REPORT OF THE

SIXTEENTH SESSION OF THE INTERNATIONAL RICE COMMISSION

International Rice Research Institute (IRRI)
Los Baños, Philippines
10-14 June 1985

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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Implementation of Rice Projections toward the Year 2000

(i) More attention should be paid to rice deficit regions, particularly Africa.

(ii) Technologies involving low cost and low input requirements should be evolved for the more vulnerable sections of farming communities.

(iii) A well established seed production and distribution industry is required in many African countries.

(iv) Countries with a long history of successful rice production should pass on their knowledge to other interested countries.

Rice Production and Trade in Asia and the Pacific

(i) Appropriate rice-based farming systems should be developed for the small scale Asian rice farmer.

(ii) More attention should be paid to rainfed and problem soil areas and to the control of pests and diseases.

(iii) Several countries in the region may need additional support to accelerate rice production.

Adoption, Spread and Production Impact of Modern Rice Technology in Asia, Latin America and Africa

(i) Government policies should be implemented to raise the purchasing power of the more vulnerable sections of the population, thus creating a more favourable climate for increased rice production.

(ii) Donor agencies are requested to pay special attention to WARDA to overcome its financial and operational difficulties.

The Diversification of Rice Production

(i) Countries with rice surpluses should breed rice for animal feed and other industrial purposes.

(ii) Research should be accelerated to improve the quality of the rice biomass.

(iii) Non-traditional wheat growing countries keen to develop rice/wheat production should establish links with national and international bodies involved in this work.

(iv) More efforts should be made to integrate forage production with rice production.

(v) Rice/fish farming should be vigorously promoted among subsistence rice farmers.

(vi) International assistance should be sought to establish research facilities for rice straw/mushroom culture.

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(i) Still earlier maturing varieties should be bred for drought conditions in Africa.

(ii) Development of rice varieties should not be restricted to semi-dwarf types.

(iii) Germplasm from indigenous rice varieties should be conserved.

(iv) IRRI and national institutes should evaluate the ratooning characteristics of rice varieties.

(v) The applicability of new irrigation methods for rice should be evaluated, particularly those aimed at conserving water.

(vi) All possible steps should be taken to ensure the efficient use of fertilizer to increase productivity and profitability.

(vii) Efforts should be made to transfer appropriate technology based on low-cost inputs to maximise the efficient use of fertilizer.

(viii) A long-term plan to develop a rice processing machinery industry should be prepared.

(ix) A regional cooperative programme should be established to test and evaluate rice milling equipment.

(x) FAO should provide the focal point in Asia and the Pacific Region to monitor the progress of work on parboiling.

(xi) A study should be made to determine at what stage during parboiling aflatoxin contamination occurs.

(xii) A focal point should be established to investigate technologies to produce nutritious foods from rice.

(xiii) The ongoing FAO/UNDP intercountry cooperation project on post-harvest technology and quality control of food grain should be used as a focal point for the exchange of information on post-harvest rice grain investigations.

Recommendation by the Commission for the Attention of Delegates to the 17th Session

A report should be prepared by delegates summarizing the progress made in carrying out the recommendations of the 16th Session.

1. INTRODUCTION

The Sixteenth Session of the International Rice Commission was held at the International Rice Research Institute (IRRI), Los Banos, Philippines from 10 to 14 June 1985. The Session was attended by 63 representatives from 37 of the Member Nations of the Commission, 10 observers from other Member Nations of FAO and 10 observers from the Philippines.

Forty four observers from 7 international organizations also participated.

The list of Members of the Commission is attached as Appendix A and the list of delegates and observers as Appendix B.

1.1 Election of Chairman and Vice-Chairmen

The Commission elected H.E. Salvador Escudero III, Minister of Agriculture and Food, Republic of the Philippines, as Chairman of the Commission; Mr. Neil Rutger (USA), as First Vice-Chairman of the Commission and Mr. Charles Rajafindrakoto (Madagascar) as Second Vice-Chairman.

1.2 Adoption of the Agenda

The Agenda as adopted is set out in Appendix C.

1.3 Address by the Honourable Minister of Agriculture and Food

The Commission was addressed by H.E. Salvador Escudero III, Minister of Agriculture and Food, Republic of the Philippines (Appendix D), Chairman of the International Rice Commission.

1.4 Address on Behalf of the Director General of FAO

The Commission heard a statement from Mr. S.S. Puri, Assistant Director-General and Regional Representative for Asia and the Pacific, on behalf of the Director-General of FAO (Appendix E).

1.5 Address by the Director General of the International Rice Research Institute (IRRI)

The Commission was addressed by Mr. M.S. Swaminathan, Director General of IRRI (Appendix F).

2. IMPLEMENTATION OF RICE PRODUCTION PROJECTIONS TOWARD THE YEAR 2000

The Commission expressed its satisfaction with the presentation of this paper (IRC 85/2) and noted that the review of the long-term strategy for rice production, based mainly on FAO's study of Agriculture Toward 2000 revealed considerable disparities in the progress made.

While expressing satisfaction that many developing countries in the Far East (including China) had increased production much faster than the average rates projected for the whole of the 1980's, the Commission was concerned that in some countries there may be surpluses which could be difficult to dispose of on world markets.

The Commission emphasized that some shift in priorities appeared to be necessary in other developing regions where production increases have been somewhat disappointing, and where it seemed unlikely that countries would catch up with the rates of increase projected for the rest of the 1980's. In the Near East the area under rice has declined and the yield per hectare in Africa has also declined. In both of these regions and also in Latin America, rice imports have increased rapidly. Because of the

great disparities in progress achieved, the Commission concluded that some greater regionalization of rice strategy seemed appropriate.

More generally, the Commission felt that the aim should be to maximize the contribution rice can make to economic and social development through productive and diversified farming systems based on rice, particularly among poorer farmers and in difficult environments such as the Sahel.

Although the Commission agreed that the long-term strategy for rice development must come from the governments of developing countries, it also felt strongly that more international assistance was required. It stressed that priority areas for the future implementation of development assistance might include the strengthening of national research institutions; the evaluation of delivery systems; and the training of skilled manpower. In addition assistance might be sought for adequate supplies of imported chemical fertilizer; the rehabilitation and improvement of irrigation works; seed industry development; and the reduction of crop losses, including the modernization of the rural milling industry.

2.1 Recommendations

The Commission recommended that:

(i) more attention be paid to rice deficit regions, particularly Africa, and that appropriate technologies be developed and resources allocated to rainfed upland and rainfed lowland areas to obtain at least the same rate of production increase as in Asia;

(ii) while maintaining the momentum of research and development on intensive rice cultivation, more emphasis should be given to the technology needed for less favourable rice ecologies and the poorer farming communities. This should aim toward low cost and low input requirements;

(iii) in countries where the seed industry is not fully developed, such as in most countries in Africa, an efficient seed production and distribution industry should be established as quickly as possible;

(iv) several rice producing countries have a long history of success in producing high yielding rice varieties; development in rice agronomy; pest control; weed management; post harvest handling; and rice based cropping and farming systems. Such valuable experiences should be passed on to other interested countries in the spirit of the technical cooperation programme among developing countries (TCDC).

3. RICE PRODUCTION AND TRADE IN ASIA AND THE PACIFIC

The Commission reviewed the paper IRC.85/4 and expressed satisfaction with its content.

The Commission noted the pre-eminent position of the Asia and Pacific Region which produced 92 percent of the world's rice. The Commission expressed satisfaction that production between 1974-1984 had increased at an average annual rate of 3.2 percent, which was slightly higher than the rate projected in the FAO Study on Agriculture Toward 2000. During the same period the Region's population grew by about 2.1 percent. Even so, for the Region as a whole, the per caput production of paddy increased by 1.1 percent.

The Commission noted that the Region's self-sufficiency in rice had increased to 102 percent, which had resulted in a net trade balance of 5 million tons of rice in 1984.

The Commission noted that increased adoption of modern varieties; increased application of fertilizer (increasing annually by about 10 percent); and the expansion

of irrigated areas were responsible for the satisfactory performance of the Asia Pacific Region.

3.1 Recommendations

The Commission recommended that:

(i) as most Asian rice farmers are small scale farmers, appropriate rice-based farming systems should be developed for them;

(ii) greater attention should be paid to rainfed rice and problem soil areas and more research is required to curb the increasing incidence of pests and diseases;

(iii) although the Asia Pacific Region as a whole had made satisfactory progress in rice production during the past decade or so, there are several developing countries in the Region which will need to pay particular attention to accelerated rice production to meet fast growing local demand. To achieve this objective they may need additional support. At the same time the momentum in countries which are already increasing their rice production should be maintained.

