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PROGRAMME PLANNING

COUNTRY AND REGIONAL PROGRAMMES

Assistance for a global project

International co-operative rice improvement for sustainable rice farming (GLO/89/003)

Recommendation of the Administrator

Estimated contribution by the United Nations Development Programme: $4,402,600
Duration: Two years and six months
Executing agency: UNDP

I. BACKGROUND

1. In 1976, UNDP helped launch the International Rice Testing Programme (IRTP), based at the International Rice Research Institute (IRRI) in the Philippines. The main objective was to foster the establishment of a co-operative research grid with the active participation of scientists from rice growing developing countries in the systematic testing and development of diverse rice strains adapted to different agro-ecological conditions. In 1980, under the title International Rice Testing and Improvement Programme (IRTIP), UNDP provided support for greatly expanded networks of international rice nurseries, germ-plasm collection, co-operative research into innovative techniques for breeding and improvement; expanded research into biological nitrogen fixation in rice paddy soils; and research into the response of rice varieties under different climatic conditions. Under the current project (1985-1989), while most of the activities initiated in 1980 are being continued, provision has been made for strengthening efforts in Africa, Latin America and the Caribbean.
2. The development of varieties adapted to different growing conditions has been achieved by IRTP by building a network for the exchange of rice varieties and breeding lines (the precursors of varieties) among countries and regions.

3. The programme on nitrogen fixation in rice paddy soils has studied the role of micro-organisms in fixing nitrogen as part of the process of natural plant nutrition. The ultimate goal is to help paddy rice farmers reduce their dependence on mineral fertilizers.

4. Training and scientific collaboration have developed rapidly. From 1975 to 1987, over 2.5 million seed packets of nearly 20,000 rice varieties and breeding lines were sent to more than 70 countries for trials. Several promising rice varieties identified have shown significantly higher yields at the farm level. The tests covered widely varying conditions (cold, drought, salinity, alkalinity, acidity, diseases, insect pests, etc.) and trial results are analysed and disseminated by a computer-based system.

5. Approximately 20 per cent of the current project is devoted to training. To date, nearly 500 scientists from more than 30 countries in Asia, Africa and Latin America have been trained in genetic evaluation and utilization which provides the basic skills needed to operate national rice-breeding programmes. More than 500 scientists from 40 countries participated in IRTP monitoring tours and visited 140 rice research stations and institutes. The project allowed strengthened collaboration among rice scientists around the world through conferences, workshops, seminars, monitoring tours and training programmes. The IRTP has thus become an invaluable vehicle for technical co-operation among rice scientists of developing countries around the world.

6. Collaboration between IRRI and the various national programmes through the IRTIP project has led to several impressive achievements. The project now proposed would take advantage of these achievements through continued intercountry co-operative efforts to obtain not only higher but more stable rice yields through identification and utilization of genetic sources of resistance to stresses such as insects, diseases, adverse soils, suboptimal temperatures, drought and flooding. The ultimate focus of the project will be on economically underprivileged farmers and ecologically disadvantaged rice growing areas.

7. During 1988, the overall research and training programmes of IRRI were evaluated by a team of independent consultants commissioned by the Technical Advisory Committee (TAC) of the Consultative Group on International Agricultural Research (CGIAR). The review, which was conducted at IRRI headquarters and in different parts of the world, highly commended the excellent work being carried out and recommended that specific programmes be provided continued support from donor agencies.
II. THE PROJECT

8. The proposed project will comprise the following two major research thrusts:

A. International network for genetic enhancement of rice

9. The introduction of high-yielding varieties of rice since the mid-1960s resulted in dramatic increases in rice production in many developing countries. However, millions of people in parts of Asia and Africa have not shared in these gains in food production. Rice yields in many developing countries are still low because of several biological and physical stresses and nutrient deficiencies. Even in the case of certain parts of the developing world where farmers have better means, indiscriminate use of chemicals in crop production is proving to be expensive and also affects the sustainability of the ecosystem. With rice farming being gradually pushed into marginal lands, the ecological sustainability and economic viability of rice production systems becomes even more important. In preparing to meet these challenges to rice production, the project embodies the following objectives:

(a) To achieve genetic enhancement of rice varieties for different ecologies through the integrated application of traditional plant breeding methods and of biotechnology;

(b) To develop screening for different stresses in relevant hot spot locations;

(c) To promote genetic heterogeneity in order to avoid genetic vulnerability to pest epidemics and to achieve a reduction in the cost of production; and

(d) To stimulate national research systems to develop varieties better adapted to specific agro-ecological and socio-economic conditions, in partnership with farmers.

