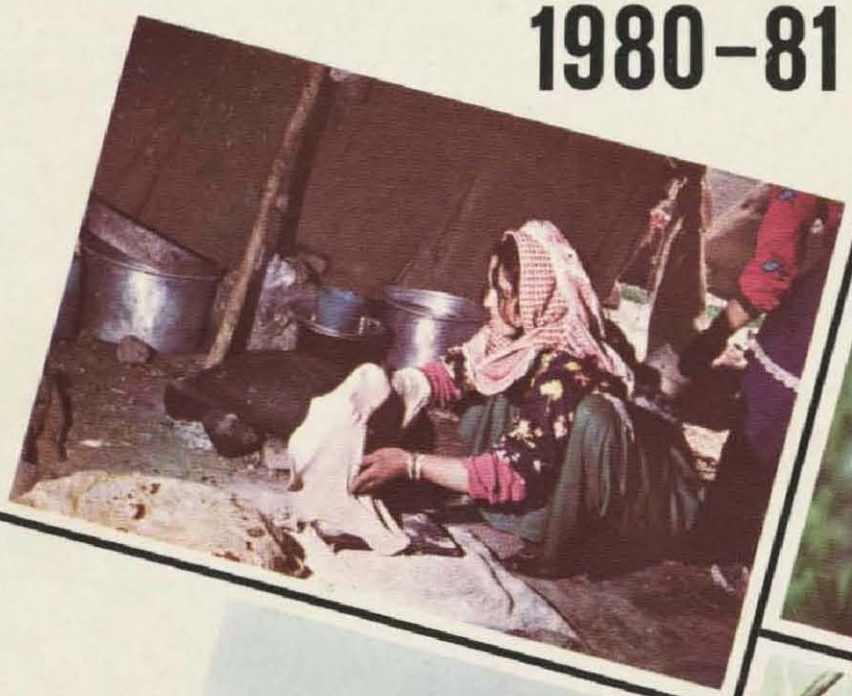
ICARDA
Annual Report
1980–81



THE INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS
(ICARDA)

The International Center for Agricultural Research in the Dry Areas (ICARDA) is an autonomous, non-profit making, scientific institution chartered under the laws of Syria, Iran and Lebanon. Established by the CGIAR, ICARDA began operations in the Near East and North Africa region in 1976. The main objectives of ICARDA are to improve and increase food production in areas with an annual precipitation of 200-600 mm, concentrated largely in the winter months.

ICARDA has been designated as a world international center for barley, lentils and faba beans, and serves, in cooperation with CIMMYT and ICRISAT, as a regional center for the improvement of wheat and chickpeas respectively. In addition, ICARDA's research activities include the study of environmental systems in the region, and the establishment of principles on which to base the development of farming strategies and research into the socio-economic constraints that limit the actual and potential production of existing farming systems.

ICARDA ADDRESSES

SYRIA		LEBANON
P.O.Box 5466, Aleppo	P.O.Box 5908, Damascus	P.O.Box 114/5055, Beirut
Telex : 31206 SY	Telex : 11396 SY	Telex : 22509 LE
Cable : ICARDA/ ALEPPO	Cable : ICARDA/ DAMASCUS	Cable : ICARDA/ BEIRUT
Tel. : 51280, 50465 52113	Tel. : 331455	Tel. : 303860

THE INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS

ICARDA

ANNUAL REPORT

1980-81

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(April 1, 1981)

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* Left ICARDA during the year

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Miloudi Nachit, Ph.D.
**Walter Nelson, M.S.

** Joint ICARDA/CIMMYT appointment

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* Left ICARDA during the year

Food Legume Improvement Program

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* Solomon Tuwafe, M.Sc.

** Joint ICARDA/ICRISAT appointment.

Forage Improvement Program

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Salvatore Ceccarelli, Ph.D.
Horst Gaul, Ph.D.
*John Lazier, Ph.D.
Nerses Nersoyan, M.Sc.
Safouh Rihawi, M.Sc.

Training and Communications

Leader — *Shawki Barghouti, Ph.D.

Acting Leader — Mohamed Habib Ibrahim,Ph.D.
Samir Ahmed Sebae, Ph.D.
Richard Stewart, Ph.D.
Colin Webb, M.Agr.Sc., B.Com.

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Plant Pathology	Omar Mamluk, Ph.D.

