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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

Research and Training in Fertilizer Technology and
Utilization (Phase II)
(GLO/82/005)

Estimated UNDP contribution: \$US3,716,000
Duration: Five years
Executing Agency: UNDP

I. Background

1. The developing countries are becoming increasingly aware of the role that fertilizers can and must play if the countries are to attain increased food production goals. During the decade of the 1970s, the developing countries increased fertilizer use from 13.5 million metric tons of nutrients in 1969/70 to 34.6 million tons in 1979/80. The Food and Agriculture Organization of the United Nations/United Nations Industrial Development Organization of the Working Group on Fertilizer has projected that the developing countries will use about 50 million tons of plant nutrients by 1985/86. Even with these sizable increases, the developing world still lags far behind in fertilizer use. In 1980, the world as a whole used 111.7 million metric tons of plant nutrients. The developing world, with approximately 70 per cent of the world's population, used only 31 per cent of the world's chemical fertilizers.

2. Fertilizer production in the developing countries has also shown a marked increase during the 1970s. By 1980, the developing countries were producing 24 million tons of plant nutrients (20 per cent of the world's total) as compared with only about 6 million tons in 1970 (about 10 per cent of the world's total). By 1985/86 it is estimated that the developing world will be producing about 38 million metric tons of plant nutrients (about 25 per cent of the world's total). Even with these large production increases, the developing countries will remain net importers of fertilizer materials: in fact, in real terms, the imports must increase.
3. The task of developing more effective fertilizer supply systems for the developing countries is a complex endeavour which involves the development and transfer of technology, increased investments in support systems, and more effective utilization of existing and/or improved technology in three areas: (a) fertilizer production; (b) fertilizer marketing including distribution; and (c) fertilizer use. Success in these areas will require the availability and effective utilization of trained personnel.
4. Although some gains are evident, fertilizer-use efficiency remains low, losses in distribution and marketing are high and fertilizer production is only 50-70 per cent of rated capacities in the developing world compared with 85 per cent or 90 per cent in the developed world. Probably, the most important factor contributing to these low efficiencies is the lack of trained personnel. Many developing countries lack the experience and facilities, as well as the economic means to train personnel to the levels and in the numbers that will be necessary. Once these inefficiencies are corrected, the production costs will be reduced and improved response to applied fertilizers should be forthcoming. Farmers should benefit from the improved availability and quality of fertilizers and this, combined with improved economics of use, will lead to greater demand and wider use.
5. It is commonly accepted that the production of food and fibre must be increased markedly in the arid and semi-arid regions of the developing world, if those areas are to adequately feed and clothe their growing populations. These are the areas that are most prone to widespread crop failure and famine. The Consultative Group on International Agricultural Research (CGIAR) has recognized these areas as needing special attention and is supporting the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the International Center for Agricultural Research in the Dry Areas (ICARDA) to work on crops of the semi-arid tropics (SAT) and the dry areas (DA), respectively.
6. Fertilizer use in the SAT and DA is very low. At present, the major use is on small irrigated areas (sugarcane, rice) or on cash crops (groundnut, cotton), grown under rainfed conditions. The staple crops (sorghum, millet, chick-peas, pigeon peas, etc.) receive little or no fertilizer. This is probably the result of uncertainty of fertilizer response, unreliability of rainfall, lack of improved agricultural technology, and consequent risk aversion by farmers plus general unavailability of this input because

necessary infrastructure is lacking. However, recent developments in farming systems research have shown that considerable increases in yield can be obtained when several components of a farming system are improved concurrently. The developments offer the promise of increased food production, with fertilizer inputs playing an important role.

7. For cereal crops, nitrogen is usually the most limiting nutrient. Nitrogen is also the most energy intensive to produce and, therefore, the most costly fertilizer used by farmers. It is estimated that an average energy equivalent to 39 litres of gasoline is required to produce, bag, and distribute a 50 kg. bag of urea to the farmer. Only a limited amount of research has been conducted to date in the SAT and DA on the efficiency of nitrogenous fertilizer and its fate following application. Losses of fertilizer nitrogen (N) to the atmosphere of 15-20 per cent are likely under the best of circumstances. With poor management practices these losses might reach as high as 40-50 per cent, particularly on lighter-textured soils. With a current annual N fertilizer usage of 3.5 million tons in India alone, and approximately 2.3 million tons in ICARDA region, a 25 per cent loss represents a financial loss of a quarter of a billion dollars. Rising costs of energy coupled with low efficiencies of plant recovery under present methods of use make it imperative to carry out a research effort to assess the magnitude of N fertilizer inefficiency and find means of overcoming this problem. A relatively small improvement in fertilizer efficiency will, in one year, more than repay the project research cost.