10. The methodology to achieve the above goals consists primarily of the following:

(a) Intense preliminary screening of breeding lines and varieties for various stresses at a few selected sites that represent a high level of pressure (hot spots);

(b) Exchanging of promising breeding lines and varieties among various countries;

(c) Formulating breeding strategies based on information gathered on varietal interactions with the environment;

(d) Fostering continued interactions and co-operation among rice scientists around the world through joint site visits and workshops; and

(e) Training rice scientists in different countries in various aspects of varietal improvement.
11. The programme will have linkages with the following:

(a) Concerned departments of IRRI for component technologies;

(b) Various networks co-ordinated by IRRI with a focus on plant nutrition and farming systems;

(c) Different national programmes; and

(d) Other international centres concerned with rice (the International Institute of Tropical Agriculture (IITA), the West African Rice Development Association (WARDA), the Centro Internacional de Agricultura Tropical (CIAT) and other international agricultural programmes sponsored by different donors.

Through on-farm testing in the farming systems network, farmers' assessment and inputs can be obtained, so as to make varietal improvement a joint activity of breeders and farmers. Strong linkages will be established with the women in the Rice Farming Systems Programme with particular reference to the greater involvement of women farmers and labour in seed selection and technology.

12. The project will help to promote South-South collaboration in breeding varieties suited to specific agro-ecological and socio-economic conditions. Central to the programme activity is the rice "variety". The thrust is to rely on the genetic versatility of the variety, rather than on costly inputs, through co-operative evaluation and identification of varieties with higher yields potential and those that serve as donors of genes to tolerate various stresses such as diseases, insects, adverse soils, adverse water status and adverse temperatures. Sharing of valuable genes rather than mere testing of fixed genotypes will be a major goal of the project.

B. Evaluation of biofertilizer germ-plasm and rice for higher nitrogen fixation

13. Nitrogen is a key nutrient for rice production. For centuries, nitrogen was supplied from organic wastes, vegetative residues and biological nitrogen fixation (BNF). There are four principal systems by which BNF can supply nitrogen to flooded rice. They are blue green algae, free-living soil micro-organism, azolla and aquatic legumes. It has only been in this century that synthetic nitrogen fertilizers were used extensively to provide this important plant nutrient. Unfortunately, synthetic nitrogen fertilizers are expensive for resource-poor rice farmers and they can contribute to environmental pollution. The goal of the BNF research component is to develop alternative sources of nitrogen for rice production that are economic, efficient, reliable and environmentally acceptable.

14. Emphasis will be placed on two BNF systems that offer particular promise as efficient and economical sources of nitrogen for flooded rice production. Substantial basic information on each of these systems has been developed by previous UNDP-supported projects and other programmes, and should be invaluable in the proposed studies. The research programme will have two components.

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Azolla

15. Azolla is an aquatic fern that contains nitrogen fixing blue green algae. It has been utilized for centuries in China and Viet Nam as a source of nitrogen for flooded rice production. However, use of azolla as a source of nitrogen is limited because of its sensitivity to high temperatures, pests and pathogens, desiccation and its high phosphorous requirement. While cultural practices can reduce these constraints, plant selection and breeding of improved azolla would also be very valuable. Thus, screening of available azolla biotypes and hybrid populations for strains that exhibit better tolerance to certain of the above-mentioned constraints will be accomplished. In addition, attempts will be made to develop a practical methodology to produce sexual hybridization between different azolla species and produce desirable azolla mutants through radiation or chemical mutagens. Efforts will be made to introduce foreign algae into azolla that may enhance BNF. Finally, the genetic and phenotypic characterization of the IRRI azolla collection will be improved. Certain aspects of this research will be done in collaboration with China, the Philippines and Viet Nam.

Development of a methodology for identification of rice cultivars with enhanced capacity to support BNF and utilize soil nitrogen

16. It has been known for several years that rice varieties differ in their capacity to support BNF under flooded conditions and that they also differ in their efficiency in utilizing soil nitrogen for growth and grain production. There is a need to understand the interaction between the genetics for both of these characteristics and the growing environment. Soil type is, of course, one of the most important variables that will be examined. In addition, practical screening techniques based on morphological or biochemical properties need to be designed in order that plant breeders may begin to incorporate these two important characteristics into modern rice varieties. This is an extremely important aspect of the project because, if successful, it will permit better utilization of BNF in rice production by resource-poor farmers.

