THE INTERNATIONAL YEAR OF RICE 2004

Concept Paper

International Year of Rice Secretariat
Food and Agriculture Organization of the United Nations

30 October 2003

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Preface

On 16 December 2002, the United Nations General Assembly (UNGA) declared the year 2004 the International Year of Rice (IYR). The dedication of an International Year to rice, a single crop, is unprecedented in UNGA's history. In declaring the IYR, the UNGA recognized that rice is the primary food source for more than half of the world's population and that enhancing the sustainability and productivity of rice-based production systems will require the commitment of many parts of civil society as well as government and inter-governmental action. The theme of the IYR, 'Rice is Life', is drawn from the understanding that rice-based systems are essential to everyone, directly and indirectly, for food security, poverty alleviation and global peace.

Rice is life and is a central part of many cultures; it is used in festivals, paintings, songs and religious ceremonies as a symbol of life, fertility and abundance. Some countries even credit rice cultivation with the development of their civilization. Rice terraces, a beautiful feature of many landscapes, are part of our ecological heritage. Rice is grown on all the continents of the world, except Antarctica. Rice-based production systems are a hub for biodiversity, which include fish, wildlife, livestock, plants and micro-organisms. Almost a billion households in Asia, Africa and the Americas depend on rice systems as their main source of nourishment, employment and income.

The world population is growing and rice production must also grow but with better and more efficient use of water, land and labour, while reducing the losses incurred during production, transportation and processing. Environmental pollution due to the inappropriate application of inputs - especially pesticides - has caused concerns. Science and technology can enhance rice production through more efficient use of natural resources, especially water. Modern biotechnology can increase the productivity of rice varieties and provide protection against pests, diseases and climatic variations.

The International Year of Rice provides an opportunity for the global community to focus on achieving the internationally agreed goals that were set out in the Millennium Declaration in 2000, which call for the reduction of poverty and hunger. Furthermore, it is an opportunity to raise global awareness on the importance of agriculture in addressing food security, poverty alleviation, and environmental management. The UNGA invited the Food and Agriculture Organization of the United Nations (FAO) to act as the lead agency for the implementation of the IYR, in collaboration with the United Nations Development Programme (UNDP); the Consultative Groups on International Agricultural Research centres (CGIAR); national, regional, and international agencies; non-governmental organizations; and the private sector.

Members of the FAO IYR-Organizing Committee and the participants of the Informal International Planning and Coordination Meeting for the IYR held 6-7 March 2003 in Rome provided critical inputs in the preparation of this Concept Paper. The contribution of a wide spectrum of partners for this paper signals the participatory and collaborative ideals of the Year. It is my sincere hope that this Concept Paper will provide crucial information on various aspects of rice-based systems, challenges and opportunities and a conceptual framework for the implementation of the IYR - 2004.

Louise O. Fresco
Assistant Director-General
FAO Agriculture Department

Mission Statement

The International Year of Rice promotes improved production and access to this vital food crop, which feeds more than half of the world population while providing income for millions of rice producers, processors and traders. The development of sustainable rice-based systems will reduce hunger and poverty and contribute to environmental conservation and a better life for present and future generations for whom Rice is Life.

I. The International Year of Rice: Background and History

Rice is life for major populations of the world and is deeply embedded in the cultural heritage of many societies. It is the staple food for more than half of the world population. In Asia alone, more than 2,000 million people obtain 60 to 70 percent of their caloric intake from rice and its products. It is the most rapidly growing source of food in Africa, and is of significant importance to food security in an increasing number of low-income food-deficit countries. Rice-based production systems and their associated post-harvest operations employ nearly 1,000 million people in rural areas of developing countries. About four-fifths of the world's rice is grown by small-scale farmers in low-income and developing countries. It follows that efficient and productive rice-based production systems are essential for economic development and for improved quality of life of much of the world's population.

It is estimated that there are about 840 million undernourished people, including more than 200 million children, in developing countries. Undernourishment greatly limits development. Improving the productivity of rice systems would contribute to hunger eradication, poverty alleviation, national food security and economic development. However, rice production is facing serious constraints including a declining rate of growth in yields, depletion of natural resources, labour shortages, gender-based conflicts, institutional limitations and environmental pollution. Overcoming hunger, poverty and malnutrition - while protecting the environment - requires collective action by all stakeholders.

The initiative for establishing an IYR commenced in 1999 when the International Rice Research Institute, reflecting the growing concerns of its members over an increasing number of serious issues facing rice development, requested and obtained FAO collaboration in having an International Year declared. This was pursued by FAO Member Countries leading to a resolution, adopted at the 31st session of the FAO Conference (Resolution 2/2001) requesting the UNGA to declare 2004 as the IYR. The request, submitted to the UNGA by the Delegation of the Philippines and co-sponsored by an additional 43 countries, was considered at the Fifty-seventh session, which declared 2004 the International Year of Rice (Box 1). FAO was invited to facilitate the implementation of the IYR in collaboration with other relevant organizations.

The importance that member states are giving to sustainable rice development is reflected in a growing number of global initiatives. These include those taken at the 1992 Rio Summit and elaborated in Agenda 21's chapter on Sustainable Agriculture and Rural Development (SARD), at the recent World Conference on Sustainable Development, in the Declaration on World Food Security and the World Food Summit Plan of Action and in the United Nations Millennium Declaration in 1996 (Box 2). These initiatives share a common theme that is central to the

declaration of the IYR: in a world of increasingly interlinked institutions, societies and economies, coordinated efforts and shared responsibilities are essential.

Box 1: Resolution Text for the International Year of Rice

The General Assembly,

Recalling resolution 2/2001 of the Conference of the Food and Agriculture Organization of the United Nations,

Noting that rice is the staple food of more than half of the world's population,

Affirming the need to heighten awareness for the role of rice in alleviating poverty and malnutrition,

Reaffirming the need to focus world attention on the role that rice can play in providing food security and eradicating poverty in the attainment of the internationally agreed development goals, including those contained in the United Nations Millennium Declaration,

1. *Decides* to declare the year 2004 the International Year of Rice;

2. *Invites* the Food and Agriculture Organization of the United Nations to facilitate the implementation of the International Year of Rice, in collaboration with Governments, the United Nations Development Programme, the Consultative Group on International Agricultural Research Centres and other relevant organizations of the United Nations system and non-governmental organizations.