8. The International Fertilizer Development Center (IFDC) was established in October 1974 on the initiative of the United States Agency for International Development (USAID) and the International Development Research Centre (IDRC) of Canada. By July 1975, IFDC was a functional, private, non-profit, organization with headquarters in Muscle Shoals, Alabama. The building programme for IFDC was initiated in April 1975 and two buildings totaling some 80,000 square feet were completed and occupied in August 1977. These buildings were financed by USAID and consist of offices, laboratories, a modern training centre, two greenhouses, and space for pilot plants. USAID also furnished grant funds for specialized capital equipment and five pilot plants. IFDC now has the capability for research, development, and training in most all aspects of fertilizers. In 1977, IFDC was accorded, by the United States Government, all of the privileges and immunities granted to international organizations. The Board of Directors of IFDC (presently with 13 members) includes people from both developing and developed countries, and its members are outstanding in world development efforts, agriculture, and fertilizers. IFDC has about 160 full-time staff members of whom about 70 are scientists or engineers from 20 countries. IFDC now has 13 senior staff members stationed overseas: in Colombia with the Centro Internacional de Agricultura Tropical (CIAT), in India and Niger with ICRISAT, in Nigeria with the International Institute of Tropical Agriculture (IITA), in the Philippines with the International Rice Research Institute (IRRI) and the fertilizer company PHILPHOS, and in Bangladesh with the Bangladesh Agricultural Development Corporation (BADC). In 1982, two or three additional positions will be outposted in Indonesia on a project with the Australian Development Assistance Bureau (ADAB).

Visiting scientists from around the world are welcomed and integrated into IFDC's research and development programme. Major funding for IFDC comes from USAID, IDRC, ADAB, the International Fund for Agricultural Development (IFAD) and UNDP. Funding for specific one-time projects has been made available from several countries including the Netherlands, the Federal Republic of Germany, Norway, and Brazil. Special project work provides about 25 per cent of IFDC's budget.

9. The mission of IFDC is the development of fertilizer technology and know-how needed to sustain and increase food production in the developing countries. More specifically, IFDC's goal is to develop technology that will keep fertilizer costs down through improvements in fertilizer efficiency, adaptation of capital and energy saving technology, and, wherever possible, use of indigenous raw materials and local personnel. Equally important are efforts aimed at the identification of constraints of fertilizer use and the development of policies that will lead to their relaxation or removal. Training of adequate personnel in the developing countries is recognized as critical to the IFDC mission and, therefore, receives major programme emphasis.

10. IFDC recognizes that it cannot carry out its mission alone but that it requires considerable assistance and must co-operate with many international, regional, and national institutions. Technology developed by IFDC scientists and engineers as well as by experts from other institutions must be tested under a wide range of conditions before its applicability can be established for a given area and the technology eventually transferred to specific producers, distributors, and users. IFDC works with existing institutions either at the international or national level to ensure that relevant fertilizer problems are identified, technology developed, personnel trained, and technology transferred to meet the needs of developing countries. IFDC works closely with a number of the International Agricultural Research Centres (IARCs) in planning and carrying out fertilizer research and tailoring it to specific crops and geographic areas. To date, agreements have been developed with ICARDA, ICRISAT, IRRI, IITA and CIAT. IFDC has also developed close working relationships with the Food and Agriculture Organization of the United Nations (FAO), the United Nations Industrial Development Organization (UNIDO), the World Bank and UNDP. Experts from these organizations participate in the planning and execution of specific IFDC activities. IFDC has major programmes dealing with research, training and technical assistance. IFDC's research programmes are aimed at solving problems that have broad applicability. Major focus has been on developing solutions to problems related to nitrogen, phosphate, and constraints to fertilizer use. Additional efforts are under way to identify problems related to sulfur, potassium, calcium, and magnesium.

11. At its twenty-sixth session in June 1979 1/, the UNDP Governing Council approved assistance amounting to \$2,695,000 for a three-year project, the main purpose of which was to carry out, in collaboration with selected and international agricultural research centres, studies on the efficiency of nitrogen fertilizers, and to develop and implement an expanded programme of

1/ DP/PROJECTS/R.12/Add.4.

training in fertilizer production, distribution, marketing and use. Also included in the project was an evaluation component to measure the effectiveness of the various training programmes. The project presently being implemented by IFDC is scheduled for termination in July 1982. Significant progress has been made in both research and training activities. Important groundwork has been laid for research in nitrogen and phosphorus which are beginning to show encouraging results. By the end of 1981, 17 group training programmes in various aspects of fertilizer technology and utilization involving 757 participants had been completed. Individual training was received by 57 participants - 25 from Africa, 14 from Asia, 14 from Latin America and 4 from the Middle East. A recent UNDP consultant mission, which evaluated the project, has highly commended IFDC for the effectiveness of the project, and has strongly recommended the continuation of UNDP support over a five-year period in order to capitalize on the training and research infrastructure now in place so that maximum benefits would accrue to the developing countries.

II. The project

12. The main objective of the second phase project is to consolidate the work done in the first phase and to expand research on the efficiency of nitrogen fertilizers. The project also aims to intensify, on a larger scale, the building up of a pool of trained staff in all aspects of fertilizer production, marketing and utilization so as to meet the personnel requirements of the developing countries to enable them to carry out research and development work in fertilizer technology and utilization.