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International School

Principal (interim)	Mary Nygaard, B.A.
	Mary Holt

Preface

The 1980-81 cropping season at ICARDA differed from the two preceding winters (one very dry and one very wet) in that the total rainfall was close enough to the long-term mean to constitute an average year. It also differed from its predecessors by the rains beginning and ending a month late: i.e. starting in early December 1980 and ending in May 1981 instead of the more normal duration of early November to April.

The 1980-81 rainfall was sufficient in respect of both total quantity and distribution to ensure good establishment, growth and development of the rainfed crops with which ICARDA is primarily concerned. As this report is being prepared, the season's harvest is being reaped and yields promise to be at least normal if not better than average. Further time is needed to assess the season in terms of the less easily quantified factors of quality and market acceptability.

The year under review has not only been normal with regard to its weather; it has also been blessed with reasonably constant leadership for ICARDA in terms of the establishment of senior staff. As was mentioned in last year's report, Dr. Owen Brough gave up the post of Station Director at Aleppo on June 30, 1980 and was succeeded immediately by Dr. Heinrich Weltzien.

Dr. Weltzien has since provided consistent leadership of high quality to the ICARDA research workers at Aleppo and some of the results of this are recorded in the report which follows this preface. He has been well supported by Dr. E.M. Matheson, who in addition to continuing his work as a triticale specialist, has carried much of the administrative load of the Station, thus ensuring as stress-free a life for his research colleagues as the politically fragile atmosphere of the ICARDA region will permit.

The contribution to ICARDA made by the Overseas Development Group (ODG) of the University of East Anglia at Norwich, U.K., ended in the summer of 1980 as was foretold in last year's report. Dr. David Nygaard has replaced Dr. Gibbon of ODG as Leader of the Farming Systems Research Program, and during the year under review much time and thought has been devoted to replacing the ODG team. This has largely been achieved, and Farming Systems research at ICARDA continues to make good progress. It is receiving strong support from the Soil Water and Nutrients (SWAN) project which is funded by UNDP and the OPEC Special Fund, and the work of which is rapidly gaining momentum.

A change of major significance was the resignation in December 1980 of Dr. Shawki Barghouti, Leader of the Training and Communications Program at ICARDA. Dr. Barghouti left the Center to take up a World Bank position in Washington D.C., a decision which was in part at least influenced by family considerations. The opportunity is taken to express sincerest thanks to him for his big contribution to the growth of ICARDA. A founder member of the staff of the Center, he has greatly encouraged its development and best wishes are offered to him, to his wife Sharon and to their family, as they begin their new life in Washington.

Other changes of importance are in train for the year to come. The present Director-General, Dr. Harry S. Darling is to retire on June 30, 1981. Dr. Darling was appointed in

late 1976 while still Principal of Wye College of London University. For the first ten months of his appointment he administered ICARDA on a part-time basis from his office in England, by frequent visits and by extensive use of telex communications. He took up his post as Director-General on a full-time basis on October 4, 1977 when he moved to Beirut.

Dr. Darling will be succeeded on July 1, 1981 by Dr. Mohamed A. Nour, who has served for the past three years as Deputy Director-General of ICARDA. Dr. Nour is exceptionally well qualified to fill the post of Director-General. He is already widely familiar with the agricultural problems of the ICARDA region, having served successively as Dean of Agriculture in the University of Khartoum: as Minister of Agriculture in the Sudan Government: and as Regional Director for Near East and North African Countries in F.A.O., before joining ICARDA as Deputy Director-General in 1978.