(Source: United Nations General Assembly; A/Res/57/162; dated 16 December 2002)

Box 2: UN Millennium Declaration

United Nations Millennium Goals

Eradicate extreme poverty and hunger

- Reduce by half the proportion of people living on less than a dollar a day
- Reduce by half the proportion of people who suffer from hunger

Ensure environmental sustainability

- Integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources
- Reduce by half the proportion of people without sustainable access to safe drinking water
- Achieve significant improvement in lives of at least 100 million slum dwellers, by 2020

Develop a global partnership for development

- Develop further an open trading and financial system that is rule–based, predictable and non–discriminatory. Includes a commitment to good governance, development and poverty reduction—nationally and internationally
- Address the least developed countries' special needs. This includes tariff–and quota–free access for their exports … and more generous official development assistance for countries committed to poverty reduction
- Address the special needs of landlocked and small island developing States
- In cooperation with the developing countries, develop decent and productive work for youth
- In cooperation with the private sector, make available the benefits of new technologies—especially information and communications technologies

United Nations General Assembly, UN Millenium Declaration, 8th plenary meeting, 8 September 2000

II. Rice is Life: Aspects of Rice-based Systems

The UNGA Declaration of the IYR not only emphasizes the importance of rice, but also points to the importance of agriculture systems as a whole when addressing issues of global concern. Agriculture systems affect and are affected by nearly every aspect of sustainable development. The IYR envisions rice as the focal point of a prism through which the intricate and interdependent relationships between agriculture, culture, nutrition, environmental resource management, biodiversity, economic policies, science, gender and labour issues can be viewed clearly.

Rice is grown under a wide range of soil moisture regimes, from deep flood to dry land, and in different soil conditions. Rice-based production systems span from 53^0 N, in the Heilongjiang Province of P.R. China, to 35^0 S in New South Wales of Australia; from the tropical rain forest climate of the D.R. Congo to the continental temperate climate in Krasnodar of F.R. Russia; from

the arid desert climate found in Egypt's Nile Delta, to the sea-level regions in Guinea-Bissau, to 2,700 meters above sea level as in the Himalayas mountain chains in Nepal. The diversity of the regions, peoples, and resources connected within the world's rice-based systems requires a diverse approach for global rice-based development that includes participation from the local to the international level.

Rice and Culture

Thousands of years ago, people from East to South Asia settled throughout river deltas and domesticated wild rice. The productivity of wetland rice crops enabled population growth and led to the development of society and civilization. Both in ancient and present times, the intense labour needed to reclaim land for rice cultivation, to build and maintain the terrace system, or to synchronize the cropping pattern against soil erosion, landslide and flooding has required villages to work collaboratively. The unifying effect of rice on people is particularly illustrative in the vast Mekong River Delta, where multitudes of different villages with separate cultures joined to tame the land and cultivate their staple crop. Furthermore, the need for standing water in rice-based systems has widely shaped the landscapes of rural areas and villages. In these ways, the struggle to cultivate and harvest rice has formed community structures and a corresponding culture of rice.

The relationship between rice and people has inspired songs, paintings, stories and other modes of communication. Festivals have been devoted to rice and rice cultivation, such as the well-known *Land Opening Festival,* which honours the beginning of the rice season in China. Rice was considered divine by many Asian emperors and kings in ancient times. The Japanese, even today, refer to rice as their "mother" and regard rice farmers as the guardian of their culture and the countryside.

Over the centuries, rice has shaped the cultures and dietary habits of its consumers. Due to its different varieties, rice provides a wide range of flavors, even when simply boiled or steamed. Rice is traditionally coupled with fish, meat or legumes such as beans and lentils, depending on the region in which it is consumed. For example, the combination of rice and fish in Asian countries has generated the term "rice-fish" societies, while Columbia acknowledges "rice and beans" as its national food. The strong relationship between wet rice production and fisheries, and its cultural importance, is reflected in many proverbs from the ancient Tai and Angkor Wat civilizations: "In the fields there is rice and in its water there is fish". Rice and legumes (i.e., beans, lentils and chickpeas), characterize world cuisines from Cajun to Mexican to Middle Eastern to Southern European. This basic dish continues to be the sustenance of the poor in many countries.

From its Asian homeland, rice (*Oryza sativa* L.), is now cultivated in 113 countries and on all the continents except Antarctica. It is significant that almost every culture has its own way of eating rice and that these different recipes are, in fact, part of the world's cultural heritage. The importance of rice to villagers in Senegal is evident in that special guests are honoured with a rice meal. From a relatively unknown crop a hundred years ago, rice today dominates the cultural and political landscape in Sacramento, California. The panoramic view of the flat rice fields in the footlands of the snow-capped mountains in the Alps is a delightful experience for visitors to

northern Italy, home of world-renowned risottos and rice dishes. Under the intense summer heat in the Nile Delta, people seek refuge from the heat in the cool air of the rice fields. Rice terraces beautify the landscapes and UNESCO declared the terraces in Banawe, Philippines, a world cultural heritage site. Efforts are underway to establish the conservation of other rice-based production systems as World Cultural Heritage sites.

Rice and Nutrition

More than two billion people still suffer from micronutrient malnutrition. Although rice provides a substantial amount of dietary energy, it has an incomplete amino acid profile and contains limited amounts of essential micronutrients. Malnutrition reduces children's ability to learn, decreases adult productivity and leads to premature death, particularly among women and children. Nutritional considerations, therefore, are essential to the IYR and the concept that *Rice is Life.*

Rice is the staple food for 17 countries in Asia and the Pacific, eight countries in Africa, seven countries in Latin America and the Caribbean, and one in the Near East. When all developing countries are considered together, rice provides 27% of dietary energy supply and 20% of dietary protein intake. Rice is a crop rich in genetic diversity; the rice species *Oryza sativa* L. has thousands of varieties belonging to sub-groups of *indica, japonica,* tropical *japonica*, glutinous, and aromatic. In West Africa, *O. glaberrima* Steud. adds to the diversity of rice. Although there needs to be greater documentation on the nutritional properties inherent in diverse rice varieties, there is considerable evidence that not all varieties have equal nutritional value. In the limited number of varieties studied, iron and zinc can range between 1-6 mg and protein between 5-14 g per 100g of rice. If better utilized, these varieties with higher nutritional value could contribute to reducing the global burden of malnutrition.

Most commonly, due to tradition and preference, rice is milled, yielding white rice. While this process reduces cooking time and increases storage life, it also removes a large percentage of many nutrients including protein, fibre, fat, iron and B vitamins. People in a number of countries parboil rice grains to preserve the nutrients naturally present in rice. Fortification techniques can be used to add essential vitamins and minerals to the grain. Unfortunately, this practice is not widespread in many rice consuming countries due to limited infrastructure for processing, regulatory control and marketing of fortified foods.