13. The specific objectives of the research on efficiency of nitrogen fertilizers in the arid and semi-arid regions are to:

(a) Broaden the data base on nitrogen efficiency in relation to soil type and climate through collaborative studies with national research centres, using labelled nitrogen;

(b) Study the interaction between soil water and fertilizer N utilization by the crop using techniques developed by IFDC;

(c) Develop fertilizer sources or fertilizer application techniques that will improve fertilizer efficiency under conditions of limited water supply;

(d) Study the role of N fertilizer in relation to soil nitrogen, fallow practices, cropping frequency, and cropping systems; and

(e) Develop a network of collaborating national research centres in the regions to test and validate the research findings of the programme on a continued basis.

14. Research on phosphate presently being carried out under the current UNDP project will be continued with funds outside UNDP sources.

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15. The main goals of the training programme of the project, which will receive over 60 per cent of the funds requested for the phase two project, are to: (a) improve fertilizer marketing systems; (b) increase fertilizer production capabilities; and (c) upgrade research capabilities, both industrial and agricultural.

16. All of the training programmes will be designed to meet the specific needs of individuals, Governments, or sponsoring agencies interested in fertilizer development. It is planned to hold several training courses during each year of the five-year phase two, plans for which will be spelled out in annual work plans to be submitted to UNDP. For instance, in 1982 alone, IFDC proposes eight courses in fertilizer marketing, procurement, distribution and management ranging from one to six weeks to be held at various geographic locations globally. Five courses in fertilizer efficiency for the tropics of durations ranging from two to 16 weeks will be held in Asia, Latin America, Africa and at IFDC headquarters. Fertilizer production and technology training courses of varying durations in 1982 will include: maintenance and production management training; granulation and bulk blending; production process economics; and ammonia/urea plant operation. These courses will be held at IFDC as well as at different geographic locations.

17. As a result of continued UNDP funding of IFDC training programmes, the following targets are proposed and, hopefully, will have been reached by the end of the second phase in June 1987. These targets are:

(a) Enrol and graduate at least 2,000 participants in group training courses. There was an average of 300 participants per year during the period 1979-1981. It is hoped this average might be increased to 400 per year for the five-year period of this project;

(b) Continue the development of structured curricula in training that offers a wide spectrum of courses needed to meet the needs of the fertilizer sector. A series of courses of graduated complexity will be developed in each of the basic components of the fertilizer sector;

(c) Develop sustained and mutually beneficial linkages with at least five national or regional institutions so that these institutions can serve as multipliers of the training programmes offered by IFDC. IFDC does not expect to meet, in its facilities, all of the trained staff needs of developing countries. Others must also play major roles not only to serve as multipliers of IFDC expertise but also to serve in their own right at centres of excellence to provide training in fertilizer use; and

(d) Improve the present system of evaluation that will allow continued improvement of IFDC training programmes. Specific attention will be given to: (i) determining training requirements of developing countries; (ii) improving methods used to select participants for individual courses; (iii) measuring effectiveness of instructors to communicate as well as participants' absorption

of information presented during each of the courses; and (iv) determining the impact of training by providing follow-up that will measure application of the principles offered in the course as viewed through the eyes of the participant, the immediate supervisor, and the senior executive of the participants' institution.

18. The training programmes described above, for which full description and detailed requirements will be made available to UNDP on project approval, will be implemented by IFDC in collaboration with appropriate counterpart organizations either in the United States (e.g. Tennessee Valley Authority's National Fertilizer Development Center) or in the developing countries (e.g. national and international centres of agricultural research). 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 IFDC in consultation with the national and international agencies. The number of participants listed above is only approximate. Based on the experiences gained during the first year and on an evaluation of the actual costs incurred for running these courses, it may be possible to increase the number of trainees in specific courses.

18. The Administrator intends, through contractual arrangements between IFDC and UNDP, to entrust the implementation of this project to IFDC, with the clear understanding that the Directorate of IFDC will seek the advice of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Industrial Development Organization (UNIDO) and the World Bank. As in the past, UNDP will follow closely all the developments in this global programme 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. Close collaboration will be maintained at all times with the international agricultural research centres participating in the project. The Project Advisory Committee, which will include representatives of selected national agencies and international agricultural research centres, normally will meet once a year to appraise the ongoing training and research programme and to advise on its future direction. Towards the end of the project, UNDP will, in consultation with IFDC, undertake a review of the accomplishments of the project to be carried out by a team of independent consultants.

20. The expenditure components of the proposed UNDP contribution are:

	<u>US\$</u>
Subcontract	3 566 000
UNDP direct costs	<u>150 000</u>
Total	<u>3 716 000</u>

21. The expenditures under the project will be contained within the Indicative Planning Figure established by the Governing Council for global projects.