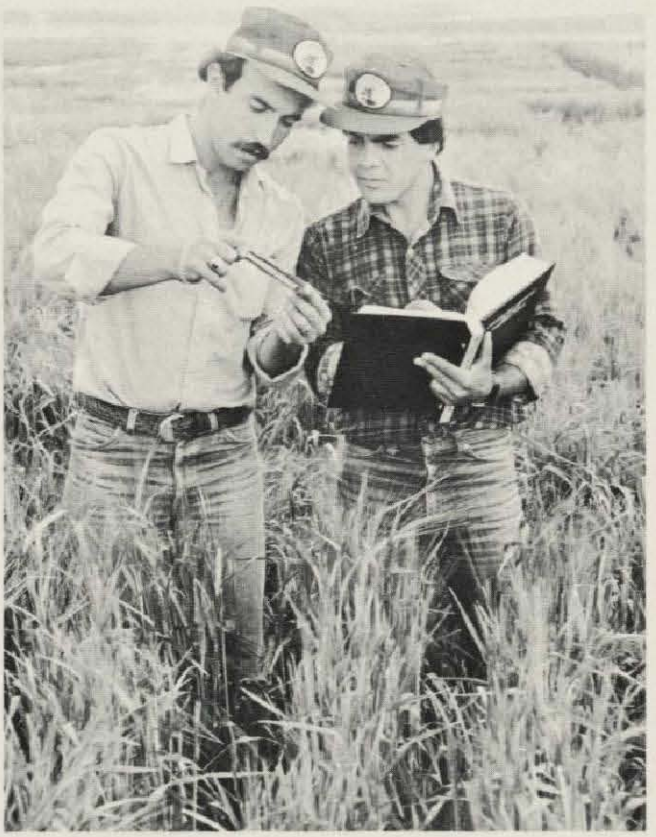
Dr. Nour is familiar in depth with the external and internal management problems which face the Center. He has served as a member of the ICARDA Board of Trustees since the Center's inception, and has been directly involved in its administration since his appointment as Deputy Director-General.

Dr. Nour's competence and experience of local conditions will be put to good use immediately he takes up his new responsibilities as Director-General, by the necessity to implement a resolution passed by the Board of Trustees at their meeting in late April 1981. This resolution ordered the management of the Center to move the Head Office of ICARDA from its present base in Beirut, Lebanon, to Aleppo, Syria. This move which has much to commend it in view of the present situation in the Lebanon, is seen as a major development of great significance to the work of the Center.

ICARDA is indeed fortunate that during the critically important period of this move in the summer of 1981, responsiblity for its leadership will lie in the hands of a man as experienced and able as Dr. Nour. Best wishes are offered to him for a trouble-free and harmonious transfer of authority from Beirut to Aleppo during the weeks ahead, and for every success in his work to direct the growth and development of ICARDA in the years to come.

Harry S. Darling
Director-General

Beirut, June 1981



Introduction

ICARDA's mandate commits the Center to a multi-disciplinary systems research approach with the object of developing improved farming systems to make more effective use of the limited rainfall available for crop production: and to offer improved ways of life to the (mainly) small and near-subsistence farmers of the region.

During the year under review, significant advances have been made in focussing the Center's research more precisely on target areas indicated by its mandate. In this introduction attention will be drawn to the following areas where progress has taken place:

Studies on Soil Water and Nutrients
Field Crop Agronomy
Ascochyta Blight control in Chickpeas
Specialist Support
Food Crop Quality
Biometrics and Computerisation

Studies on Soil Water and Nutrients

This research at ICARDA is spearheaded by staff of the SWAN (Soil Water and Nutrients) Project which is part of the Farming Systems Program and which is financially supported by UNDP and by the OPEC Special Fund. The neutron-scattering (neutron probe) technique is now widely used by ICARDA staff to study in breadth the operation of a range of factors influencing water penetration into the soil, water storage in the soil, and water use by crops.

It is still too early to assess the quantity and quality of soil water data already collected, but it is apparent that ICARDA will soon have an impressive data bank on this subject. These data include climatic information, and records from crop physiologists working on stress reactions to drought and salinity.

Field Crop Agronomy

Progress made by the SWAN team in the identification of crop nutrient deficiencies on drier sites, especially the lack of P_2O_5, has enabled more comprehensive interpretations to be made of results from agronomy trials in previous seasons. For the first time it is envisaged that substantial yield increases in the hitherto neglected 250 mm rainfall zone, may result from judicious fertilizer use as a major component in a carefully worked-out package approach.