4. STATEMENTS OF THE RICE SITUATION IN MEMBER NATIONS OF THE COMMISSION

The Commission reviewed papers 85/5 and expressed appreciation with the scope and content of the country statements.

4.1 AFRICA

4.1.1 Burkina Faso

The Commission noted that Burkina Faso has some 41 000 ha of rice. Rural consumption is 4 kg per head per year, but in Ouagadougou the capital, per caput consumption reaches 58 kg per year. There are three rice ecologies, the most important being lowland rice which covers some 38 000 ha. Upland and irrigated rice cover the remaining area. The main constraints to rice development are lack of a clear strategy for increased rice production and lack of research on lowland rice. Improvements are also needed in rice milling and marketing.

4.1.2 Egypt

The Commission noted that the acreage under rice in Egypt over the last five years has tended to decrease and it amounted to 985 000 feddans 1/ in 1984. The decrease is due to farm labourers leaving the land to work for petroleum producing countries where they obtain higher wages. This has caused production costs to increase and some rice producers have shifted to producing other crops. The average yield of paddy is about 5.74 t/ha and total production in 1984 amounted to about 2.2 million tons. Intensive activities are being undertaken by the Ministry of Agriculture to raise the average yield of paddy per feddan through the introduction of high-yielding varieties and better cultural practices.

4.1.3 Gambia

The Commission noted that rice is the most important crop in the Gambia, accounting for 40-45 percent of the total cropped area. In spite of an increase in annual production as a result of opening up new land, domestic production is still insufficient to cope with demand. Rice is grown under three regimes: upland; swamp (inland, mangrove and riverine grassland); and irrigation.

1/ One feddan is about 0.4 ha.

Ecological and economic conditions favour extensive swamp and upland rice production, but at present the national thrust is toward irrigated rice production which is subsidized at 70 percent of production cost. The scope for increased production is enormous, but is limited by lack of capital investment; insufficient trained personnel; the need to determine priorities for production; and the need for better research strategies.

4.1.4 Ghana

The Commission noted that annual production in Ghana had increased from 55 000 t a year in 1970 to 66 000 t in 1984. This was brought about by mechanization in the northern regions and to the use of improved seed. Lowland seasonally flooded areas account for about 85 percen tof the total rice area. The true rainfed area is about 10 percent and irrigated land accounts for only 5 percent of the total rice area. Ghana has soils for rainfed rice production. About 6 million ha of well-watered land exist in the forest zone. In the savana land of the northern part of Ghana, about 4 million ha are suitable for rice cultivation. Compared with some countries, productivity is low, ranging from 590 kg/ha in 1982 to 1 158 kg/ha in 1984.

4.1.5 Guinea

The Commission noted that Guinea has 560 000 ha planted to rice and produced 403 000 t of paddy in 1984. Rice consumption is about 90 kg per caput per year. Guinea is 78 percent self-sufficient and in 1984 imported 80 000 t. Upland rice predominates and various different ecologies comprise mainly lowland rainfed rice and mangrove rice. There is little irrigated rice grown - only some 18 000 ha - and the Commission noted that Guinea needed assistance in a number of areas, including training; applied research; the establishment of seed production centres; and to extend the area under irrigated rice. By these means self-sufficiency in rice could be attained and Guinea would then aim to export rice to neighbouring countries.

4.1.6 Sierra Leone

The Commission noted that rice accounted for 80 percent of all cereals grown in Sierra Leone. Rice is cultivated in five different ecologies. By far the largest area is the upland ecology with 267 482 ha (68 percent). Average yield on the uplands is about 1 t/ha and the average farm size is 1.48 ha. Inland valley swamps account for about 23 percent (91 576 ha). The remaining 9 percent consists of mangrove swamp, the Bolilands (saucer shaped depressions associated with the Rokel river) and riverine grassland. The low yields are the result of widespread use of low yielding traditional varieties; low soil fertility coupled with insufficient fertilizer use; pests and diseases; nutrient toxicities (iron, salinity), inefficient cultural practices; post-harvest losses; and unattractive and inefficient marketing systems. Government is now embarking on a series of programmes to try to ensure 80 percent rice self-sufficiency by 1988.

4.2 NORTH CENTRAL AMERICA

4.2.1 Dominican Republic

The Commission noted that rice is the main cereal consumed in the Dominican Republic. Rice cultivation covers about 120 000 ha yielding some 325 000 t with an average productivity of 2.69 t/ha. About 95 percent of the rice is grown under irrigation either by transplanting or direct seeding. The increase in productivity over the past few years has been achieved by using high yielding varieties (mostly from IRRI) which are now used on 90 percent of the rice area. Rice consumption is about 58 kg per caput per year and for the past three years the Republic has been self-sufficient in rice. The major problems confronting rice farmers are soil salinity in some areas; insufficient machinery for land preparation and levelling; high input costs; and inadequate credit facilities.

4.3 SOUTH AMERICA

4.3.1 Colombia

The Commission noted that Colombia is a surplus rice country in Latin America which produces about 1 800 000 tons of paddy on 420 000 ha. As the price on the international market is lower than the national price, Colombia cannot compete on the international market. Colombia should reorientate its rice programme toward rice production for animal nutrition with low cost, low input, not much quality on marginal lands only suitable for rice in Colombia. This objective, however, requires new technology, particularly a new breeding programme to be generated.

4.3.2 Mexico

The Commission noted that in Mexico rice is grown under irrigation (by transplanting and by direct seeding) and under upland conditions. Over the past 40 years rice production has increased from 66 000 to 620 000 tons and only exceptionally is rice imported. The average productivity is now 3.3 t/ha. There is still considerable potential for increased rice production in areas where natural flooding occurs. Before this can be done however, it will be necessary to build up the infrastructure.

4.3.3 Suriname

The Commission noted that Suriname has been self-supporting in rice since 1919 and surplus rice is exported to Europe and the Caribbean. The Government is planning to further increase rice production and three major projects totalling about 20 000 ha have been implemented. This means that by 1990 the total rice area of Suriname will be about 64 000 ha.

4.4 ASIA

4.4.1 India

The Commission noted that rice is one of the predominant food crops in India, occupying nearly 38 million ha, followed by wheat with 23 million ha. The national average yield is 1.85 t/ha. There are specific areas however, where the yield reaches 4 t/ha. A number of projects are being established to increase productivity and in these the aim is to increase yields by 150 kilos per hectare per annum.

4.4.2 Indonesia

The Commission noted that rice production in Indonesia had risen from 11.7 million t in 1964 to 25.8 million t in 1984; an annual growth rate of 5.9 percent. Many factors have contributed to this increase in production. These include improvement in the distribution of agricultural inputs (seeds, fertilizers, pesticides); better extension services; the development of a group farming approach; and better credit and marketing facilities. The operation of a price support system also helps to stabilize the price of rice. Post-harvest losses are estimated to be quite high, somewhere between 10 and 25 percent, and a campaign has been started to reduce these losses.

4.4.3 Japan

The Comission noted that the present agricultural policy in Japan aims to keep a balance between supply and demand for rice through the promotion of a crop diversification programme. The government fixes the purchase price to give farmers an incentive to produce rice. The Government also fixes the resale price to the wholesaler to stabilize consumer expenditure.

4.4.4 Laos

The Commission noted that Laos has a deficit of about 71 000 tons of milled rice per year. To reduce this deficit and become self sufficient in rice the Government intends to intensify rice production and to extend the area under rice. Some of these measures will be an effort to reduce shifting cultivation; to promote double rice cropping on irrigated land; and to cotivate small farmers to join cooperatives. Efforts in the future will also be made to train more skilled manpower at all levels, particularly in crop protection methods and seed production. The norther part of the country requires a research centre to study the specific climate and other problems of the region.

4.4.5 Nepal

The Commission noted that rice production in Nepal had remained at a more or less constant level for the past 15 years, though there was some increase both in production and productivity during the sixth five-year plan period (1980/81 to 1984/85) when production in the last year of the plan rose to 2.7 million tons. Future production increases will depend on productivity per unit of land as the potential for further increase in acreage is limited. Rice is grown under a wide range of ecological conditions and more research is needed to obtain the best yields from these areas.

4.4.6 Sri Lanka

The Commission noted that of an estimated 747 000 ha of rice planted in Sri Lanka in 1984/85, 658 000 ha were wet season rice. The record paddy production of 119 000 million bushels (50 bushels equal 1 t) obtained in 1982/83 was only 10 million bushels short of self-sufficiency in terms of consumption and seed paddy requirements. Average productivity for the year 1983 was recorded as 3.53 t/ha. the major contributing factors to the recent increase in production are the extensive use of improved varieties which are now planted in 85 percent of all cultivated rice lands; an increase in the irrigated paddy area; increased fertilizer use; and the adoption of improved management practices.