Rice and Agro-biodiversity

The potential to diversify food sources within the rice-based ecosystem is quite high, given that wetland rice fields are the habitat for a wide variety of terrestrial and aquatic organisms due to the continued presence of fresh water. For thousands of years, rural people have relied heavily on the existing biodiversity within rice-based ecosystems, and in many cases enhance this biodiversity with cultivated plants, domesticated animals and aquaculture to secure their daily food supply and income. Local people use fish, frogs, snails, insects, and other aquatic organisms derived from these ecosystems as their main source of animal protein and essential fatty acids. Aquatic organisms in rice paddies can either be natural components of biodiversity that are trapped in the paddies, or they can be introduced intentionally such as tilapia, barb and carp species. Fisheries

are particularly important for poor people, especially the landless, who may also earn modest incomes from marketing fresh or processed aquatic food and medicinal products.

Various kinds of livestock are supported by rice-based systems. Ducks feed on small fish, other aquatic organisms and weeds within the paddy fields, while buffaloes, cattle, sheep and goats graze on rice straw as their main food source in rice-producing areas. Rice bran, a by-product of rice milling, and low quality and surplus rice grains provide feed supplementation for livestock. In turn, livestock help farmers with transportation needs and land preparation: for example, livestock waste can be recycled into organic fertilizer.

Rice fields also host a wide variety of natural enemies or predators, which provide a mechanism to control harmful insects and pests, thus reducing the need for pesticides. Similarly, fish feed on weeds and assist in weed control. Other plant species share a symbiotic relationship with rice. For example, *Azolla*, a nitrogen-fixing aquatic fern, can be grown in paddy fields to improve nutrient availability, to reduce weeds and to facilitate fish-livestock integration. Plant varieties are used by farmers for food and medicine and as feed for fish and livestock.

The agro-biodiversity within the rice-based system presents great opportunities for improved nutrition within rural communities, increased farmer income through crop diversification, and the protection of a wealth of genetic resources for future generations. In order to realize the full potential of the rice-based systems, measures must be taken to responsibly manage the land and water resources upon which they depend.

Rice and the Environment: Managing Land and Water Resources

Water management is the key to creating sustainable rice-based production systems, particularly because rice is the only major cereal that can withstand water submergence. For thousands of years, natural selection pressures such as drought, submergence, flooding, nutrient stresses, biotic stresses and human intervention have contributed to the great diversity in rice varieties and rice ecosystems. Based on their diversity, rice agronomists and ecologists have proposed several classification systems, of which the most widely used distinguishes five water related categories: rain-fed lowland, deep water, tidal wetlands, upland and irrigated rice. During the 1990s, only about 11% of the world's rice harvested areas were upland; the remaining harvest came from water-flooded systems.

The topography of the local landscape within which rice is cultivated has led to the development of specific water management and cultivation practices that produce some specific beneficial outcomes. The terrace system in mountainous areas is a typical product of the ponding technique which has allowed cultivation even on steep slopes. This technique is instrumental in preventing soil erosion and landslides. Another advantage of this technique is its capacity for flood control: the field bunds have a high water storage capacity which reduces peak flows under heavy rains. The layer of water due to ponding in rice cultivation minimizes weed growth and therefore reduces the need for herbicides and labour requirements for weed control. The permanent presence of water on the field also generates percolation of water and groundwater recharge, which is often beneficial for other types of water use.

The complexity of the relationship between rice and water is well exemplified in rice-based systems with soil submersion. Submerged conditions enable organic matter to accumulate in soils, which contribute to carbon sequestration. In submerged systems, soil organic matter serves as a nutrient reservoir and provides rich sources of mineral elements for plants. However, the continuous flooding of rice fields without an adequate drying period has negative effects on other chemical and biological processes within the soil, such as a retarded rate of humus decomposition, a decreased rate of soil nitrogen mineralization, salinity build up and water logging. In addition, wetland soils are known for methane emission, a greenhouse gas. Finally, the continuous presence of water encourages the occurrence of disease, such as malaria, while this very same water presence supports natural predators for mosquitoes (the malaria carriers) and allows farmers to supplement their livelihoods from the rice-based systems' agro-biodiversity. The seemingly contradictory advantages and disadvantages that submerged rice systems have on people and the environment can be better resolved through good agriculture practices. Rice-based systems have been designed to use freshwater resources for multiple purposes and to support the biodiversity that originally relied upon the natural aqua-ecosystem while also enabling intensive rice cultivation systems that include fisheries, livestock, and plant species.

Rice is Livelihood: Rice, Employment and Income

The importance of managing rice-based ecosystems in a sustainable way is underscored by the strong relationship between rice production and local livelihoods. Rice is often the main source of employment, income and nutrition in many poor, food insecure regions of the world. In South Asia, where 530 million people live on less than US $1 a day, calories supplied by rice account for about 60-70 % of total food intake. Rice cultivation is the principal activity and source of income for about 100 million households in Asia and Africa. Post-harvest and transformation activities generated by rice production also employ a large share of the total labour force in Southeast Asia. Several countries are also highly dependent on rice as a source of foreign exchange earnings and government revenue.

Although global per capita demand for rice is declining, rice demand as a whole will continue to expand due to population growth and increasing consumption patterns in different regions, including Africa. In the past two decades, international rice prices have followed a marked declining trend, both historically and in relation to other cereals. This tendency has been fostered by technical improvements, which have resulted in a lower production cost per unit and sizeable gains in global production through the late 1990s. For many small farmers, the plunge in rice prices has been one of the major causes of poverty and hardship and has seriously undermined their household food security, encouraging migration from rural to urban areas. Rice farmers are also exposed to high degrees of risk due to the vagaries of weather and price fluctuations. For these reasons, rice is central to many government development and food security programmes. Given the direct relationship between the rice market and rural livelihoods, many governments intervene and play an active role in domestic rice price stabilization.

Rice and Post-Harvest Production Activities

Post-harvest rice activities support the livelihoods of more people than those who are involved in rice cultivation itself. The term, “post-harvest activities” refers to the suite of processes “from the floor to the fork,” including threshing, milling, processing, market transport and cooking. Although much progress has been made in the prevention of post-harvest losses in rice, in developing countries rice losses average between 15 and 16 percent. These rice losses are significant during critical operations such as drying, storage and milling. The major reasons for these losses are poverty, insufficient or scarce access to technical information and lack of access to appropriate technologies.

