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COUNTRY AND INTERCOUNTRY PROGRAMMES AND PROJECTS

CONSIDERATION AND APPROVAL OF GLOBAL AND INTERREGIONAL PROGRAMMES AND PROJECTS

Project Recommendation of the Administrator

Assistance for a global project

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)  
Research and Training in Sorghums and Millets (Phase III)  
(GLO/81/012)

Estimated UNDP contribution:                   \$US 6,600,000  
Duration:   Five years  
Executing Agency:                                UNDP

I. Background

1. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), located in Hyderabad, India, was established by the Consultative Group on International Agricultural Research (CGIAR) in 1972, in order to improve food production in the semi-arid tropics (SAT) which cover over 50 countries in a wide belt of Asia, Africa, Latin America and Australia. Most of the population of these regions, numbering over 600 million, lives at subsistence levels. More than one-half of this population, 350 million people, lives in India, and most of the remainder lives in West, East and Central Africa. The principal food crops are sorghum, millet, chick-peas, pigeon peas and groundnuts which are grown by small farmers with very limited resources in a harsh environment of depleted soils, erratic rainfall and sparse or no irrigation.

2. ICRISAT's objectives are to:

(a) Serve as an international centre for improving the genetic potential of sorghum, pearl millet, pigeon pea, chick-pea and groundnut;

(b) Develop farming systems which increase production through more effective use of available resources;

(c) Identify factors constraining agricultural development and evaluate ways of alleviating them; and

(d) Support national and regional research programmes through collaboration, conferences and training.

3. Sorghum and pearl millet provide the staple foods for millions of people in the semi-arid tropical regions of the world. Together, they rank first in order of calorie intake in Africa, third in Asia and the Middle East, and are second only to rice in total areas planted. Pearl millet is best suited to consistently produce grain in the harsh climate of the hot, drought-prone regions and is grown on an estimated 26.7 million hectares on the Indian sub-continent and in Africa, with an annual production of about 14 million metric tons. Sorghum is grown on an estimated 60 million hectares producing 43 million tons annually on the same continents, in regions where the rainfall is a little higher, but where climatic and biological stresses are still major factors limiting production. The factors that reduce grain yields are low and erratic rainfall, diseases, insect pests, weeds, low soil fertility, and sub-optimum management. The farmer's average yields are low - 500-600 kg/ha for pearl millet and 650-950 kg/ha for sorghum, which is about one-fifth of the yield obtained in developed countries where sorghum is fed to livestock. These two crops are grown mostly by farmers who cultivate small areas and have little or no capital for purchased inputs.

4. From its inception, ICRISAT has been receiving substantial assistance for the improvement of sorghum and millet. The first phase of UNDP assistance, amounting to \$3,725,000, was approved by the Governing Council at its fifteenth session (DP/PROJECTS/R.2/Add.5). This phase, which was carried out during 1973-1977, placed emphasis on investigating ways and means of increasing the yields of these two crops, improving their nutritive value and developing a cadre of trained personnel. UNDP assistance for a further five-year period, amounting to \$5,466,700, was approved by the Governing Council at its January 1978 meeting (DP/PROJECTS/R.14/Add.3). The main objective of the second phase has been to expand and intensify the work carried out under the first phase to improve the yields of sorghum and millet through various programmes for selecting, breeding and testing different strains of these two crops for resistance to insect pests, diseases, weeds and drought, and for high yield, stability and quality. The project consists of three distinct but closely related spheres of activity. In the work involving genetic research and breeding, ICRISAT can draw on a world germ-plasm of over 19,000 and 12,000

strains, respectively, of sorghums and millets. In developing materials suitable for use at the farmers' level with high yields and stability over seasons, ICRISAT is carrying out a number of co-operative testing in national programmes in India and around the semi-arid tropics, particularly Africa.