4.4.7 Thailand

The Commission noted that in Thailand in 1983/84 some 10.7 million ha of wet season rice were planted. In the dry season some 685 000 ha were planted under irrigation. Wet season productivity varies between 1.7 and 2.4 t/ha, while the area under irrigation yields between 2.7 and 3.5 t/ha. The major limiting factors to rice production are pests and diseases; drought; floods and deep water; acid soils; weeds and soil salinity. The aim of the current rice improvement programme is to improve grain quality; drought tolerance; cropping systems and cultural practices on rainfed rice.

4.4.8 Viet Nam

The Commission noted that the total area under rice in 1984 in Viet Nam was 4.7 million ha and productivity was about 2 t/ha. The objective is to oftain 4t/ha over about two million ha of favourable rice growing land and to try to increase rice yields in marginal areas. There are a number of constraints which will have to be overcome and these include poor seed varieties; and insufficient supply of chemical fertilizers; pests and diseases; and natural calamities.

4.5 OCEANIA

5.5.1 Australia

The Commission noted that following significant growth during the 1970s, rice production in Australia has levelled off at about 800 000 t a year. During this

period average yields have been as high as 6.7 t/ha. All rice in Australia is grown under flood irrigation. Yield preparation relies on the use of large machines for land preparation with levelling aided by laser and computer technology. About 85 percent of the rice crop is exported, principally to Papua New Guinea, Hong Kong, the Middle East and the Pacific Islands. Virtually all the 70 000 t of milled rice placed on the domestic market each year is for human consumption.

5. ADOPTION, SPREAD AND PRODUCTION IMPACT OF MODERN RICE TECHNOLOGY IN ASIA, LATIN AMERICA AND AFRICA

The Commission reviewed documents IRC 85/6a/6b/6c and 6d relating to the spread and production impact of modern rice technology and expressed satisfaction with their content.

The Commission noted that the adoption and spread of modern rice technology had contributed substantially to increase rice production since 1965. Improved varieties were introduced into most countries in the mid-1960s. In Asia, rice production in Banglasdesh, Indonesia, South Korea, Pakistan, Thailand and the Philippines increased more than 3 percent annually between 1972 and 1979. Rice production in Burma, China and India increased at almost the same rate. By 1980 about 40 percent of the rice in South and Southeast Asia had been planted to high yielding varieties.

The Commission also noted that in India, Indonesia and the Philippines a review has been made of the factors affecting the adoption and spread of modern rice technology among farmers. While these factors will vary somewhat in other countries in Asia and in other rice growing regions of the world, the major conclusions will probably be valid for all these areas.

Perhaps the most important is the commitment of governments to a rice improvement policy. It is particularly evident in Indonesia and the Philippines that national programmes would not have gone ahead so fast or succeeded so well without strong government commitment. For the successful implementation of a multidisciplinary approach it is necessary that government, parastatal and private bodies fully participate in such programmes. Credit for farmers and a sound marketing and price policy also have an important bearing on the success of programmes. The Commission further noted that governments in all three countries have laid stress on institution building by encouraging the formation of farmers groups and by strengthening government institutions. Reserch and education has played an important part in the successful implementation of the rice improvement programmes and lastly the prominence placed on the extension services has been instrumental in the dissemination of new rice technology to farmers.

The Commission noted that in Latin America the adoption of modern rice varieties has continued to expand. In 1981 it was estimated that about 26 percent of the total rice area had been planted with these and a further boost to production took place in 1984. New varieties were introduced into the region among others jointly by the Centro Internacional de Agricultura Tropical (CIAT) and Instituto Colombiano Agropecuario (ICA). Varieties are regularly being superseded as research develops new, more productive and disease resistent types. The adoption of these varieties in Latin America compares favourably with the Asian experience.

The Commission noted that rice production in Africa is of considerably less importance for the economy than in Asia, and Africa is the biggest net importing region in the world. The main thrust for the spread of improved varieties in Africa has been to develop those able to adapt to a number of different growing conditions and to produce plants with resistance to pests and diseases and with good yields.

The exact impact of improved varieties on rice production is difficult to determine. For one thing yields are higher because they receive more fertilizer, are usually grown on better land, and receive higher labour inputs than traditional

varieties. Although it seems self evident that economic returns to farmers are higher with modern than with traditional varieties, it is not always clear how much of the increase should be attributed to modern varieties and how much to complementary production factors.

A response function exercise to analyse the effects of improved varieties, fertilizer, irrigation and residual unmeasured factors, showed that rice output in eight Asian countries, Burma, Bangladesh, China, India, Indonesia, Philippines, Sri Lanka and Thailand, increased by nearly 120 million tons between 1965 to 1980. These eight countries produce 85 percent of Asia's rice. Based on this exercise, it could be shown that improved varieties contributed 27 million t to annual rice production.

In the continuing search for further improvements which will have a still greater impact on production, the Commission noted that research is now concentrating on other important aspects, for example, a salt tolerant variety for conditions where sea water occasionally inundates coastal rice fields, and the development of medium or deep water varieties that will yield better where the standing water depth regularly exceeds 30 cm and where semidwarf rices have little or no advantage over tall rices. Special efforts are also being undertaken to develop varieties for upland conditions.

5.1 Recommendations

(i) The Commission noted that the international demand for rice was almost static. The Commission further noted that there were serious differences in the nutritional levels of the population in developing countries which claimed to have attained self-sufficiency in rice production. The Commission recognized that this was due primarily to the low purchasing power of vulnerable sections of the population. The Commission recommended therefore that government policies should be implemented to raise the purchasing capacity of this sector of the population, thus increasing the domestic demand for rice and creating a more favourable environment for a sustained increase in production.

(ii) The Commission recommended that donor agencies be requested to pay greater attention to the West African Rice Development Association (WARDA) to overcome current financial and operational difficulties. The Commission noted that Africa had great and as yet untapped resources for rice production, and that the development of such potential may well rest on the endeavours of regional or subregional cooperative organisations such as WARDA.

6. THE DIVERSIFICATION OF RICE PRODUCTION

The Commission reviewed documents IRC 85/7a/7b/7b1/7b2/7c1/7c2/7c3/7d/7e/7g and 7s concerning the diversification of rice production and expressed satisfaction with their content.

6.1 A New Direction for Plant Breeding Programmes

The Commission noted that rice surplus countries of Asia are now investing major resources in grain quality improvement. China, with increasing rice surpluses, is reorienting its breeding programmes to develop high quality rices for the export market. Japan has reoriented its breeding programmes to develop rice varieties for animal feed. Plant breeders in Japan are developing varieties with a large grain which have a higher potential yield. Large grained varieties generally have poor grain quality, but as the grain is for animal feed this is of little consequence. Rice bran is an excellent source of high quality oil. Some rice surplus countries could explore the possibility of breeding rice with a higher oil content in the embryo and the bran.

The Commission also noted that there is increasing interest in the utilization of the entire rice biomass for animal feed, for fuel, and for industrial purposes. Varieties that can produce a higher biomass are likely to have higher yield potential. The idea is to make full use of the byproducts unfit for human consumption such as

straw, hull and bran for the production of paper, cement, bricks and charcoal; for the extraction of cooking oil; as feed for livestock and as a source of nutrients for crop production.

6.1.2 Recommendations

The Commission recommended that:

(i) countries with a trend toward rice surpluses should emphasize the development of rice varieties with a larger grain and larger biomass to be used as animal feed and for other purposes (such as rice bran oil). The yield of such varieties could be 50 percent higher than the present high yielding varieties. Japan already has varieties with a 10 percent higher yield;

(ii) in all rice producing countries research should be accelerated to improve the use of the rice biomass (the whole plant).

6.2 Multiple Cropping under Rainfed Conditions

The Commission noted that breeding rice plants to fit into multicrop sequences does mean making compromises. The rice crop has to be squeezed into a shorter growing period to accommodate additional crops (rice or other), or improved rices have to be developed to cope both with deeply flooded and water logged fields or with dry conditions at the start and end of the monsoon. Variety IR 36, released in 1976, when seeded directly, and coupled with improved weed management practices is an attractive variety to introduce as an extra crop in many areas. Varieties with a shorter growing cycle and high yield are now available and include among others IR 58 (100 days) and this should help to stimulate farmers to move toward a more intensive system of cultivation. New improved varieties with drought and flood tolerance will stimulate efforts to intensify cropping in adverse environments.

The development of these early maturing and high yielding varieties has increased the scope for multiple cropping in rainfed areas. Their shorter growing cycle has added some 30 to 60 days to the period during which there is enough water in the soil to grow another crop. Grain legumes such as mungbean, soybean, cowpea, peanut and pigeon pea are obvious choices in this respect.