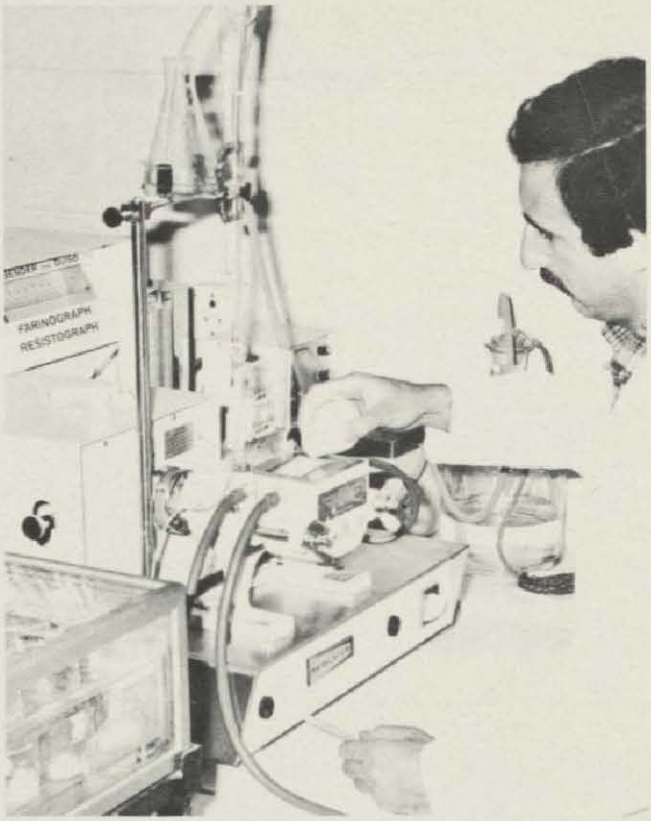
It is already apparent that this approach should contribute to increased water use efficiency by crops and to increased agricultural production from the lower rainfall areas of the region. Having said this, it should be emphasized that much remains to be done before the new technology which is expected to result from this research is ready for extension to the farmers by the national programs. To this end, research continues.

Ascochyta Blight Control in Chickpeas

Chickpeas are a crop of great importance in the ICARDA region both as a local protein food supply in human diet and as a source of cash income for the farmer. The crop is traditionally planted in spring and early summer when the rains are ending and is allowed to mature under dry weather conditions on residual moisture in the soil.

Agronomically it was realised that, in theory, earlier planting at the beginning of the winter rains could give a much longer growing season with potential for large increases in yield. In practice, such early planting, if attempted by farmers, results in heavy crop loss through *Ascochyta* blight, a fungus disease whose spread is encouraged by rainfall.

Research by ICARDA scientists over the past four years has not only established that the threat of *Ascochyta* blight is the reason



for the universal late planting of chickpeas, but has also shown that germplasm with good genetic resistance to the disease exists in the Center's chickpea collection at Aleppo. Disease resistant (tolerant) cultivars have been produced and their use in conjunction with winter planting has resulted in consistent yield increases of at least 100 per cent.

In the year under review, trials were carried out in collaboration with the Department of Research of the Syrian Ministry of Agriculture at 18 locations. In these, the cultivar ILC 482 selected by ICARDA for its resistance to *Ascochyta*, when planted in winter, gave more than double the yield of the local Syrian chickpea cultivar used as a control and planted in the spring.

General adoption of winter planting, which is now possible through the use of *Ascochyta*-resistant (tolerant) cultivars, should make possible substantial increases in chickpea yields over wide areas as a direct result of disease control. It should also result in greatly increased efficiency in the use of the limited supply of soil water from rainfall. By this improved efficiency in water use, winter planting is expected to enable chickpea production to extend into lower rainfall zones than spring planting will permit, thus further increasing the growth of this important crop.

Specialist Support

The advances made possible by the control of *Ascochyta* blight in chickpea just described, illustrate forcefully the need for crop improvement programs to receive strong specialist support from plant pathologists. Need undoubtedly exists for similar support to be available in the fields of virology, entomology, weed control, soil science, biometrics, food crop quality and other areas of technical specialisation.

There is a natural tendency for individual programs to seek to recruit their own specialists: but this could constitute very wasteful use of scarce resources, not only in respect of trained manpower but also where laboratories and costly equipment are concerned.

It is ICARDA's policy to build up a team of specialists covering the range of scientific expertise required to give adequate support to research in progress or envisaged. The Center has now established a Specialist Support Section and research units covering plant pathology, entomology and weed control are serving all programs. One specialist worker at as high a level as possible is associated firmly with each program to provide the necessary linkage with the Support Section. Laboratories and equipment are used in common.

