid Rice Technology Diffusion in West Africa (RARIDIWA), especially through the SPFS. The FAO Conference, at its 31st Session on 13 November 2001, adopted the RESOLUTION 2/2001: International Year of Rice, sponsored by the delegation of the Philippines. The Conference requested the FAO Director-General to transmit this Resolution to the Secretary-General of the United Nations with a view to having the United Nations declare 2004 as the International Year of Rice.

The Secretariat published four issues of the IRC Newsletters; three reports of the sessions and workshops; three proceedings; and three books on *Hybrid Rice* (English and Spanish), *FAO Rice Information* and *Speciality Rices of the World*. The Commission also improved its WebPages by inserting up to date rice information and databases.

Crop and Grassland Service (AGPC): Research and training activities on hybrid rice technologies -- which were provided through the Regular Programme, four TCP projects and two UNDP-funded projects -- have resulted in the release of a number of hybrid rice combinations and cytoplasmic male sterile (CMS) lines in Member Countries and the growing of about 800,000 hectares of hybrid rice in 2001/02 by farmers in Asia, excluding China; especially in Bangladesh, India, the Philippines and Viet Nam. Pilot tests on the development and transfer of the Rice Integrated Crop Management (RICM) system, in collaboration with national programmes in Bangladesh, Brazil, China, Indonesia and Vietnam, have taken place. A TCP Project on RICM in Thailand has recently been implemented. In particular, the transfer and

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identification of cereal technologies in Bangladesh were strengthened through a UNDP-funded project. Support also has been extended to the transfer of NERICA (New Rice for Africa) varieties in West Africa and to the African Rice Initiative (ARI) initiated by WARDA and its Member Countries and UNDP. In collaboration with ESCB, technical supervision has been provided to test the development of Inland Valley Swamp for rice-based production systems in Burkina Faso, Côte d'Ivoire and Nigeria under a project, which is funded by the Common Fund for Commodity and executed by WARDA. Several missions were undertaken to provide technical support to national rice programmes, especially through the Rice Intensification of the Special Programme for Food Security in Member Countries.

Seed and Plant Genetic Resources Service (AGPS): Initiatives aimed at enhancing seed security of Member Countries for rice production have been implemented. As a logical follow-up to the assessments of the Seed Policies and Programmes in FAO Member Countries, the Service has initiated a number of projects aimed at establishing sustainable rice seed production - under both high-input and low-input conditions.

Plant Protection Service (AGPP) and Global Integrated Pest Management Facility: New rice integrated pest management programmes have been initiated in West Africa, covering Mali, Burkina Faso and Senegal. In Asia, the fourth and final phase of the FAO regional IPM rice programme, community IPM intercountry programme, completed most of its work. Over 2 million farmers in about 100 000 villages across twelve countries in Asia have participated in this programme. Work on ecological analyses of rice agro-ecosystems, designed by ecologists in the regional IPM Rice programme, has now led to several publications in world-leading ecological journals.

The Global Workshop on Red/Weedy Rice Control was organized in Cuba in 1999 and resulted in a conclusion that there is an evident increase in red rice incidence in many rice-producing countries due to the increase of direct-seeded areas; no simple method for the control of weedy/red rice exists. In 2001, the Workshop on *Echinochloa* spp control was convened in China. This workshop concluded that there is still an air of uncertainty on the taxonomic status of many species, sub-species, varieties and binomials of *Echinochloa* and that a practical manual for the identification of these species should be prepared by experts in the near future and should be made available to field workers and extension specialists in countries where the weeds are a problem.

Water Resources Development and Management Service (AGLW): Technical assistance in the introduction of efficient water management technologies for rice cultivation has been provided to Member Countries, especially under the Special Programme for Food Security in Bangladesh, Burkina Faso, Cambodia, Ethiopia, Laos, Madagascar, Malawi, Mali, Nepal, Rwanda, Sri Lanka, Tanzania, Uganda. Computer programmes CROWAT, CLIMWAT and AQUASTAT for rice water requirement and water resources information were developed and disseminated.

Land and Plant Nutrition Management Service (AGLL): On-station and on-farm trials as well as on-farm demonstrations and training on methods for enhancing nitrogen fertilizer efficiency were carried out in Malaysia, Indonesia and the

Philippines during 1995-98, under a sub-regional project on Nitrogen Fertilizer Efficiency and Environmental Impact for Irrigated Rice Systems in Southeast Asia funded by Japan.

Agro-Industries and Post-Harvest Service (AGSI): Activities related to rice, especially rice post-harvest operations, introduction of metal silo for grain storage have been carried out in Guinea and Viet Nam and four documents on processed rice manuals and on rice quality control were prepared and disseminated.

Basic Food Stuffs Service (ESCB): Two Sessions of the Intergovernmental Group on Rice (IGG on Rice) were convened in Rome: the 39th Session in 1999 and the 40th Session in 2001 to review the major problems and issues facing the world rice economy, including rice policy development and the short-term market outlook and prospects. In addition, the IGG on Rice, in its role as International Commodity Body for rice vis-à-vis the Common Fund for Commodities (CFC), is also responsible for sponsoring projects for funding by the CFC. During the 40th Session of the IGG on Rice, the Secretariat (Rice Group of ESCB) informed the Group of the submission for possible approval of the project entitled "Bridging the Irrigated Rice Yield Gap in Venezuela and Brazil", which was submitted by the Latin American Fund for Irrigated Rice (FLAR). The Service also contributes, on a regular basis, a review and short-term outlook for the rice market, to "Food Outlook", FAO's bi-monthly publication.

Food and Nutrition Division (ESN): The 56th meeting of the Joint FAO/WHO Expert Committee on Food Additives (JECFA), to evaluate the safety of certain mycotoxins occurring in foods, was held in Geneva from 6 to 15 February 2001. The Codex Alimentarius Commission will use the assessments for ochratoxin and trichotecenes (deoxynivalenol, T-2 and HT-2 toxins) which are known contaminants of rice. The Codex Standard for Rice (CODEX STAN 1998-1995) has been maintained without alteration during this period. Activities have been undertaken to examine the intraspecies variation in nutrient content of different rice cultivars. Several conference papers/posters and reports have been prepared.

Inland Water Resources and Aquaculture Service (FIRI): Technical assistance has been provided to Member Countries in assessing and developing the various options of aquaculture in rice-based farming systems as a means of promoting food security and securing sustainable rural development. Major activities and achievements include the FAO Workshop on Integrated Irrigation and Aquaculture (IIA) held in Ghana (1999). Several studies and analyses have been initiated by FIRI on the availability and use of aquatic organisms in rice-based farming, with a rich aquatic biodiversity and traditional knowledge, in selected sites e.g. Cambodia, China, Laos and Viet Nam.

Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (AGE): The FAO/IAEA Consultants' Meeting on Integrated Soil, Water and Nutrient Management for Sustainable Rice-Wheat Cropping Systems in Asia was held at FAO Headquarters in Rome from 23-25 August 2000. Recommendations for a future FAO/IAEA Coordinated Research Project (CRP) were formulated and a draft of the Project Document was prepared.