6.2.1 Recommendations

The Commission recommended that:

(i) non-traditional wheat growing countries keen to develop rice/wheat cropping systems should establish linkages with national and international bodies involved in this work, as well as with organizations such as IRRI, CIMMYT and FAO, to avoid duplication of effort and to ensure the judicious use of available resources;

(ii) efforts to add a grain legume crop to the rainfed rice be strengthened.

6.3 The Integration of Forage Production with Rice Growing

The Commission noted that insufficient attention has been paid to the integration of forage production with rice growing.

There are some 11.1 million buffaloes, 13.7 million heads of cattle, 9.9 million goats and 3.7 million sheep in the ASEAN countries and some 90 percent of these live on mixed farms.

The Commission noted that animal feed technology is now available to overcome seasonal feed deficiencies in most farming districts of Southeast Asia. In many areas there is already evidence of the adoption of shrub legume planting; crop diversification involving dry season pulse production; legume over-seeding of grazing areas and paddy bund areas; and the use of crop byproducts and concentrates to improve the quality of straw diets.

The Commission further noted that while the technique of using Azolla as a nitrogen fertilizer for rice is well known, less well known perhaps is its value as a fodder crop. In China and Viet Nam, Azolla has long been used as a fodder crop, particularly for pigs, and also for cattle, buffaloes and poultry. In Viet Nam, it is estimated that the protein yield from one ha of Azolla harvested after one month is equivalent to that from 800/1 100 kg of soybean.

In China, Azolla is also considered of more value as a fodder crop than as a green manure. It has also been demonstrated that growing Azolla can reduce soil salinity. For example, on a mud flat in the Jiangsu Province, salinity in the top 10 cm of soil was reduced from 0.43 percent to 0.06 percent over three years.

6.3.1 Recommendation

The Commission recommended that more efforts be made to integrate forage production with rice production, particularly in the mixed farming communities of the ASEAN countries. Azolla strains adapted to various tropical ecologies be developed for use as fodder crop as well as nitrogen biofertilizers.

6.4 Fish Culture in Paddy Fields

The Commission noted that there are about 75 million ha of irrigated rice in the world and it has been estimated that if one third of this area were used for rice/fish cultivation, about 2.2 million t of fish could be harvested annually additional investment.

For successful fish production in rice fields there are a number of conditions which must be met. These include a regular supply and efficient control of water; a suitable species of fry readily available to the farmer; the skill of the farmer himself; and at the end of the day a market that will absorb production and stimulate the farmer to greater effort.

The Commission noted, however, that in countries with a highly developed rice economy, the combination of fish and rice culture is on the decline. The main reasons being the increased use of pesticides and the introduction of the high yielding short stemmed varieties of rice. There is also the fact that growing two paddy crops per year leaves little room for fish culture in rice fields. Another problem encountered in the development of fish/rice culture in some countries is an irregular supply of suitable fry.

6.4.1 Recommendation

The Commission recommended that for subsistence rice farmers who do not market rice, other crops or activities such as fish/rice culture should be vigorously promoted wherever possible.

6.5 Using Rice Straw to Cultivate Mushrooms

The Commission noted that a development of some interest which could net the farmer an increase in income is the production of mushrooms by using inoculated rice straw as the growing medium. After harvesting the mushrooms the straw, partially decomposed and containing the hyphae of the mushrooms, is a good animal feed or a better organic manure.

6.5.1 Recommendation

The Commission recommended that in each region of the IRC, international assistance should be sought to establish research facilities for developing the technology of rice straw/mushroom culture. Such technology should be available to Member Nations so that the practice can be promoted among small farmers. The use of the technology on a larger scale should also be investigated.

7. PROSPECTS FOR SOME NEW TECHNOLOGIES IN RICE PRODUCTION AND PROCESSING

The Commission reviewed papers 85/8b/8d1/8d2/8e1/8e2/8f/8g/8h/8i and 8s relating to new technologies for rice and expressed satisfaction with their content.

7.1 Improving Rice Varieties

The Commission noted that growing environments have been classified into five major categories; irrigated, rainfed lowland, upland, deep water and tidal wetlands. During the sixties and early seventies, variety improvement at IRRI focussed on germplasm for irrigated areas which produce three-fourths of the world's output. Since 1975, however, IRRI has also been developing varieties for the less favoured environments; drought or submergence prone rainfed lowland areas, upland areas; deep water areas and tidal wetlands. Many national rice improvement programmes have adopted similar strategies.

7.1.1 Recommendations

The Commission recommended that:

(i) still earlier maturing varieties be bred for drought conditions in Africa without sacrificing yield;

(ii) the development of modern rice varieties should not be restricted to semi-dwarf types because many intermediate varieties also have potential in rainfed ecological areas of Africa;

(iii) with the increasing spread of uniform high yielding varieties, indigenous varieties which may constitute unique genetic material are in danger of being lost. Countries and international organizations such as FAO and IRRI should give additional attention to conserving such germplasm;

(iv) IRRI and national institutes in developing countries renew their efforts to evaluate ratooning ability, since ratooning produces a profitable second crop of rice. The Commission noted that 20 000 ha of ratooning rice are currently being cultivated in Texas (USA).

7.2 Prospects for Hybrid Rice

The Commission noted that progress made in the research and development of hybrid rice technology in China and the research experience gained at IRRI so far, made it clear that hybrid technology is one of the possible ways to increase rice production by at least 1 t/ha above the present yields of improved semi-dwarf rice varieties in irrigated areas. Keeping in view certain traits of rice hybrids such as stronger and more active root systems and early seedling and vegetative vigour, the Commission noted that it is likely that rice hybrids may also adapt well to rainfed lowland and adverse soil conditions.

The major problems of hybrid rice technology which would continue to exist are the necessity to change the seed every season, and shortage of a good seed supply. The adoption of hybrid rice technology, however, may well depend on the extent of pressure to produce more on a given piece of land; the extent of the yield advantage shown by the hybrids compared to the pure line varieties; and the capacity of a country to organize an efficient seed production, processing, certification and distribution programme.

7.3 Water Management in Rice Irrigation

The Commission noted that there is no single optimum water management system for irrigated rice; rather, programmes should be evolved to suit specific field conditions and farmers' needs. Two primary criteria govern the choice of water systems namely, maximum yield per unit of land and maximum yield per unit of water used. The

interaction of these two parameters with physical, environmental and social factors such as scale of cultivation, methods of land preparation, use and availability of farm inputs, labour, capital and institutional support, environmental health and other factors will determine the appropriateness of the irrigation technology to be used in a given set of circumstances.

The Commission also noted that one of the major criticisms directed at irrigation development in general and rice irrigation in particular is the adverse environmental impact these activities may cause. The increased multiplication of vectors and intermediate hosts of tropical diseases, notably malaria and schistosomiasis, is often attributed to rice irrigation projects. Improvements to the flood irrigation of paddy and the adoption of better irrigation methods are likely to alleviate these health hazards.

7.3.1 Recommendation

The Commission recommended that the applicability of new irrigation methods for rice be evaluated, particularly in the light of the advantages of new irrigation technology for water saving and to minimize any adverse environmental impact. The Commission also recognized the importance of water management in the rainfed lowlands and upland rice areas to conserve rain water and avoid damage caused by flooding and lack of drainage. The Commission urged that assistance be given by FAO and IRRI to Member Nations to achieve these objectives.

7.4 Improving Fertilizer Use

The Commission noted that between 1965 and 1980 the estimated effect of fertilizer on improved rice varieties grown in eight Southeast Asian countries amounted to 24 percent of the total increase in production.

Considerable research efforts are being made to evolve situation-specific fertilizer management practices to better improve efficiency. Broadly, the different efforts that are being undertaken to minimize nutrient losses and increase fertilizer use efficiency are the identification of the most suitable type of fertilizer for specific ecological situations; the improvement of application techniques, including split application, placement, etc., change in particle size; use of coating materials and chemicals, including those indigenously available to reduce the dissolution rate of applied material; applied material and other related management practices such as water management, disease and pest control, weed control, etc.

The Commission also noted that much better use could be made of farmyard manure, rural compost, the incorporation of crop residues into the soil and mulching. Improved and simpler techniques for the use of these materials are readily available.

The techniques of using the residue from biogas plants has gained popularity in China and India, but is still in its infancy in many countries. Green manuring, the use of blue-green algae Azolla (non pathogen microorganisms) are other possibilities for partial supply of nitrogen and other nutrients to the rice plants.

In view of the prevailing high prices of chemical fertilizers, small scale rice farmers may not be in a position to apply the full recommended doses to boost rice yields in their intensively cropped smallholdings. It is important, therefore, to ensure that maximum use is made of both chemical and organic fertilizers (including biofertilizers). The formulation of fertilizer recommendations based on the cropping system as a whole is thus necessary.