Rice is Life not only because of the food provided by its grains, but also because of the contribution of various parts of the rice plant to human life. For example, rice straw has been used as roofing material. A participatory assessment of farmers’ needs, therefore, is essential for an efficient post-harvest system because each stage of the process includes specific trade-offs. The contribution of post-harvest operations to economic development is often underestimated. The production, servicing and maintenance of tools, implements and equipment for harvest and post-harvest operations have created additional sources of employment for rural populations, while the trading of rice tools has supported the development of many manufacturing industries.

Gender in Rice Farming Systems

Women and men often develop different expertise and knowledge in rice farming systems. Women and smallholder farmers play an important role in both rice production and post-harvest activities, yet they often do not receive proportionate social and economic benefits when improvements in rice cultivation are initiated at the field level. For example, the introduction of high-yielding rice in Asia during the Green Revolution increased the need for cash incomes in rural households to cover the cost of improved rice seed and other inputs, which resulted in “urban flight” where men moved to cities to earn cash. This increased the need for female labour for farming tasks, thus increasing women's already high labour burden. In order to enhance the productivity of rice-based production systems, especially for smallholder farmers, a careful assessment of gender and labour roles is essential.

Studies show that women often encounter more limitations than men regarding access to critical productive resources and services. They face greater difficulties when trying to access credit, farm inputs, marketing facilities, extension services and information. Furthermore, members of smallholder farming households, in particular women, children, the elderly, and people afflicted by illness such as HIV/AIDS, may have different information needs. They often employ cultivation practices that help them to obtain livelihood benefits: they select crop varieties that maximise returns on scarce labour instead of focusing on increasing yield per unit of land.

National laws may give men and women equal rights to land but in practice this is not always the case. It is frequently observed (i.e. in Gambia) that the introduction of new rice-farming techniques, especially irrigation, have negatively affected women's rights to use certain rice

fields. As soon as the new technologies resulted in increased income, men gained control of the women's fields in order to capitalize on increased economic revenues. Real strides in poverty alleviation and improved livelihoods cannot be achieved if the female portion of the population is left behind. For this reason, there is a need to increase awareness on women's work in rice fields and a corresponding increase in information access for women on improved crop production techniques. Finally, there is an urgent need for equitable land and resource policies at the national level, with corresponding enforcement, to ensure that women can benefit from improvements in rice-based systems.

Rice Science

Rice science has made great advances. During past decades increasing demand for rice has been met mainly through yield-enhancing measures of the "Green Revolution" in the 1970s, which introduced improved rice varieties and improved production technologies. In recent years, effective application of research advances has been slow, especially in areas of physical stresses, such as drought, flooding, salinity and acidity. During the same period, the rice-consuming population has continued to grow, while land and water resources for rice production are diminishing.

Science provides the basis for improving the productivity and efficiency of rice-based systems. Improved technologies enable farmers to grow more rice on limited land with less water, labour and pesticides, thus reducing damage to the environment. In addition, improved plant breeding, weed and pest control, water management, and nutrient-use efficiency increase productivity, reduce the cost, and improve the quality of the products of rice-based production systems. New rice varieties are under development that exhibit enhanced nutritional value, minimize post harvest losses and have increased resistance to drought and pests. Recent advances in hybrid rice and the new rice for Africa (NERICA) are just two examples of the contributions of science to the development of rice. Furthermore, public and private research institutions have worked together to determine the nucleic acid sequence of the entire rice genome. The resulting DNA database will assist in the creation of a new generation of rice varieties, including – in the not distant future – varieties with improved nutritional qualities. Partnerships between CGIAR centres, National Agricultural Research Systems and the private sector, especially in the area of modern biotechnology, should be strengthened to improve rice quality, productivity and efficiency in rice production.

Economic Policy Issues

With few exceptions, major rice producing countries are also large rice consumers. Governments are often confronted with the classic policy dilemma of keeping prices low for poor consumers, while keeping them attractive to producers. Traditionally, the need to resolve these conflicting interests has led to a large degree of government intervention in the sector, making rice one of the most heavily protected agricultural commodities, subject to price stabilization measures and high tariff and non-tariff barriers. This high level of protection has contributed to the low levels of international trade in rice, which currently accounts for only 4-6 percent of global production, compared with about 12 percent for maize and 18 percent for wheat. However, this situation began to change in the 1980s, with the implementation of structural adjustment programmes and,

in 1994, with the WTO Agreement on Agriculture, which provided the basis for reduced government intervention and trade liberalization.

Under the new international trade environment, world trade in rice is expanding strongly, with a growing number of countries relying on imports to meet their domestic needs, especially in Africa. While the benefits of the opening to trade have accrued mainly for urban consumers by enabling them to buy rice at lower prices, most of the brunt has been borne by the small, poor farmers in the developing countries, who lack the safety nets and income assistance programmes available to their counterparts in the developed countries. Developing countries are now confronted with the challenge of keeping abreast of the trade liberalization momentum to reap the benefits associated with a more efficient allocation of resources, while also providing some alleviation to the plight of small producers, especially those who will find it difficult to move to other sectors of the economy during the transition. Some developed countries, however, will face the dilemma of opening their borders to rice from low-cost producers, while at the same time preserving the cultural heritage and environmental benefits associated with rice production systems.

The IYR: Challenges and Opportunities

The significance of rice-based systems to issues related to nutrition, the environment, agro-diversity, livelihoods, food security, science and policy for the entire community involved in rice production, processing and consumption implies that improving these systems holds considerable challenges and opportunities. The IYR aims to confront the issues associated with rice-based systems in a global, coordinated framework in order to positively harness the potential of properly managed rice-based systems. The following discussion examines the facets of the rice prism to identify the size of the challenges and the opportunities for synthetic solutions that benefit rice-based systems as a whole.

Improving Nutrition and Food Security

Many diverse aspects within the rice-based system can be considered in order to improve nutrition. Changing processing techniques and improving the nutrient content of the varieties produced are further strategies to improve nutritional status. These include strategies to increase dietary diversification through the promotion of complementary crops and livestock or fisheries activities within the rice-based system. This will enhance household food security both through improving producer income as well as adding essential fatty acids, vitamins and minerals to the diet.

Current and future challenges relate to transmission of information to governments and consumers about improving food security in rice-based communities, as well as the dissemination of technologies and appropriate practices. In order to move forward with the appropriate and safe use of new food technologies, consumers and producers must be better informed of the potential benefits, risks and limitations of new technologies such as biotechnology. The “golden”rice—a product of genetic engineering—is being evaluated by international and national research systems. A safe “golden”rice variety, if adopted, would provide more vitamin A to the rice-consuming population. The IYR can help nations develop the infrastructure to support and

regulate these advances, including adequate systems for the transfer of appropriate technology and methods of monitoring changes in food security in rice consuming countries. Finally, the IYR can help increase awareness on the need to support the diversity of rice genetic resources and living organisms in rice-based systems for complete nutrition in a varied diet.