Food Crop Quality

The genetic improvement of crops involves the production and use of new cultivars and at once raises the question of their acceptability to the men and animals expected to eat them. The assessment of food crop quality is an important subject area requiring advanced technical skills and great professional experience. The need for such quality assessment has been recognized by ICARDA since its inception but action to meet the need has been delayed by three major considerations. The first was the difficulty of identifying and recruiting a scientist of the requisite calibre and ability to establish and run the laboratory services entailed in such work. The second was the difficulty of providing the laboratory facilities with the sophisticated and usually expensive technical equipment required. The third consideration was the relative lack of parameters for the assessment of crop quality for local purposes.

These three areas of difficulty have been resolved during the year under review and ICARDA has now the capacity to assess food quality in terms relevant to its crop improvement programs. The basic need for a food quality specialist was met by generous help from the Canadian Grain Commission, Winnipeg, Manitoba. The Commission has loaned to ICARDA the services of Dr. Philip C. Williams, who is Head of its Analytical Development Division and who visits Aleppo for relatively brief periods twice a year to direct and supervise the work. Under his leadership a laboratory has been established, an essential minimum of equipment has been installed, and a skeleton staff has been trained. Drawing on his wide experience, Dr. Williams has developed quality standards which appear to conform closely enough to local needs to provide reliable results.

Laboratory services for the assessment of quality in cereals and food legumes are now operational. A parallel service for forage quality is developing fast. Already the Center is in a position to give a lead in the development of cereal quality analysis for Arabic bread. Guidance is being given to the plant breeders in the crop improvement programs through this new dimension of ICARDA's research.

The opportunity is gladly taken to thank the Canadian Grain Commission and Dr. Williams for their assistance in this much appreciated and most important development in the work of the Center.

Biometrics and Computerisation

The need for authoritative advice and help in the statistical treatment of experimental results is keenly felt in all aspects of ICARDA's research. During 1978-1980 this need was met by the recruiment on a short-term basis of a senior staff member from Oregon State University. During the year under review, ICARDA recruited on a more permanent basis, a senior biometrician with wide experience of agricultural research in general and of research by international centers in particular. This scientist is now active in the Specialist Support Section and his assistance is much in demand from workers in the Farming Systems and Crop Improvement Programs.

This side of ICARDA's work will soon be greatly strengthened by the installation of an advanced computer system under the control of a newly appointed Director of Computer Serrvices. This installation will not only handle the research needs of ICARDA, but will also support the library and information services as well as playing a major role in the work of the central administration and accounts. The computer is expected to be operational in late 1981.

Dr. H.S. Darling, C.B.E.

Dr. Harry S. Darling, C.B.E., ended an illustrious career in agricultural research, education and administration, when he retired as ICARDA's first Director-General in June 1981. His successor is Dr. M.A. Nour, ICARDA's first Deputy Director-General.

His services in establishing ICARDA and putting it on a sound basis during its initial years, culminated a career which included many academic successes, valuable research work in several countries, and administrative services in universities before he came to ICARDA.

At this Center, he had the responsibility of assembling a foundation staff and facilities, including finance, which have helped to make a strong impact in international circles in a remarkably short time. He was an ex-officio member of the ICARDA Board of Trustees.

Despite these responsibilities, Dr. Darling maintained a close personal relationship with the staff and field work at Tel Hadya, Syria, and in other countries in a region which often had special problems during these early years. He also established good relationships with national leaders and programs. He took a personal interest in planning ICARDA's work and chaired the weeklong In-House Review each year.

In 1967, he was honoured for his services by Queen Elizabeth II of England as a Commander of the British Empire and, two years later, was awarded an honorary D.Sc. degree from Ahmada Bello University, Zaria, Nigeria, where he was Dean of Agriculture and Director of the Institute of Agricultural Research, 1962-68, and Deputy Vice-Chancellor in 1966.

Dr. Darling was born at Lurgan, Northern Ireland, and did his initial tertiary studies at Queen's University, Belfast, where he graduated as B.Sc. in Pure Zoology in 1938, and B. Agr. in Agricultural Zoology, both with first class honours, a year later.

After two years at the Imperial College of Tropical Agriculture, Trinidad, West Indies, where he obtained Associateship of the College by course work and entomological research, he was successively locust control officer in Iran and Arabia, research entomologist in the Agricultural Research Division of the Government of Uganda and later in the Research Division of the Ministry of Agriculture, Sudan, before becoming senior lecturer in agricultural zoology at Khartoum University, Sudan.