7.4.1 Recommendations

The Commision recommended that:

(i) considering the significant role that fertilizers play in increased production and keeping in view that in most developing countries fertilizer input is far

below the recommended level, countries should take all possible steps, including price adjustment, to ensure the efficient and increasing use of fertilizers to increase productivity and profitability;

(ii) an all out effort should be made, especially through the effective transfer of appropriate technology such as optimum soil and crop management practices (water, pest, disease, weed control, etc.) to maximize the efficiency of fertilizer use;

(iii) balanced use of mineral fertilizer should be integrated with the use of organic and biofertilizers to ensure optimum and economic use of available resources.

7.5 Mechanization for Small Farms

The Commission noted that a review by the International Centre for Industrial Studies in 1979 indicated that only 6 percent of the world's agricultural machinery is produced in developing countries. Thus, developing countries wanting to mechanize rapidly must import machinery. Because of the low volume of sales, there is an inadequate network of dealers to provide spare parts and service to farmers. Most imported agricultural machines are sold by agencies located in large cities. Such agencies are often too far away from the farming areas to provide the necessary after-sales service.

Much of the machinery that is available from developed countries is not suitable for use in developing countries. For example, studies have shown that 66 percent of the land holdings of farmers in Asian countries are 2 ha or less in size and most agricultural machines require larger holdings to be used profitably.

The Commission concluded that machinery designed for small farms needs to meet five criteria. It must be simple to operate; be easy to maintain; low cost; of rugged design; and reliable. Further extension work is required to popularize the machinery already developed.

7.6 Modernization of Rice Milling

The Commission noted that the present trend in milling is mainly directed toward obtaimning a quality rice with high extraction rates and low processing cost. There have been large investments in new rice mills in recent years. Countries have also given considerable thought to technological improvements in the parboiling process and the utilization of rice by-products, particularly rice husks.

The Engleberg one-pass huller type of mill still predominates in rural areas. Thousands of this type of mill have been installed because of its low maintenance costs and ease of use by small farmers. This type of milling unit is widely used particularly in Bangladesh, India, Laos, Nepal, Pakistan, the Republic of Korea, Sri Lanka and West Africa. There are about 76 000 Engleberg type hullers in India processing about 60 percent of rice for home consumption. About 4 000 hullers operate in Nepal.

The Commission also noted that rice is generally over-polished in huller mills because of the increased pressure required for dehusking and polishing in one milling operation. Depending on the condition of grain, the bran polish can take about 12 percent of the paddy weight instead of the recommended 6 percent. In milling mixed varieties with different grain sizes, rice is overmilled even more to dehusk the small-sized grains. This results in physical and nutritional loss as the nutritive layer of the grain is completely removed in overmilling. The net result is low outturn and an inferior quality of milled product. The milling yield of rice, in terms of white rice milling in this type of mill, is about 3 to 5 percent lower than that of a conventional type. The difference will, however, be less in parboiled rice milling because the grain is harder.

7.6.1 Recommendations

The Commission recommended that:

(i) a long-term plan to develop a rice processing machinery industry, including provision for training personnel in repair and maintenance work and the standardization of spare parts, be prepared;

(ii) a regional cooperative programme of testing and evaluation of rice milling equipment, particularly for small-scale village and cooperative level milling, should be developed. This should include improvements to the huller-milling system.

7.7 Technological Developments in the Parboiling Process

The Commission noted that recent advances in technology have improved the quality of the parboiling process. It is claimed that parboiling reduces post-harvest losses by increasing milling yields and it also increases the nutritive value of rice.

The work on improvement in parboiling is gaining momemtum. It is therefore important that there is a continuing programme to maintain the pace of development, both on a commercial scale and at farm and village level where most parboiling takes place.

The Commission also noted that an extensive study conducted recently in Sri Lanka on the occurrence of aflatoxins in rice revealed that the aflatoxin content of rice produced by commercial parboiling was higher than that in household parboiled rice. The study also revealed that there was no significant contamination in raw processed rice.

7.7.1 Recommendations

The Commission recommended that:

(i) FAO should provide the focal point in Asia and the Pacific Region to monitor the progress of work on parboiling studies and to provide whatever assistance is necessary in the exchange of information and knowledge among developing countries on a regional and interregional basis. The current activities on technological improvements in the region on parboiling should be documented for wider distribution. As most parboiling takes place in the home or village, the need to improve the quality of small-scale parboiling was emphasized;

(ii) a study be made to discover at what stage during parboiling aflatoxin contamination occurs.

7.8 Using Cereal Technology for Rice Products

The Commission noted after reviewing the Working Paper IRC/85/8d, that there were considerable opportunities for using already well known cereal technology to produce rice products such as rice-soya-milk blends (RSM); rice germ; high protein flour; edible oil and improved local type foods.

7.8.1 Recommendations

The Commission recommended that:

(i) a focal point be established to investigate extrusion and other cereal technologies to produce nutritious foods such as noodles, foods of local type and weaning foods from rice blended with other flour and that these be evaluated for commercial viability and consumer acceptance;

(ii) the ongoing FAO/UNDP intercountry cooperation project on post-harvest technology and quality control of food grain be used as a focal point to monitor the progress of work and to provide assistance to exchange information among developing countries on a regional and interregional basis. The current activities on post-harvest rice grain investigations should be given wider distribution.

8. RICE PRODUCTION SYSTEMS: ISSUES TO BE CONSIDERED

The Commission reviewed paper IRC/85/9 and expressed its satisfaction at the content.

The Commission noted that this paper reviews some selected issues related to the physical (agroclimatic, land, water), the institutional (social, economic, psychological) and trade aspects of rice production systems. A review of recent experiences among the developing countries clearly indicates that rice technology is a major determinant in the "food balance sheet" of poor countries, especially developing Asia.

The Commission also noted that limited resource endowments in each country determine to some extent the different technological levels in rice production systems. Because of population pressure in the developing countries, farmers have adopted agricultural production practices that are leading to desertification, soil erosion and an excessive rate of deforestation

The institutional relationships between the rice production systems and marketing are expressed through the pricing and invervention adopted by the individual governments of developing countries. Most developing countries would like to implement a set of price policies that would collectively meet the following objectives: increased production, higher producers' income, lower prices for consumers at a reasonable cost to Government treasury. Since pricing policies are specific to each country, the Commission further noted that the balance of these above-mentioned objectives would depend on the intervention goals that each country wanted to pursue. It must be considered, however, that too much Government intervention in all aspects of the rice production systems would entail hidden costs which would be detrimental to the economy in the long run. A well-balanced set of input-output pricing policies therefore imply consideration for the efficient allocation of resources in the agricultural sector.

A rice technology can only be successful in the long run if the government policies formulated by national programmes can sustain its viability. Sustaining a technology implies a long-term and sincere commitment of funds to support the agricultural sector; the evolution of an administrative capacity that can monitor, analyze and evaluate the technology at its different stages of adoption; and the integration of technology with the overall development goals of society.

9. RECOMMENDATION BY THE COMMISSION FOR THE ATTENTION OF DELEGATES TO THE 17TH SESSION

At the conclusion of the meeting, the Commission recommended that to preserve continuity and to improve service to Member Nations of the Commission, a report be made to the 17th meeting of the Commission by Member Nations summarizing progress made in carrying out such recommendations from the 16th Meeting as they found appropriate.

10. ANY OTHER MATTERS

11. DATE AND PLACE OF NEXT SESSION

The Commission noted that, in accordance with Rule I of its Rules of Procedure, the date and place of the next session shall be determined by the Director General of FAO in consultation with the Chairman.

The Commission expressed appreciation of the invitation extended by the Representative of Brazil, the Dominican Republic and Mexico for the hosting of the next Session and unanimously agreed that the final decision as to date and place be left to the Director General of FAO in consultation with the Governments of the Member Nations concerned.

12. ADOPTION OF REPORT

The report of the meeting was unanimously adopted by the Commission.

13. CLOSING OF THE SESSION

The Sixteenth Session of the International Rice Commission was closed by the Chairman, H.E. Salvador Escudero III, Minister of Agriculture and Food, Republic of the Philippines, who expressed his warm appreciation to the Delegates and Observers for the contributions they had made toward the success of the Session.