5. As a vital companion piece to basic research in sorghum and millets being carried out at ICRISAT headquarters in India, UNDP has been providing substantial financial assistance to an African Co-operative Programme designed to:

(a) Co-operate with and strengthen existing West African agricultural research programmes to develop higher-yielding varieties of sorghum and millets, and to introduce appropriate technologies to achieve consistent and reliable yields; and

(b) Train large numbers of national personnel in all aspects of production and research on sorghum, millets and companion crops, as well as in related areas of farming systems, to make maximum use of available soil, water and other resources. To date, UNDP assistance to the African Co-operative Programme, which is also supported by other donors, amounts to \$11,575,000. Three separate phases of UNDP assistance were approved by the Governing Council at its nineteenth session in 1975 (DP/PROJECTS/R.3/Add.2), at the January 1978 meeting (DP/PROJECTS/R.9/Add.1) and at the twenty-eighth session in June 1981 (DP/PROJECTS/R.14/Add.5).

6. An important component of the current UNDP project at ICRISAT headquarters in India is the training of developing country personnel from the semi-arid tropics, with special emphasis being given to African countries, many of which have a shortage of adequately qualified and trained personnel. Major accomplishments in training are as follows: (a) 184 scientists and technicians from 36 countries trained for 6-8 months in cereal improvement and production; (b) 13 M.Sc. and Ph.D. research students from 7 countries trained, with 4 continuing in 1981; (c) 10 research fellows from 7 countries have been trained, with one currently participating in the sorghum pathology programme; and (d) 4 international interns from 2 countries trained, with one currently in the Upper Volta and two at the ICRISAT Center.

7. In order to bring together crop scientists working with sorghum and millet in developing countries with a view to facilitating exchanges in knowledge and experience of research in these two crops, ICRISAT has hosted several workshops, conferences and symposia. Twenty-seven journal articles and 56 other publications covering a broad range of sorghum and millet research topics have been put out by ICRISAT.

8. Significant achievement of the genetic, breeding and trials on sorghum and millet under different agro-ecological conditions are as follows:

(a) The sorghum programme has developed 10 cultivars for either distribution or final intensive evaluation in Ethiopia, Kenya and Venezuela. It has also, for the first time, provided nine hybrids for testing in the All India

Co-ordinated Sorghum Trials, and provided some 150 new parents for further evaluation in hybrid combinations. It has also developed improved techniques for evaluating the different food uses of sorghum, and ways of evaluating seedling response to heat and moisture stresses. These techniques have long-range implications for future breeding work.

(b) The pearl millet programme has contributed a promising downy mildew-resistant cultivar for Indian national trials, and has initiated important work on the development of semi-dwarf hybrids. It has developed promising lines providing ergot resistance, identified sources of smut and rust resistance, and discovered that several distinct races of downy mildew may exist. It has also developed new techniques to evaluate seedling response to heat and moisture stresses, rather similar to the work done on sorghum. It has also initiated a series of regional trials and exchange nurseries in many African countries.

9. A new research component of potential significance in the current phase of the UNDP project is the investigation on biological nitrogen fixation being carried out by certain micro-organisms in the root zones of sorghum and millet. Data obtained to date through pot culture experiments have confirmed that nitrogen fixation does take place in the root zones of sorghum and millet plants. Several micro-organisms involved have been identified. Since these two crops are grown largely on poor soils with little or no fertilizer, techniques to maximize the biological nitrogen fixation to provide nitrogen to the crops, at practically no cost, hold considerable potential from the standpoint of the resource-poor farmers who cannot afford to purchase expensive, artificially produced chemical nitrogen fertilizers.

10. Since the current UNDP project is scheduled for completion in December 1982, the progress and accomplishments of the project were recently reviewed by a team of three well-known independent consultants appointed by UNDP. This team has very favourably commented on the progress being made, and has strongly recommended follow-up support for a further five-year period to expand, intensify and strengthen all relevant aspects of sorghum and millet research development, in particular, the training of scientific and technical personnel from developing countries.

