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COUNTRY AND INTERCOUNTRY PROGRAMMES AND PROJECTS

PROJECT RECOMMENDATION OF THE ADMINISTRATOR

Supplementary assistance for a global project

Increasing the Fixation of Soil Nitrogen and the Efficiency of  
Soil Water Use in Rainfed Agricultural Systems in the Countries  
of North Africa and Western Asia  
(GLO/78/003)

Estimated UNDP contribution:	\$US 850,000
Duration:	Two years
Executing Agency:	UNDP

I. Background

1. At its January 1979 meetings,<sup>1/</sup> the Governing Council approved assistance for a project involving a research programme designed to enhance soil nitrogen through nitrogen fixing bacteria and crop rotations with legumes, and to maximize efficient use of soil water under arid conditions with a view to increasing crop yields. The project is being administered by the International Center for Agricultural Research in the Dry Areas (ICARDA) in the Syrian Arab Republic, which is part of the network of the international agricultural research centres sponsored by the Consultative Group on International Agricultural Research (CGIAR). The primary concern of the International Center for Agricultural Research in the Dry Areas (ICARDA) is rain-fed agriculture in a region that includes much of the vast arid and semi-arid areas of North Africa and West Asia. This region has a Mediterranean-type climate, with hot, dry summers and relatively cool, moist winters. Those parts of the region receiving ICARDA's attention are limited in their opportunities for agricultural improvement by lack of water, having annual rainfall values ranging from 600 mm down to 200 mm or even less, making sustained agriculture difficult.

2. From Pakistan in the east to Morocco in the west, most of the countries in ICARDA's region are struggling to feed themselves: in most years, they fall short of the goal. The region's chronic food deficit is among the most serious in the world. With population growing rapidly and the cost of food imports rising along with general price inflation, the people of the area are usually eating less with each year.

3. In its effort to increase food production and raise rural living standards in the region, ICARDA maintains programmes for the improvement of three principal groups of food crops: basic cereals, including bread wheat, durum wheat, barley and triticale; legumes, including lentil, chick-pea and faba (or broad) bean; and forages. As an essential complement to the crop programmes, the farming systems programme develops improved techniques and technologies for exploiting the high-yield potential of improved crop varieties acceptable to traditional farmers.

4. ICARDA conceives of its entire research programme as forming an integrated farming systems approach to solving the problems of food production in arid regions. The programme's primary objective is to develop improved farming systems that are acceptable to traditional farmers and that will improve farmers' productivity and income, while conserving or enhancing soil and water resources. As an overall framework for its work, ICARDA is developing a detailed description and analysis of the region's agricultural sector in its total economic context. More detailed studies of existing traditional, rain-fed farming systems in various agroclimatic zones in the region will be useful to guide future single-focus research on farming systems components.

5. ICARDA researchers are also studying the relationships between soils and crops and the potential for management of soil water and nutrients under the various climatic conditions in the region. The major emphases of this research are nitrogen and phosphorus fixation, nitrogen mineralization and the subsequent use of nutrients by crops in various rotations under different conditions of soil fertility and moisture. Specific studies of traditional and potential cropping systems, including crop-livestock mixtures, are important for the integration of the centre's crop-improvement, agronomy, and livestock-management research. Studies on weed control will enable researchers and farmers to compare the relative benefits of the increased crop production resulting from eliminating weeds, with the value of weeds as livestock feed.

6. In order to achieve the above goals, ICARDA has established the following objectives:

(a) To conduct research into and develop improved cropping, livestock and cropping-livestock systems;

(b) To serve as an international centre for research into and the improvement of barley, lentils and faba beans;

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(c) To serve as a regional centre, in co-operation with other appropriate international agricultural research centres, for research in other crops of major importance to the region, such as wheat and chick-peas;

(d) To collaborate with and foster co-operation and communication among other national, regional and international institutions in the development of adaptation, testing and demonstration of improved crops, farming and livestock systems; and

(e) To foster and support training in research and other activities carried out in the furtherance of its objectives.

7. Several research activities of ICARDA are carried out in close collaboration with the International Maize and Wheat Improvement Centre (CIMMYT), dealing with wheat and barley, and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) relating to farming systems and food legumes. Both CIMMYT and ICRISAT are currently receiving substantial UNDP assistance under the global programme designed to help increase food production in developing countries. ICARDA's principal research station has been established in Aleppo near Damascus, Syrian Arab Republic, on a 950 hectare site where experimental trials are already under way. Construction of permanent buildings is presently under way and will be completed in different stages. Co-operative research agreements have been made with the Governments of Cyprus, Egypt, Jordan, Pakistan, the Sudan and Tunisia. Similar arrangements will be made with other countries of the region. ICARDA's proposed research on maximizing the utilization of soil nitrogen through legume/cereal crop rotations and efficient use of available water in the arid and semi-arid regions of the countries being served by ICARDA has the potential for substantially increasing food production.