APPENDIX A

LIST OF MEMBERS OF THE COMMISSION

Australia
Bangladesh
Benin
Brazil
Burkina Faso
Burma
Cameroon, Rep. of
Colombia
Cuba
Dominican Republic
Ecuador
Egypt
France
Gambia
Ghana
Guatemala
Guinea, Rep. of
Guinea Bissau
Guyana
Haiti
India
Indonesia
Iran
Italy
Japan
Democratic Kampuchea
Kenya
Korea, Rep. of
Laos
Liberia
Madagascar
Malaysia
Mali
Mexico
Nepal
Netherlands
Nicaragua
Nigeria
Panama
Pakistan
Paraguay
Philippines
Portugal
Senegal
Sierra Leone
Sri Lanka
Suriname
Thailand
United Kingdom
United States of America
Uruguay
Venezuela
Viet Nam

APPENDIX B

LIST OF DELEGATES AND OBSERVERS

Chairman:	H.E. Salvador Escudero III Minister of Agriculture and Food (Republic of the Philippines)
First Vice-Chairman:	Neil Rutger (United States)
Second Vice-Chairman:	Charles Rajafindrakoto (Madagascar)

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APPENDIX C

AGENDA FOR THE SIXTEENTH SESSION

1. Opening of the Session
2. Adoption of the Agenda
3. Election of Chairman and Vice-Chairmen
4. Implementation of Rice Production Projections Towards the Year 2000
5. Rice Production and Trade in Asia
6. Statements of the Rice Situation in Member Nations of the Commission
7. Adoption, Spread and Production Impact of Modern Rice Technology in Asia, Latin America and Africa
8. The Diversification of Rice Production
9. Prospects for some New Technologies in Rice Production and Processing
10. Rice Production Systems: Issues to be considered
11. Any Other Matters
12. Date and Place of next Session
13. Adoption of Report
14. Closing the Session

APPENDIX D

ADDRESS BY H.E. SALVADOR ESCUDERO III
MINISTER OF AGRICULTURE AND FOOD
REPUBLIC OF THE PHILIPPINES

Your Excellencies, Distinguished Guests, Ladies and Gentlemen:

It is my privilege to welcome you to our country on this 16th Session of the International Rice Commission, that you have taken time out from your hectic schedule attests to the sense of urgency we all share concerning world production of rice.

I consider it auspicious that on my twelfth month in office as Minister of Agriculture and Food for the Philippines, the International Rice Commission meets in my country to reassess the global rice situation. In the Philippines, as in many countries of the developing world, rice is the staple food - and the holding of this 16th Session of the Commission in our country makes our policymakers and scientists privy to the dynamics of the Commission's work on global rice strategies.

Global cooperation in food production is as pressing now as it has been in the past two development decades. The vision of a world where "no child shall go to bed hungry and where no man shall fear for his next day's bread" still eludes us. Even as we dream of a world without hunger, millions of people continue to die from lack of food.

Imbalances in world food production haunt us still. Food surpluses in the industrialized countries contrast too sharply with food shortages in the developing world. Much as we wish that the gulf between the nations of the North and those of the South vanish, the chasm seem to grow even wider.

But all is not lost. The very fact that the International Rice Commission meets today reaffirms that we have now succumbed to despair, and that adversity may yet bring out the best in us.

The green revolution that has doubled and even tripled rice yields all over the world keeps our hopes alive for a world without hunger. If we are to keep our gains and advance even further, however, we must overcome the structural barriers of myopic national interests. The need for food knows no frontier, and any ideology that ignores this is not worthy of man's fealty.

Sustained internal efforts on the part of developing countries to attain increasing self-sufficiency in food production is certainly the most basic element in obtaining a real answer to the problem of hunger. Nevertheless, this effort requires timely and sufficient international technical as well as financial support in tandem with internal policies and strategies.

The international support we have been getting was instrumental to the success of our food production programs here in the Philippines. In crop agriculture, the high yielding varieties from IRRI were pivotal in the self-sufficiency we attained in rice. In livestock and fisheries production, international assistance is helping us accelerate our pace.

The Food and Agriculture Organization has consistently offered its services, and in many cases, its finances for the implementation of key agricultural programs. The establishment of an animal by-products utilization training center in the province of Bulacan was made possible with FAO technical assistance to the tune of ₱ 15 million. As farmers learn ways of transforming animal by-products into processeed forms, ensuing supplemental earnings should encourage heightened primary processing in our farms.

In fisheries, where we intend to make further headway, especially with a shrinking land frontier, international assistance has enabled us to gain faster momentum. Aquaculture, which now accounts for 23% of our total fish production, got an added boost with the implementation of a $36 million Asian Development Bank-assisted project in our Panay provinces. The three provinces covered by the project are located within one of our major milkfish nd shrimp culture belt, and the potential for expanded production are therefore considerable.

The projects I just mentioned do not at all exhaust our list of internationally assisted projects. The only serve as examples of the constructive relationship we have forged with bilateral as well as multilateral institutions in pushing our country initiatives in agriculture further forward.

The encouragement I have been getting from the international community has goaded me all the more to make the Philippines a model of developing country agriculture. The challenge has not proved easy but we have performed better than I thought.

In the past twelve months, a large part of my personal attention was devoted to mobilizing the entire Ministry of Agriculture and Food to recover from our losses in rice production caused by the combined effects of an eight-month drough in crop year 1982-1983, spiralling costs of production, a virtual standstill in agricultural credit, and a consumer oriented pricing policy which served to erode farm incomes. Thus, over the past year, we have sought to help restore rice production to self-sufficient levels, mostly through much needed reforms in our credit, pricing, and market intervention policies. Our efforts are starting to pay off and we expect to harvest our largest crop ever this year. We expect a palay harvest of 163.9 million cavans or 5.3 million metric tons of milled rice, which would be higher by 1.2% over our 1982 record crop.

Apparently, we in the Philippines must overcome a cycle of boom and bust in rice production if we are to sustain the self-sufficiency we attained in 1976. Rice self-sufficiency is a continuing priority among rice-consuming countries and while some have achieved this goal, others have yet to succeed. In some cases, a hard-earned self-sufficiency is being threatened by natural calamities and policy lapses.

In the desire of some governments in the developing world to stabilize consumer prices, price control has been a convenient policy tool, but oftentimes, farm products such as rice suffer the severest penalties. A cost-price squeeze leads to falling margins which dampen the incentive to produce. Farmers are then drawn into shifting to more profitable crops. A price support policy may be offered as a compensating device but whether this offsets the distortions brought about by regulated markets is still in doubt.

This is only one instance where public policy on agriculture can work against production. Our experience bears out that other equally sensitive areas to policy lapses are credit, farm input supply as well as management, and technology.

In particular, the supply and cost of credit as well as its delivery structure are nagging concerns in developing country agriculture, particularly in small landholdings. In the Philippines, our Masagana 99 rice self-sufficiency program offered the farmer an innovative non-collateral, low-interest credit package but credit supply shortages as well as high arrearages promted us to devise other approaches. In keeping with market liberalization and concommitant deregulation of credit, some other ways of maintaining financial incentives for farmers with the least distortions in the market need to be explored. This is a problem area which member countries of the Commission should find worth pursuing.

And as always, appropiateness of technology is a continuing concern. The search for location-specific technologies conducive to optimum production at the least cost to farmers should be relentlessly pursued. With ever-rising production costs, indigenous and low-cost technologies are the only options left. This is particularly urgent in countries where irrigation capacity is still minimal. The disparities in productivity

between rainfed and irrigated farmers must be rectified if public policy is to give substance to its avowed goal of achieving a more equitable distribution of the benefits of increased production.

The international reach the Commission enjoys grants it a unique capability to influence the shaping of public policy for agriculture. Whether it be in pricing, credit, or technology, the Commission can tap the best minds in the world to solve the problems that continue to impede optimum productivity for the farmer. Meeting the challenge with operational strategies, however, always proves to be much tougher than rhetoric. With the impressive track record of the men behind the Commission, it is our hope that we can translate rhetoric into action.

Thank you.

APPENDIX E

ADDRESS BY DR. S.S. PURI
ASSISTANT DIRECTOR-GENERAL OF FAO AND
REGIONAL REPRESENTATIVE FOR ASIA AND THE PACIFIC

Mr. Chiarman, Dr. Swaminathan, Distinguished Delegates, Ladies and Gentlemen.

On behalf of the Director-General of FAO and on my own behalf, I deem it an honour to have this opportunity of welcoming you to the 16th Session of the International Rice Commission.

We in FAO are highly indebted to the authorities of the Philippines for having agreed to host this Session of the International Rice Commission. In particular, Mr. Minister, we are grateful to you for your personal interest and support in organizing the Session. I am happy that you have been elected as Chairman of this Session. I offer you my congratulations. I have no doubt that the deliberations in the Session will benefit a great deal from your competent guidance.

As you may be aware, the previous session of the Commission was held in October 1982. Ordinarily, the Commission meets once in four years. Therefore, in the normal course, the present session of the Commission would have been convened only in 1986, but this was preponed to 1985 so as to coincide with the celebration of the 25th anniversary of IRRI. I need hardly add that IRRI has made outstanding contribution to the development of rice. Hence it is only befitting that there should be a Commission session alongside the 25th anniversary celebrations of IRRI. We are happy that Dr. Swaminathan, Director General of IRRI, is present at this function and has kindly consented to address the Commission.