Managing Water Resources in Rice Ecologies

Diversity in rice-based systems is largely supported by water. There is, however, growing concern over the sustainability of global fresh water resources and the need to justify large amounts of fresh water use has become more important. The IYR can help to better understand the cost and benefit of water use in rice-based systems. At present, there are two prevalent approaches for rationalizing water scarcity within rice-based systems. The first approach aims at reducing the amount of water required for cultivation. It includes the development of rice varieties that are better suited for dry soils including aerobic rice varieties, and reduction of the ponding system at the field level by introducing intermittent irrigation, improved irrigation systems and strengthened management practices. The second approach focuses on justifying water use by employing each drop of water for multiple uses - an example being the concurrent use of water both for irrigation and aquaculture. It emphasizes that water management techniques must be introduced consistently with the system so that water savings at the field level do not deprive other existing uses.

Considering the multiple uses of water at the rice system level, it is inaccurate to accuse rice production as wasteful. The IYR can help raise awareness among the many beneficiaries of water in rice fields such as the diversity of life forms that are sustained within the rice-based system. This is not highly dependent on creating new scientific and technological approaches, but it does require more stakeholder participation at all levels and some institutional arrangements.

The possibility that water availability may become more limited in the foreseeable future is high, and necessitates the cultivation of rice in low water regimes. This would lead to changes in water and nutrient management, cropping patterns and tillage practices. A changed scenario would provide for enhanced soil aeration with plausible consequences of soil organic matter depletion, decline in carbon sequestration, enhanced emissions of nitrous oxide, reduced methane emissions and lower soil fertility. Increased productivity and resilience of irrigated rice ecosystems, under possible water resource constraints, requires further technological development and management interventions.

Environmental Protection

There are a growing number of environmental concerns in rice production. The indiscriminate use of pesticides and inefficient use of fertilizers need to be confronted, as do the emissions of carbon dioxide, methane, nitrous oxide and ammonia. Air, water and soil pollution is exacerbated by increased fishing pressure, degradation and loss of wetlands through development, destruction of fish breeding grounds, illegal fishing tools and the introduction of exotic species together exerting immense pressure on the terrestrial and aquatic biodiversity in rice-based ecosystems.

It should also be noted that rice-based ecosystems host a wealth of "hidden" biodiversity within small scale farming systems, which are often managed by women. It is characteristic that up to nearly 90 per cent of the planting material used by poor farmers is derived from seeds and germplasm produced, selected, and saved by the farmers themselves. Knowledge regarding in-situ conservation and "hidden" biodiversity often remains unrecognized at technical and institutional levels. However, these seeds and germplasm represent generations of local genetic resources and the IYR can help spread awareness of the importance of preserving bio-genetic resources.

Environmental resource protection is of increasing public concern, and has been reflected in a growing number of international agreements such as the Convention on Biological Diversity and the Framework Convention on Climate Change. The attention now being given to protecting the environment has to be channelled into action complying with these agreements using an ecosystem approach that considers all the various issues related to rice development and the complexity of rice-based agro-eco-systems. The IYR will help to exchange concrete ideas on these environmental issues and related challenges and opportunities among the various stakeholders.

Enhancing Productivity: New Technologies with the Efficient Use of Resources

Enhancing the productivity of rice-based systems in a sustainable manner requires a three-pronged strategy: firstly, increasing the efficiency of land, water, labour, seed and fertilizer inputs through improved crop management techniques; secondly, improving post-harvest operation activities; and thirdly, developing and making available new rice technologies through science. Enhancing productivity requires improvements in national capacity that can be achieved through increased training and information exchange. Nations also require the capacity to develop new technologies, assess their safety, and transfer them into the field.

Closing the Yield Gap: Improving Crop Management Techniques

Most existing rice varieties, particularly the high yielding varieties and hybrids, have a potential yield that exceeds actual yield. Furthermore, there is considerable variation in the actual yield levels achieved even under similar production systems. The gap reflects numerous deficiencies due primarily to inadequate crop, nutrient and water management practices. Improved crop management technologies are available but many have not been widely introduced, tested or modified to suit local conditions. Methods for improving technology transfer include innovative means for sharing and exchanging knowledge and technology among research institutions and providing services to growers without large public sector support. Successful examples such as the Farmer Field School exist and can be more widely promoted. However, the institutions providing support, especially the extension agents at local levels, have limited funding and inadequately trained staff.

Soil-nutrient management is also an important aspect of improving crop management techniques for enhanced productivity, through the adoption of nutrient-efficient rice varieties, improved nitrogen placement methods and the use of appropriate diagnostic tools. Integrated management of pest, weeds and diseases in rice production with the use of a combination of resistant varieties,

natural enemies, good agronomic practices and the timely application of appropriate pesticides with the appropriate dosage has proven to be more economically and environmentally sound. Integrated Pest Management promotes the development of agricultural biodiversity in rice fields. These management techniques can be achieved by improving information flow from agricultural research institutions to the farmers.

It follows that limitations in crop management are interlinked and require a fully integrated system approach, also known as Rice Integrated Crop Management (RICM), which holistically combines variety, soil and water, nutrients, pests and other crop management practices for optimum economic efficiency and environmental sustainability. The IYR can help promote information exchange and the use of the RICM approach for "good agriculture practices," a phrase that encompasses the concept of using inputs more efficiently for increased productivity and economic return. It ensures that environmental and social aspects are taken into consideration at each decision point in the production chain.

The Systems Approach to Post Harvest Operations

The post-production system for rice has become a stimulus for growth with the introduction of high yielding varieties of rice and improved crop management. Small-scale rice producers dominate production systems in the low-income countries, and require considerable help to keep abreast of changing technological and economic innovation if they are to remain competitive. The IYR can increase awareness as to the importance of improving information mechanisms from the national level to the local level through "training and extension" services. In particular, the IYR can emphasize the importance of "adding value" to rice products, a term that refers to processing activities that strategically use all parts of the harvest for economic return. For example, the polishing process causes a low-value broken rice, which can be transformed into rice flour. This product can then be transformed into high-value rice pellets to feed fish or into rice noodles for people for increased farmer income and livelihood.