## II. The project

11. The main objectives of the third phase project are to:

(a) Consolidate current work on sorghum/millet research and development, to capitalize on results already obtained;

(b) Generate important new research findings;

(c) Develop improved varieties; and

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(d) Continue the training of developing country personnel on a greatly expanded scale. Project activities will be carried out as an integral part of ICRISAT's multidisciplinary programmes in other crops, farming systems and agro-economic research which are financed by other donors.

12. Specific activities of the project are as follows:

#### Sorghum

(a) Improvement and stabilization of screening procedures for important economic traits such as resistance to grain molds, stem borer, midge, charcoal rot, leaf diseases and weeds (Striga);

(b) Expanded identification of source material for priority yield limiting traits for incorporation into improved varieties with resistance to various insects and diseases, including grain mold and possessing improved food quality; and

(c) Identification of useful hybrids and varieties for selected areas (e.g. Ethiopia, India, Mali, Nigeria, Senegal, Sudan, United Republic of Tanzania, etc.) and a better knowledge of crop management;

#### Millets

(a) Development of varieties and hybrids that produce stable and consistently high grain yields in general cultivation, combining resistances to various diseases;

(b) Large-scale field-screening techniques for identification of drought resistance and transfer of these techniques and improved materials developed to national programmes;

(c) Development of a broadened range of sources of resistance to downy mildew, ergot, smut and rust with multiple sources of resistance; and

(d) Rapid and efficient screening techniques to identify significantly high nitrogen fixing genotypes;

#### Training and workshops

13. In order to strengthen the capability for research in the national programmes in the developing countries, a concerted effort will be made to accommodate an increased number of research scholars, research fellows, in-service fellows and in-service trainees with suitable academic qualifications in all aspects of sorghum and millet improvement, including research management, and technology transfer techniques. About 10-12 fellowships will be awarded to selected candidates from African countries to obtain Master degree training in relevant aspects of sorghum and/or millet improvement. These fellowships will be awarded to candidates who are in responsible positions in national crop improvement

programmes. A number of workshops, conferences and symposia will be organized during the course of the project to enable scientists engaged in sorghum and millet research to exchange knowledge and experiences which would benefit their individual national programmes.

14. The research and training programmes described above, for which full descriptions including the countries expected to participate in them will be made available to UNDP on project approval, will be implemented by ICRISAT in collaboration with national research institutions of developing countries. As already indicated, special conferences, seminars and workshops will be arranged as needs arise. Participants in those events as well as training courses will be carefully selected by ICRISAT, in consultation with appropriate national agencies.

15. 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 own direct costs component, funds for required consultancies in order to undertake an independent evaluation. It is anticipated that such an assessment will be made at two different periods, midway in the course of the project and at the end. Visits will be made to selected countries around the world in order to provide adequate coverage of the countries involved so that the assessment will be meaningful. Special attention will be given in that evaluation to the outcome of the project with regard to strengthening national sorghum and millet crop improvement and extension programmes and the utilization of new technologies by farmers resulting in increased production.

16. The Administrator intends, through contractual arrangements between ICRISAT and UNDP, to entrust the implementation of this project to ICRISAT, with the clear understanding that the Director-General of ICRISAT will seek the advice of FAO as needed. 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 which will be established for the project. A concerted effort will be made to link the training and research activities with field work being undertaken at the country and intercountry levels. FAO's assistance will be sought in implementing national trials and the introduction of new varieties and hybrids as they are developed. The Project Advisory Committee, which will include representatives of selected national agricultural research centres, will meet normally once a year, or at such times and places as deemed appropriate by ICRISAT. It will appraise the ongoing training and collaborative research programmes and advise on its future direction. Towards the end of the project, UNDP, in consultation with ICRISAT, will undertake a review of the accomplishments of the project to be carried out by a team of independent consultants. This review will take place in conjunction with the assessment referred to in paragraph 15 above.

17. The expenditure components of the proposed UNDP assistance are:

	<u>US\$</u>
Subcontract	6 200 000
UNDP direct costs	<u>400 000</u>
Total	<u>6 600 000</u>

The proposed UNDP contribution will be contained within the Global IPF establish by the Governing Council for the current cycle.

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