Mr. Chairman, in order to provide a background to the discussions that will be held by the Commission, it might be appropriate if I present a brief review of the recent trends of rice production in the world. At the last IRC Session held in 1982, rice situation between 1977 and 1981 was reviewed. I shall, therefore, begin by referring to the performance in more recent years, that is from 1981 to 1984.

In 1981, world's rice production in terms of paddy was around 412 million tons. In 1984, it increased to 465 million tons. This indicates that between 1981 and 1984, a high average annual compound growth rate of 4.3% was achieved.

Mr. Chairman, this global achievement is, in some respects, misleading because it conceals significant variations among the different regions of the world. In Asia-Pacific Region, there has been a substantial increase during this period. In 1981, this Region accounted for a rice paddy production of 373 million tons. In 1984, it went up to 426 million tons. In the rest of the world, taken together, there was no increase in rice paddy production during this period. In fact, there was a marginal decline from about 39 million tons in 1981 to about 38 million tons in 1984. Going specifically by regions, I may state that in Africa the annual level of production declined from 8.4 million tons of rice paddy in 1981 to 7.9 million tons in 1984. There was an even more substantial decline in North and Central America where rice paddy production went down from 10.6 million tons to 8.3 million tons. In South America Region, there was some step up in production from about 13.3 million tons in 1981 to 14.7 million tons in 1984. In Europe, rice production remained practically static between 1981 and 1984.

Since Asia-Pacific Region accounts for more than 90% of world's rice paddy production, it seems necessary that I should present a more detailed account of the performance of this Region. For this purpose, I have chosen the period 1974-1984. There are two reasons for my choice. Firstly, 1974 was the year when the World Food Conference was held and the world community adopted certain goals affecting food security. The second reason is that rice paddy production in Asia cannot be properly appraised except in a broad historical perspective and the decade ending 1984 provides a suitable time span for this purpose.

In Asia-Pacific Region, there are a total of 20 paddy producing countries. In 1974, all these countries, taken together, recorded a production of 373 million tons. In 1984, the production went up to 426 million tons of rice paddy. Taking the ten intervening year into account, there was an annual compound growth rate of 3.2% in respect of rice paddy for Asia and Pacific Region as a whole. However, the performance of different countries in the Region during this period tended to be extremely uneven. There were three countries, namely, Burma, Indonesia and Sri Lanka, which recorded high growth rates ranging from 5.8% to 6.9%. Then there were seven countries, namely, Australia, China, Democratic People's Republic of Korea, India, Pakistan, Philippines and Viet Nam, which recorded medium growth rates ranging from 3% to 4% in respect of rice paddy production during the period 1974-1984. Finally, there were as many as ten countries in the Region which recorded a growth rate below 3%. In fact, three of them had a growth rate which was below 1%.

There is another way of looking at the unevennes of performance among the different countries in Asia-Pacific Region. This is with regard to the level of rice paddy yields per hectare. The yields vary from about 0.9 tons to about 6.5 tons per hectare. Out of 20 paddy producing countries in the Region, there were five countries which in 1984, had high yields ranging from 5.3 tons to 6.5 tons of paddy per hectare. These countries were Australia, China, DPR Korea, Japan and Republic of Korea. Then there were three countries namely, Indonesia, Burma and Sri Lanka, which had a yield level ranging from 3 to 4 tons. There were four countries, namely, Malaysia, Pakistan, Philippines and Viet Nam, whose yields ranged from 2.5 to 3 tons per hectare. Finally, there were eight countries in the Region whose paddy yield levels in 1984 remained below 2.5 tons per hectare. These countries were Bangladesh, Bhutan, Kampuchea, India, Laos, Nepal and Thailand.

As regards levels of rice paddy yield in regions outside Asia-Pacific, I may mention that, in Central and South America, let alone Africa, the regional average yield is only about 1.8 tons per hectare although in some of the countries with relatively small areas of less than 100 000 hectares, the average yields may be as high as 5 tons per hectare. Brazil, which accounts for about half of the rice paddy production of the whole of the Central and South America has a yield level of only 1.5 tons per hectare. Moreover, the yields in South and Central America have remained more or less stangnant during the last ten years or so.

It would thus be seen that there are a widely varied experiences of rice paddy production in the world - some very successful and some rather poor. Hence there is plenty of room for sharing experiences.

While on the subject of yield levels of rice paddy, I would lake to single out China and refer to some of the details concerning this country. This is because China is the largest producer of rice paddy in the world. In some ways, Chinas's performance in stepping up yield levels during the decade ending 1984 is most remarkable. In 1974, China produced 127 million tons of rice paddy in an area of 36 million hectares. In 1984, the area under paddy in China was reduced by two million hectares and yet the level of rice paddy production went up by 51 million tons. This incredible achievement was due to the fact that China increased the average yield per hectare of rice paddy from about 3.5 tons in 1974 to 5.3 tons in 1984. This implied an annual compound growth rate of nearly 4% in respect of paddy yields over a huge area of nearly 34 million hectares.

There are many reasons for this phenomenal progress in China. However, if there is one reason that I may single out, it is the remarkable expansion in the usage of chemical fertilizers. In 1974, China's use of mineral fertilizers was around 50 kilogrammes of NPK per hectare. By 1984, it had more than trippled and the average usage exceeded 180 kilogrammes per hectare. This was in addition to the large quantities of organic fertilizers used by Chinese farmers.

This large expansion of fertilizer usage in China was facilitated by the Chinese authorities through several policy measures. Firstly, fertilizer supplies are assured to the farmers in exchange for grain or cash crops sold by the farmers to the Government. For those farmers who purchased fertilizer in cash, the Government

encourages fertilizer use by maintaining a low standard price. The Government also offers subsidies to encourage fertilizer use in remote areas where production and transport costs are high. And, finally, the physical availability of fertilizer is assured through a large network of supply and marketing cooperatives who account for nearly 87% of the retailing of the total fertilizer consumed. The total number of retail points in the country run by cooperatives is around 600 000.

I am mentioning these details about China to highlight the fact that, if the high yielding varieties of rice have to play a meaningful role, there is no substitute for giving adequate nutrients to these highly fertilizer responsive varieties. Hence an appropriate fertilizer supply, pricing and distribution policy, in conjunction with an appropriate paddy marketing and pricing policy, seems to me, to be crucial for an accelerated growth of rice production in various countries where the full potential of the new rice technology is yet to be realized. I may add that in all such countries, the level of fertilizer application is still less than 50 kg of NPK per hectare. In some cases, it is even less than 20 kg.

Mr. Chairman, I would like to briefly refer to the fact that FAO has been paying special attention to rice production due to its unique importance to the millions of people of the developing countries. An Inter-departmental Working Group on Rice was set up by the Director-General of FAO to review and streamline all FAO activities on rice and to recommend a longer-term programme of activities, including joint activities with financing institutions with a view to providing investment in rice. The Group recommended that increasing rice production and availability should receive greater priority in FAO's programme with particular emphasis on identifying areas and projects for investment leading to higher rice production and improved productivity.

FAO has also recently completed a study on prospects of strengthening rice paddy production in selected countries of the Pacific Islands. The study has clearly brought out that there are good opportunities for increasing domestic production of rice paddy provided that governments formulate the needed policy and give necessary support. I am happy that some of the Pacific Island countries are participating in this Session of the IRC and should be able to assess the situation in their own countries on the basis of experiences of other countries.

Mr. Chairman, let me turn to another aspect of rice, namely, rice trade. It is significant that although rice is the foremost food of the developing world, its world trade has been limited to 10-12 million tons annually and is expected to remain at that level in the foreseeable future. Consequent to improved production of rice in several Asian countries, rice import by the developing countries into the Asian Region declined from about 5 million tons in the early 1970s to about 3 million tons ten years later. During the same period, the exports of rice from the Region went up from about 5 million tons to 8 million tons. Thus the Region has now a positive net trade balance of about 5 million tons in rice and its self-sufficiency ratio increased to 102%. In Africa, despite lower outputs, both in 1983 and 1984, and larger requirements, rice imports are likely to remain at the same level - 3.2 million tons - as during the past two to three years. Balance of payment problems and shortage of foreign exchange will limit the amounts that can be purchased. The South American import which rose from 200 000 tons in 1982 to 500 000 tons in 1983, went down to 400 000 in 1984. On the other hand, the Central American import increased from 400 000 tons in 1983 to 600 000 tons in 1984.