Harnessing Science: Development, Safety Assessment and Technology Transfer

High-yielding rice varieties, hybrid rice and the recently developed NERICA rice are available to achieve higher or more stable productivity in different ecological zones. Though science has the potential to positively address almost every aspect of *Rice is Life*, there continues to be a number of challenges confronting the scientific community working on varietal improvements, which must be considered in a longer-term perspective. Still, opportunities exist for facing the challenges. Raising the yield ceiling can be achieved by a redesigned rice plant with improved yield potential and the development of hybrid rice for the tropics. For example, international research institutions collaborating with national institutions can bring a broader approach to confronting genetic uniformity and erosion leading to an end product that is highly vulnerable to major biological attack, as well as encouraging adoption of varieties having more nutritional quality, and the integration of varieties requiring less water and fertilizer in rice-based production systems. Collaboration amongst these institutions and other stakeholders also has an important role in promoting a scientific understanding of biotechnology developments that enhance breeding. Many rice lines have been developed through the application of biotechnology tools. Future food and nutritional security will depend on availability of rice varieties with higher yield

potential, durable resistance to diseases and insects, tolerance to abiotic stresses and higher levels of micronutrients in the grains. Biotechnology research can also help scientists to understand the traits in new rice varieties that confer resistance, stabilize yields and help sustainable rice production.

The successful mapping of the rice genome in 2002 has further increased the potential for science. Through genetic alteration, the yield potential of rice could increase, while disease, weed and pest resistance and tolerance to drought and salinity could be achieved without harming the environment. However, these opportunities create new imperatives for biosafety, field testing, and capacity building within nations to ensure that the new innovations benefit local people and do not incur long-term costs on the environment. The IYR presents an opportunity for developing countries to acquire assistance to increase capacity building and establish biosafety regulations, as recommended during the Twentieth Session of the International Rice Commission, held in Bangkok, 2002.

National research programmes, the China experience

The importance of national level programmes for technological and scientific development has been demonstrated by China in the case of hybrid rice varieties. Chinese scientists initiated hybrid rice breeding efforts in the late 1960s and the first commercial hybrid was introduced in 1974. In the year 2000, it was estimated that hybrid rice was cultivated on approximately 16 million hectares in China and the technology is being successfully transferred to other Asian countries. This model illustrates both the success of hybrid varieties, and the importance of national level programmes for an entire region. 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. F_1 seed production is more costly than seed production for high-yield rice varieties, although the yield rates of hybrids offer a significant return on initial investment. The investment barrier for F_1 seed production represents another challenge to a sustainable increase in rice production.

Traditional Rice-based Agricultural Systems: Heritage for the Future

World cultural heritage has evolved with rice development and specific agro-ecological features of the landscape. IYR activities will include awareness raising on the importance and functioning of benchmark rice-based systems, as well as activities for their safeguarding and enhanced viability. Emphasis will be placed on redressing the erosion of such systems; a major opportunity rests in the inclusion of outstanding rice-based systems in the Globally Important Agricultural Heritage Systems (GIAHS) Project, a multi stakeholder, multi-agency initiative for the global recognition, dynamic conservation and sustainable management of agricultural heritage systems. This initiative is expected to lead to the creation of a new category of World Heritage for Agricultural Heritage Systems under the World Heritage Convention.

Rice in the Institutional Context

In the wake of reduced capacity in national agricultural research and extension, non-governmental development partners, including civil society organizations and the private sector have, in some cases, begun to work with governments on sustainable agriculture and rural development. Good examples of such partnerships can be found within the context of smallholder rice, such as expansion of NGO-facilitated farmer field schools on Integrated Production and Protection Management programmes throughout Asia, and more recently, in Africa. More partnerships are required, however, to increase farmer access, particularly among women, to land, credit for investments in resources and information access to new technologies and innovations. Expanding and widening partnerships, including the private sector, will be a central challenge in many countries.

Intergovernmental regulatory instruments affecting agriculture are becoming more prominent and of key importance for major crops like rice. For example, the negotiations related to: food quality (CODEX); climate change; to trade including non-tariff trade barriers; to biological diversity and related issues of safe movement of modified living organisms; to the recent treaty on plant genetic resources to assure equal access and benefit sharing all affect crops like rice.

The Challenge and Opportunity for Synergy

The overall challenge for rice-based systems is to identify and execute synergetic solutions for rice development. “Synergy” is the concept that the whole can be greater than the sum of its parts, but this is only possible if decision makers, technicians, farmers and civil society are well aware of the many factors related to sustainable rice production. The IYR aims to be an “information broker,” a mechanism for increasing information exchange amongst all levels in the rice-production chain and across nations for a synergetic approach to rice development.

The IYR provides an opportunity for harmonization of the different facets of rice-based systems to enhance the role of rice for human needs now and in the future. Diverse elements in rice-based production systems have different requirements in terms of water, land and labour resources; these could be mutually beneficial under certain sets of management regimes but destructively competitive under other sets of management techniques. Therefore, there is an urgent need for harmonization of diverse policy instruments, which are often under the auspices of different ministries, for sound policies on rice development. The IYR is an opportunity to improve the management of rice-based systems through information exchange, technology transfer, and concrete action.

IV. A Conceptual Framework for IYR Implementation

The preceding sections of the Concept Paper have outlined the history of the IYR (section 1), described the main components that must be considered for sustainable rice development (section 2), and discussed issues that the IYR 2004 can address (section 3). This next section shall discuss the framework, strategy and expected outputs of IYR implementation.

The IYR Framework

The fundamental objective of IYR implementation is to promote and help guide the efficient and sustainable development of rice and rice-based production systems now and in the future. In order to meet this overarching goal, the IYR strategy will focus on the following **intermediary objectives:**

- Increase public awareness, at all levels, on the contributions of rice-based systems for food security, better nutrition, poverty alleviation and livelihood improvement.
- Increase public awareness on the diversity and the complexity of rice-based production systems, as well as the challenges and opportunities for sustainable development of rice-based production systems.
- Promote, and provide technical support to ensure sustainable development of rice and rice-based systems at the global, regional, national and community levels.
- Promote the conservation and enhancement of rice-based products for economic, social, cultural and human health aspects of the population.

In achieving its objectives, the IYR is committed to the following **guiding principles**:

- a participatory, consultative, innovative and proactive approach, which acknowledges the ability and capacity of all stakeholders;
- the recognition of the differences in agro-ecological and socio-economic-cultural conditions of the rice and rice-based production systems and the constraints relative to their sustainable development in different regions, countries, and communities;
- harmonization of effort, contribution and participation among all stakeholders through an agreed upon framework.