17. Training and staff development and the dissemination of information will be a major component of the project and will receive nearly 50 per cent of the contribution requested from UNDP. Interdisciplinary teams of scientists concerned with genetic evaluation and utilization of rice will be invited to participate in formal, four-month training courses. A course of special interest to those concerned with biological nitrogen fixation will be offered through the international network in soil fertility evaluation for rice of IRRI. Several scientists from countries in the tropics will participate in this course each year. The intensive training activities, covering advanced degree training and research fellowship awards, participation in conferences, symposia, workshops and monitoring tours to review the performance of rice varieties in different environments will be expanded. The training courses in genetic evaluation and utilization will be held twice yearly at IRRI, IITA and WARDA in Africa. CIAT in Latin America will assist in these training programmes, particularly for French- and Spanish-speaking trainees. The participation of trainees from Africa and Latin America will be increased.
18. The monitoring tours or site visits referred to above will be organized for a joint review of the co-operative field trials by groups of scientists involving those from different national programmes and from IRRI. These site visits provide an opportunity for interaction among rice scientists from different countries. Joint review of field performance provides a useful feedback for follow-up trials as well as for research strategies. Monitoring tours also provide an important mechanism for the training of the young scientists who participate in such tours from time to time. The number of monitoring tours per year will be kept at an optimum level to meet the programme's goals. If any increased activity is needed, inputs will be sought from selected national programmes.

19. Reports of network results, site visits and other relevant information will be published and distributed to rice scientists and research administrators around the world. Data from the network trials will be computerized for speedy dissemination of relevant information to the rice scientists in different countries to enable them to make use of the data in an appropriate manner in their research programmes directed towards varietal improvement. The utilization of promising breeding lines (for hybridization or further yield evaluation or release to farmers) will be monitored through appropriate procedures. Advisory committee meetings, monitoring tours and other appropriate forums will be used for discussion with national agricultural research systems on effective utilization of the findings from the network trials.

20. In order to assess the impact of the project activities at the farm level and to measure the effectiveness of the various training programmes, UNDP will provide, under its direct cost component, funds for required consultancies in order to undertake an independent evaluation. It is anticipated that the assessment will be made at two different periods: midway in the course of the project and at the end. In order to arrive at a meaningful assessment, visits will be made to selected countries around the world in order to obtain adequate coverage of the countries involved. Special attention will be given in the evaluation to the outcome of the project with regard to strengthening national rice improvement and extension programmes and the utilization of new technologies by farmers, resulting in increased production. A consultant mission will also appraise research on BNF and develop an intercentre co-operative programme on BNF linking research in developing and developed country institutions.

21. The Administrator intends, through contractual arrangements between IRRI and UNDP, to entrust the implementation of this project to IRRI with the clear understanding that the directorate of IRRI will seek the advice of the Food and Agriculture Organization of the United Nations (FAO). As in the past, UNDP will follow closely all the developments in this global project and, together with FAO, will participate in the project advisory committee (PAC) to be established for the project. A concerted effort will be made to link the research activities to be undertaken with field work being undertaken at the country and intercountry levels. The PAC which will oversee this co-ordination will include renowned scientists currently engaged in all relevant aspects of rice breeding, genetics, testing and biological nitrogen fixation research. The Committee normally will meet once a year to appraise ongoing research activities and to advise on its future direction. Specialists from other international centres will be invited, as appropriate, to serve on the committee.
22. Midway in the course of the project, UNDP, in consultation with IRRI, may decide to schedule an evaluation of project activities to be undertaken by a team of two or three independent consultants. Such an evaluation, if needed, could be undertaken in conjunction with one of the PAC meetings mentioned in paragraph 18 above. Towards the completion of the project, a thorough evaluation of its results and accomplishments will be mounted by UNDP in consultation with IRRI, to be carried out by independent and eminent consultants.

23. The proposed support to be extended to IRRI by UNDP during its first full year (1989) represents 15 per cent of the total running core budget of the rice programme of the Institute, which is estimated at $26.5 million. During the period of the project (1989-1990), the proportion will remain approximately the same but will be decreased subsequently. The balance of the IRRI budget is being financed by other members of CGIAR. The UNDP will not contribute towards any capital expenditures that might be made to IRRI in addition to its regular budget.

24. The proposed UNDP contribution is $4,402,600 of which $4,152,600 will be for sub-contracts, while direct costs will account for the remaining $250,000. The expenditures under the project will be contained within the indicative planning figure (IPF) available for global projects established by the Governing Council for the fourth cycle.

III. RECOMMENDATION

25. The Administrator recommends that the Governing Council approve this project.