The supplies from the exporting countries have been more than adequate to meet import demand. In fact, some of the developed exporting countries, due to low price, have cut down their exportable surpluses. The world rice stock is forecast to reach a record high of 50 million tons exceeding the 1984 stock by 6 million tons. Most of the increase is expected to be concentrated in China, India, and Indonesia. Stocks in most other low-income, food deficit countries are estimated to remain at their current low levels or to fall even further.

FAO has also been assisting the member governments through an Inter-governmental Group on Rice. The 29th Session of this Group met only about a month ago. The topics discussed were the review of rice situation and outlook and international activities on

rice, particularly recent development in rice trade, national and regional rice policies with special reference to their impact on consumption, production and trade.

Before concluding my remarks on the international trade aspects of rice crop, may I repeat what I stated earlier, namely, that the total international trade in rice seems to be inelastic and has remained within the narrow range of 10-12 million tons annually. In coming years, this is not likely to expand. Hence it seems to me that, to a significant extent, future increase in rice production, particularly in Asia, would depend a great deal on an increase in the effective demand in the domestic markets of individual paddy producing countries. This would indirectly mean that if such increase in effective economic demand for rice is to be brought about, there must be a greater diffusion of purchasing power among the large masses of people, particularly in the rural areas of various Asian countries. This underlines the need for rural development especially oriented in favour of target groups such as the small farmers, marginal farmers, and agricultural labourers. In other words, in the situation of some of the rice producing countries of the world, particularly among the Asian countries, considerations of larger equity in the process of development are going to be necessary not merely from the point of view of social justice but also from the point of view of sustaining increased agricultural production, particularly in regard to an important food crop such as rice.

Mr. Chairman, in the end, I may say that the mandate of this Commission is to promote actions in respect of production, conservation, distribution and consumption of rice by monitoring and reviewing the scientific, technical and economic problems. As you might have observed, the Commission has a very comprehensive agenda before it. I sincerely hope that this 16th Session of the International Rice Commission will lead to proposals to strengthen national programmes and guide international efforts in their support. Needless for me to say that FAO stands ready to play its part.

APPENDIX F

ADDRESS BY DR. M.S. SWAMINATHAN
DIRECTOR-GENERAL, INTERNATIONAL RICE RESEARCH INSTITUTE
INDEPENDENT CHAIRMAN, FAO COUNCIL

FUTURE CHALLENGES

The International Rice Commission was established soon after FAO was founded in recognition of the importance of rice to the nutrition and economic well-being of the people of Asia, and of several countries in Latin America and Africa. In its early meetings, the IRC came to the conclusion that unless indica rice varieties can be made to respond to fertilizer application and improved water and soil fertility management, rice yields will continue to stagnate between 1-2 t/ha in the indica growing countries of Asia. Therefore, IRC suggested an Indica-Japonica hybridization programme which started functioning at the Central Rice Research Institute, Cuttack, India in 1952. My own first job in India was in this programme. For several technical reasons, the indica-japonica hybridization programme did not result in many high yielding varieties of rice. However, it did give rice to varieties like Mashuri developed in Malaysia. Mashuri is still popular in several countries of South and Southeast Asia because of its ability to perform well during the southwest monsoon period.

The establishment of the International Rice Research Institute at Los Banos by the Ford and Rockefeller Foundations and the Government of the Philippines in 1960 marked the beginning of a new era in the improvement of indica rices. Thanks to the availability of the Dee-gee-woo-gen dwarfing gene from China and semi-dwarf varieties like Taichung Native 1 from Taiwan, IRRI scientists could develop by 1966 the variety IR8 which established new yield records in indica rice. IR8 proved that if the plant architecture can be modified in a way that the crop can take advantage of nutrients and water, yields can be substantially improved. The progress in improving rice production made after the introduction of high yielding varieties has been referred to by both our distinguished Chairman and the Assistant Director-General of FAO. I would like to highlight a few of the future challenges we will have to face in rice research and development.

I. Expanding the Environmental Coverage of High Yield Technology

Seventy six percent of the world's rice production at the moment comes from irrigated areas. However, there are substantial rainfed areas in Asia, Africa, and Latin America which require attention. Out of nearly 203 million ha of wetland soils in Africa, only 4.9 million ha are presently under rice. In contrast, out of 121 million ha of wetland soils in South and Southeast Asia, 90.3 million ha are under rice. The rainfed areas are prone to both moisture stress and moisture excess. In deep water areas, rice plants may have to withstand 50-150 cm of standing water. IRRI's strategy for rainfed rice research consists of the following steps:

1. Define and characterize the target ecosystems

2. Develop genetic materials for each major ecosystem

3. Adapt soil, water, and crop management practices to each ecosystem

4. Tailor more intensive cropping systems in order to optimise the benefits from the available production resources

IRRI scientists have estimated that over 86.5 million ha of rice land in South and Southeast Asia are affected by salinity, alkalinity, and different soil deficiencies and toxicities. Therefore under IRRI's Genetic Evaluation and Utilization (GEU) programme, the available germplasm material is screened for a wide range of soil toxicities and deficiencies. Several of the new varieties like IR36 and IR64 have not only a broad spectrum of resistance to the important pests and diseases but also a broad spectrum of tolerance to important soil stresses.

II. Bridging the Yield Gap

If we assume that the national average yield in rice could reach about 6 t/ha provided there is water and nutrients for sustaining a good crop, we can classify the major rice growing countries into four groups:

Group I	Practically no gap between potential and actual yield
Group II	Less than 25%
Group III	More than 50%
Group IV	More than 75%

The constraints responsible for the prevailing gap between potential and actual yields may relate to ecological, technological, socio-economic, institutional, and political factors. IRRI has considerable experience in conducting studies which can help to identify the precise constraints responsible for the gap between potential and actual yields in farmers' fields. In Group I countries where there is practically no gap, we have to work on techniques which can help to raise the ceiling to yield further. China, for example, has covered 8 million hectare during 1984 with hybrid rice. According to Chinese scientists, the hybrid rice strains cultivated in China give about 20-25% more yield than the best available semi-dwarf varieties.

III. Improving the Efficiency of Small Farm Rice Cultivation

There is a decline in the real price of rice and many other agricultural commodities. Therefore, farmers are facing serious economic difficulties in purchasing inputs and in meeting their household expenditure. IRRI recommends a three-pronged strategy to face this problem:

1. Varieties with pest resistance, tolerance to soil toxicities and deficiencies and high yield potential should be cultivated in order to minimize risks and reduce cost of production.

2. Home grown inputs like biofertilizers, green manures, and organic manures should be substituted for market purchased ones.

3. More attention should be paid to improving the efficiency of fertilizer and water use. For example, over 50 percent of the applied urea nitrogen may be lost during the southwest monsoon period as a result of ammonia volatilization, nitrification, denitrification, leaching, and runoff. Methods are available now to minimize these losses. IRRI also advocates integrated pest management (IPM) procedures in order to reduce cost and avoid ecological damage.

Production techniques can be grouped into the following three categories depending on the nature of the action needed:

1.	Group I	Individual farmer (seeds, non-monetary inputs)
2.	Group II	Government action (research extension, input supply, input-output pricing, insurance)
3.	Group III	Group action (IPM, scientific land and water management, integrated nutrient supply, producer-oriented post-harvest technology)

Only when individual initiative and action, government support and group action are blended in a mutually supportive manner that we can bring about higher and more economical production of rice.

The experience of the last two decades has shown that we must pay greater attention to issues relating to economics, employment, equity, energy, and ecology both in technology development and transfer.

The famine of jobs is like to become the most serious famine in the coming years. Therefore, the effective utilization of the whole plant including straw, bran, and hull deserves greater attention. We must work on techniques which will not displace labour but which will help to generate diversified opportunities for gainful employment, both in the on-farm and off-farm sector.

IV. Soil Health Care and Plant Genetic Resources Conservation

To promote sustainable rice production, it is important that the germplasm sources of rice are conserved for present and future use. Similarly, all aspects of soil health care require greater attention. The International Rice Germplasm Center at IRRI has nearly 77 000 distinct strains. A Five-Year Plan (1983-1988) has been drawn up to collect the remaining germplasm, particularly from endangered habitats.

IRRI operates the International Rice Testing Program (IRTP), the International Network of Soil Fertility and Fertilizer Evaluation for Rice (INSFFER) and the Asian Rice Farming Systems Network (ARFSN) in order to provide the national rice research systems the best available material and know-how. Through international cooperation, it will be possible to maintain and defend the progress already made in irrigated areas. By appropriate cooperation with advanced research laboratories, the most recent techniques of genetic engineering, computer science, satellite imagery, micro-electronics, and biotechnology can be harnessed for the improvement of the rice crop.

In all our R&D efforts, the aim should be to promote the productivity, profitability, stability and sustainability of rice farming systems. I am confident that the discussions in the IRC meetings will help this cause.

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