8. The soil, water and nutrients research referred to in paragraph 5 above forms the main thrust of the UNDP-sponsored effort at ICARDA. To date, this project has conducted research on five sites, representing a range of different rainfall characteristics. Crop yields have been increased with application of phosphate fertilizer under very dry conditions. It has also been demonstrated that under less than 300 millimetres of rainfall, a fallow system contributes to a build-up of available soil nutrients, particularly nitrogen. In light of these studies, dry areas under 300 mm. of rainfall may have more potential than had been thought previously, and it is possible that major yield increases of specific crops can be attained economically. However, these investigations are presently being conducted in the vicinity of the main station near Aleppo, and they have to be extended to other areas and countries in the region to conclusively demonstrate the potential. With the experience gained during the last three years of the UNDP grant, ICARDA is confident that the methods used can be further refined and extended to other regions, thereby contributing to significant production increases of crops being grown under very dry regions which are dependent almost exclusively on very limited rainfall. Since the current UNDP support to the afore-mentioned programme will end on 30 June 1983, ICARDA has requested supplementary financial assistance to continue the project for an additional period of two years from 1 July 1983.

## II. The project

9. The main purpose of the supplementary assistance is to enable ICARDA to continue, expand and intensify the research and training programmes on improved efficiency of soil water use and enhancement of biological nitrogen fixation through legumes.

10. Specific objectives of the follow-up programme are:

(a) Evaluation and testing of three basic cropping rotations, namely: (i) continuous cereal; (ii) fallow/cereal; and (iii) legume/cereal, to be evaluated in light of their productivity, acceptability and profitability. Additional important investigations will include quantities of biological nitrogen fixed by legumes, measurement of the seasonal dynamics of soil moisture and mineralization of nitrogen to compute water and nitrogen use efficiencies;

(b) Determination of the major factors contributing to nitrogen and other soil nutrients within the crop rotations in an effort to alleviate nutrient limitations to productivity;

(c) Determination of the role of biological nitrogen fixation within the cropping and soil/water management systems to include studies on: identification, quantification and evaluation of native strains of rhizobium; and evaluation of additional strains of rhizobium for efficiency in nitrogen fixation and for competitive ability with native soil rhizobium;

(d) Investigations on environmental constraints to productivity, in particular, soil moisture within the crop rotations with a view to improving the efficiency of use of limited available water through proper soil/water management practices; and

(e) Augmenting the training component of the project by development of training materials and conducting specially designed training courses in soil physics, soil fertility, crop management, crop rotations and microbiology.

11. The afore-mentioned programmes will be implemented by ICARDA. The field, greenhouse and laboratory research will be conducted at ICARDA's main station in the Syrian Arab Republic. Certain aspects of these studies will also be undertaken at national institutions within and outside the region. The work on nitrogen fixation will be co-ordinated with that of scientists in other leading laboratories around the world, including the UNDP-supported nitrogen fixation research at the International Rice Research Institute (IRRI), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the International Institute for Tropical Agriculture (IITA) in Nigeria. Special arrangements will be made for developing close co-operative links with national programmes in selected countries of the region as well as Australia, the United States and other interested countries. Close linkages will be developed at

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concerned international agricultural research centres with regard to basic as well as applied research, especially in relation to the contribution of legumes and nitrogen fixation in cropping systems, including rotations, mixed cropping, inter-cropping and soil/water/plant relationships.

12. As already provided for in the current UNDP project, the additional activities envisaged under supplementary assistance, as described above, will be reviewed by the Project Advisory Committee at the beginning of 1984, and again a year from that date, with appropriate advice from the Food and Agriculture Organization of the United Nations. The project will also be evaluated by a team of independent consultants towards the end of the supplementary assistance period.

13. The expenditure component of the proposed supplementary assistance is as follows:

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Subcontract	800 000
UNDP direct costs	50 000

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

### III. Recommendation

15. In the light of the above considerations, the Administrator recommends that the Governing Council:

(a) Approve this project; and

(b) Authorize the Administrator to make the appropriate arrangements with ICARDA for the execution of this project.

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### Notes

1/ See Official Records of the Economic and Social Council, 1979, Supplement No. 10 (E/1979/40), annex II, decision 79/1.