The **framework** of the IYR shall consist of an organized system of partners at the global, regional, national and local level. As the nominated lead organization for the IYR, FAO has established an IYR Coordination and Implementation Unit to coordinate IYR activities at all levels. The IYR Coordination and Implementation Unit recognizes the efficiency of a programme approach, where Member Countries form National and Regional Working Groups for the IYR and organize IYR observance as is regionally and nationally required; this implementation platform is based on the premise that Member Countries can best serve local people, with cooperation from NGOs and the private sector. FAO will ensure a coordinated effort among the national and regional satellite groups.

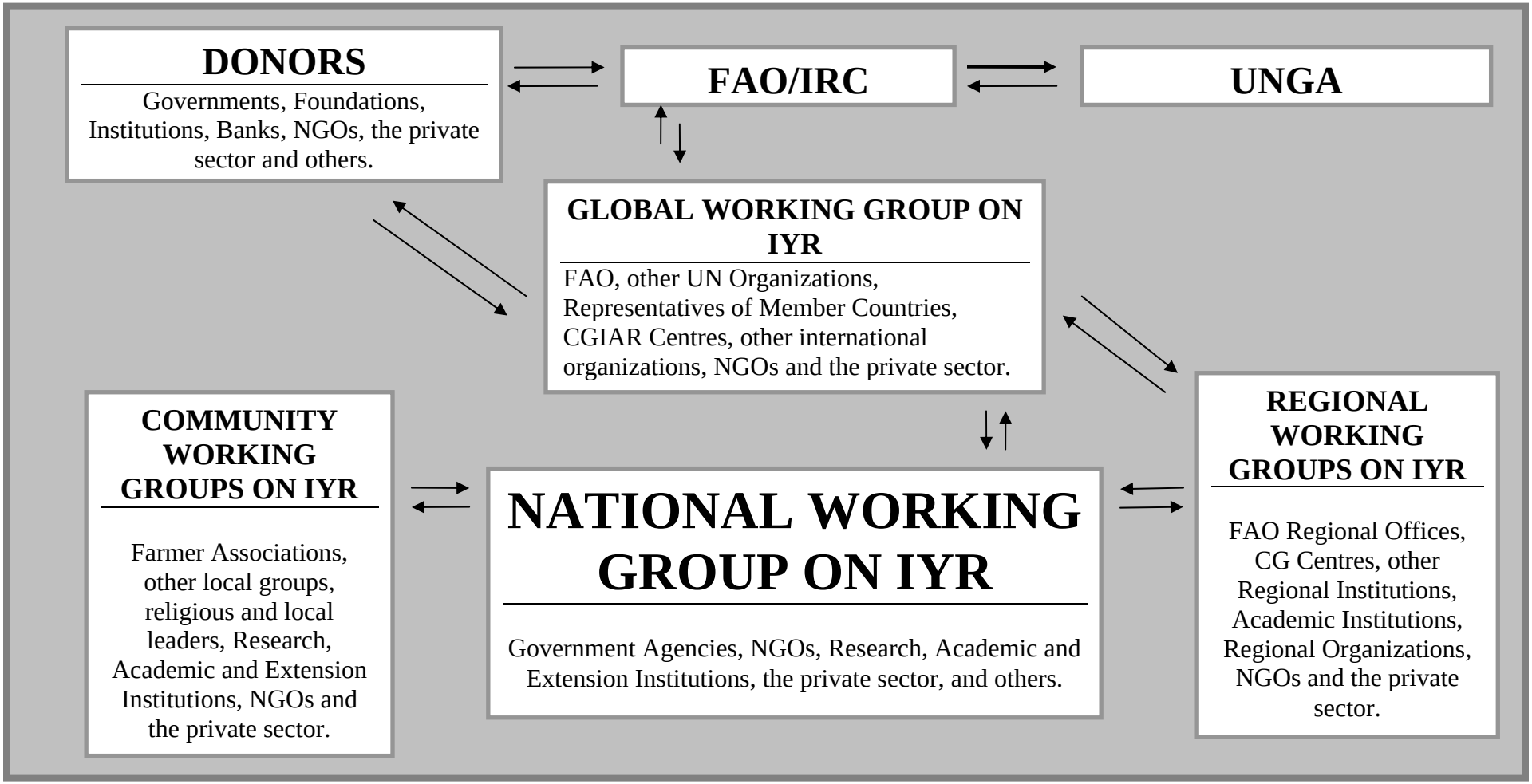
At the global level, coordination of the IYR activities will be the responsibility of an Informal International Working Group, which consists of representatives from the different groups of stakeholders. Daily management will be undertaken by the Secretariat of the International Rice Commission, hosted by the Crop and Grassland Service at FAO. The IRC Secretariat receives guidance and support from the Senior Management of the FAO Agriculture Department and the FAO Organizing Committee for the implementation of the IYR. In addition, the team will be assisted by short-term and long-term consultant experts.

The need for all stakeholders to work together for sustainable rice development was expressly acknowledged by the UNGA when it nominated the following major partners to work together for the IYR:

- *FAO:* As the lead IYR organization, FAO will draw on past expertise in rice development, as cultivated in its role as host for the International Rice Commission (IRC)[1] and the Inter-Governmental Group Working on Rice (IGGR). In addition to its Headquarters, FAO has Regional, Liaison and Representative Offices across the world and therefore has the infrastructure and capacity to coordinate a global awareness and action campaign.
- *The United Nations agencies and other international developmental and research organizations, especially the CGIAR centres:* International agencies provide critical contributions to the development of rice-based production systems through a large number of programmes, agreements, research initiatives and other measures to address sustainable development constraints. There are a growing number of conventions and international commitments to be recognized in the development process.
- *Member Governments of both rice producing and consuming countries:* National institutions and local authorities provide the broad political, technical, economic and social framework that foster development; their public institutions have an important responsibility in ensuring that sustainable strategies and approaches are promoted and facilitated.
- *Non Governmental Agencies (NGOs):* These groups generally enjoy strong relationships with local communities through an array of grassroots projects. They are keenly interested in new means for fostering sustainable development and are very skilled in ensuring that these innovations reach local people.
- *Farmer associations and rural communities:* These groups are essential as they bring local knowledge and practical expertise to the negotiation table and the IYR is committed to ensuring that these groups benefit from improvements in rice production.
- *The private sector:* This sector can influence most factors important to rice development, especially with regard to improving the efficient use of production inputs and processing methods. The private sector is now engaged in many research and development activities that were previously in the public domain. The ownership of agricultural technologies will present both challenges and opportunities for rice in the future.

[1] With respect to the stagnation of world rice production, the Conference of the Food and Agriculture Organization of the United Nations (FAO) at its Fourth Session in 1948, having reviewed the deliberations of the Third Session of the Conference of the Organization and the International Rice Meeting held at Baguio in the Philippines, decided to establish the International Rice Commission to promote national and international action in matters relating to the production, conservation, distribution and consumption of rice.

IYR PLATFORM



The IYR Strategy

The basis of the IYR implementation strategy is to engage the entire community in initiating combined and mutually beneficial actions for facing the challenges associated with a sustainable increase in rice production. This is to be achieved through the following **activities:**

- Collection and analyses on the relationship between rice-based systems and the global concerns as described in the "Rice is Life" section of this paper.
- Establish and conduct a sound multi-media communication strategy to disseminate information on rice-based systems which will assist Member Countries and regional institutions in the formulation of medium and long-term strategies for sustainable rice development. FAO, in close collaboration with other partners, will produce information packages and identify existing documentation for IYR use. FAO will also prepare country guidelines for National Working Groups on the IYR and ensure that the IYR international website is frequently updated with news from all levels on IYR observance.
- Organize and support global, regional and national workshops on rice-based systems. Key areas for consideration have been identified by the participants of the Informal International Planning and Coordination Meeting for the implementation of the IYR, held 6-7 March 2003, Rome, Italy.
- Conduct case studies to generate additional information and knowledge on particular aspects of rice-based systems.
- Organize and support global, regional, and national contests and exhibitions on rice and related issues.
- Provide technical support to Member Countries and farming communities in the formulation of strategy, programme and projects to support the sustainable development of rice and rice-based production systems.

Given that the IYR is a global awareness and action campaign, **reporting activities** are necessary to increase awareness on successful IYR initiatives, and they shall accompany all of the actions which are listed above. Reporting activities include the periodic monitoring of and advising on individual stakeholder activities through communication channels and networking arrangements. A final report on the activities and achievements of the IYR will be prepared by FAO in collaboration with the Informal International Working Group, for submission to the Secretary General of the UN and to all stakeholders. In addition to reporting on the outcome of the IYR, the document will also identify priority areas for follow-up activities beyond 2004.

In order to make IYR activities a success, **adequate funding** is essential. FAO will contribute considerable human resources from Headquarters and its decentralized regional, sub-regional and country offices. However, voluntary contributions from a wide range of sources will be necessary to implement the activities envisaged for the IYR. To meet these requirements, FAO proposes to establish a Trust Fund for the IYR covering the period from 2003 to 2005. In addition to using traditional relationships with multilateral and bilateral organizations, diversified and innovative fundraising approaches will be developed for seeking additional financial support from all stakeholders and private sources. Finally, the IYR strategy will make efficient use of its resources

by using IYR funds to help establish and inform National Organizing Committees for the IYR. These committees can continue to develop the vision of the IYR beyond 2004.

Expected Outputs

The IYR 2004 is not simply a one-year effort, to be forgotten in 2005. Therefore the IYR strategy will be to employ the Year as a catalyst for information exchange and the initiation of medium and long-term programmes for sustainable rice development. For this reason, the establishment of IYR Committees at the National and Regional level is an essential aspect of the Year and FAO places particular emphasis on supporting the formulation of national programmes and development strategies for the medium and long-term. To achieve its objectives, observance of the IYR is expected to result in a number of outputs at all levels that increase understanding, provide development guidance and act as a catalyst for longer-term action.

Global outputs:

1. Published information on existing and planned international activities leading to scientific and economic contributions to efficient and sustainable rice development approaches and practices.
2. Examples of the transfer of successful economic and technology methods at national and local levels.
3. Dialogue and demonstration at the international level that contributes to heightened awareness of the importance and linkages of international inputs to the development efforts.
4. Strengthened communication networks between global partners and those at other levels.
5. Agreed approaches for strengthening the linkage between research and development projects and activities at the global level with those at regional, national and local levels.
6. Global recognition and improved understanding of outstanding rice-based agricultural heritage systems.

Regional outputs:

1. Contributions to regional conferences, consultations and meetings that improve awareness of challenges and opportunities relating to sustainable development of rice and rice-based production systems.
2. Enhanced communication and networking systems for linking IYR partners both within and outside the region, and at all other levels.
3. Examples of regional initiatives and activities that have contributed to sustainable development of rice-based production systems.

National outputs:

1. Published guidelines and approaches for national policies for sustainable development of rice and rice-based production systems and examples of their successful implementation.
2. Educational and training material on IYR related issues will be developed and issued in appropriate formats for distribution to educational, vocational training, and technical institutions. They will be made available to all partners.

3. Networking mechanisms will be established for information dissemination and for monitoring the implementation of activities for sustainable development of rice-based production systems.
4. National projects will be formulated and initiated for implementing policies and programmes that are required for sustainable development of rice and rice-based production systems within the national agricultural development context.

Community outputs:

1. Programmes for strengthening the linkages between partners at the local level will be designed and implemented.
2. Networking between local, national, regional and international partners will be developed and implemented.
3. Mechanisms for ensuring local empowerment and participatory approaches in resource use and general rice development decisions will be established.

Beyond 2004

The IYR will establish a framework for enhancing sustainable development of rice-based production systems and provide some of the means for achieving sustainability. However, sustainability must be rigorously pursued following the conclusion of the IYR. When reporting on activities and observance of the International Year of Rice, proposals that highlight priorities, make use of lessons learned and garner support for future action at all levels will be presented. After observance of the IYR in 2004, FAO will collaborate with partners in establishing and assisting follow-up activities.

V. Concluding Remarks

The UNGA decision to observe an International Year of Rice is timely. It offers an important opportunity to use a collective approach towards resolving increasingly complex sustainable development of rice and rice-based production systems, which have important technical, political, economic and social dimensions. More than half of the world population relies on rice for its staple sustenance, particularly in developing countries. Myriad rice recipes, uses and products illustrate the international appeal and cultural significance associated with the food. By-products of rice are fed to livestock, fish, other aquatic organisms and wildlife. Rice and rice by-products are the starting point in many food chains that lead to daily food on the table. Rice cultivation and post-harvest activities provide employment to several hundred million people in low-income countries, thus improvements in rice-based production systems are closely linked to poverty alleviation. Rice and rice-based production systems maintain water, assist in land reclamation, provide a habitat for fish, livestock, beneficial insects and wildlife, help reduce soil erosion, aid in carbon sequestration and their natural beauty can be harnessed for economic initiatives related to eco-tourism and cultural awareness activities. The complexity, diversity and utility of rice-based ecosystems underscore the need for a coordinated, international approach to sustainable rice development. The mission of the Year is to achieve a more sustainable increase in rice production, thus leading to less hunger, better nutrition, less poverty and a better life.