In 1954, he became head of the Department of Hop Research, Wye College, London University, where he obtained his Doctor of Philosophy (Ph.D.) degree as the result of his research with the pests of stored grain in the Sudan.

After his service in Nigeria, 1962-68, he was principal of Wye College for nine years before his appointment as Director-General of ICARDA in 1977.

He and Mrs. Darling look forward to their retirement in Ashford, Kent, England where, however, they will have been missed after so many years in Africa and the Middle East.

Administration

Board of Trustees

Under the chairmanship of Dr. Andreas Papasolomontos (Cyprus) with Dr. Lowell Hardin (USA) as vice-chairman, the Board of Trustees has again given ICARDA outstanding service during a year in which many important decisions have been made.

Dr. Ekkehard Clemens (West Germany) and Dr. Sten Ebbersten (Sweden) joined the Board during the year, and Dr. Hassan Saoud now represents Syria in place of Dr. Salah El-Kordi who we thank for his services while a member.

Personnel

June 30 brings the retirement as Director-General of Dr. H.S. Darling who made such a great contribution to ICARDA's remarkable progress during its initial years. More detailed references to Dr. Darling's career are given in the previous section.

ICARDA is fortunate indeed, to have Dr. M.A. Nour as its second Director General, and looks forward to continued progress under his administration.

Dr. G.C. Hawtin, Program Leader, Food Legume Improvement Program, has been appointed as Deputy-Director General (Outreach). He will take up this position on his return from Sabbatical Leave at the University of Manitoba, Winnipeg, Manitoba, Canada, at the end of 1981. Dr. M.C. Saxena is Acting Leader of this Program.

With completion of the contract of the Overseas Development Group and consequent return of Dr. David Gibbon to the University of East Anglia, United Kingdom, Dr. David Nygaard was appointed Leader of the Farming Systems Program.

During the year, Dr. Shawki Barghouti, Program Leader, Training and Communica-

tions, joined the World Bank, Washington, D.C., U.S.A. Dr. Habib Ibrahim is Acting Leader of this Program.

Specialist Support Section

The Specialist Support Section began its activities during 1980. Its role is to support the programs in all activities that are not program specific and need the expertise of a specialist.

It comprises the following sections: microbiology, plant pathology, entomology, weed control, analytical services and biometrics. The newly formed Computer Unit and the Germplasm Unit, financed by IBPGR, are closely connected with this section.

Outreach

Outreach activities have expanded in several directions. Plans are well in hand to extend high elevation research into Pakistan, and a Food Legumes Specialist is ready to take up his station in Tunisia.

In February, ICARDA helped to coordinate the first national training program for Sudanese and Egyptian scientists at Hudeiba Research Station, Khartoum. This experience has laid the foundation for national training programs in other countries.

While the Jordan Cereal Improvement Program is directed from Aleppo, Syria, the project is now more closely integrated with the University of Jordan and the Ministry of Agriculture, Jordan. Acceptance of additional responsibilities by national scientists is an encouraging development.

A special delegation visited Saudi Arabia to discuss expansion of work in that country.

Offices

At its meeting in May, the Board of Trustees made a major decision to transfer the senior administration from Beirut, Lebanon, to Aleppo, Syria, thus strengthening the ties between the Directorate of the Center and the work at Aleppo.

Owing to the continued pressure for space, a fourth office, to house the Food Legume Improvement Program, has been established in Aleppo. However it is planned to begin movement of more scientific staff to Tel Hadya during the coming year and thus remove the need for so much office space in Aleppo.

The Cairo office continues to maintain its strength, especially in its services to the Nile Valley Project. A small staff to attend to administrative duties, has been retained in Amman, Jordan.

As always, the Damascus office remains as an important focal point, especially with reference to relationship in Syria.

Guest Houses

The guest house at Damascus has been extended to provide additional accommodation at this important international centre for ICARDA's staff and visitors.

The guest house at Rayak, Lebanon, which was so useful for people visiting Terbol Research Center, has been transferred to the larger nearby town of Zahle.

The main guest houses at Aleppo, continue to provide valuable services for the many visitors, as well as the trainees, who visit this centre.

International School

The International School has moved to another building which is providing improved facilities for its activities.

Presentation Days

An innovation this year has been a series of Presentation Days for ambassadors and other important international personnel to see the work at Aleppo. These successful occasions were very important in extending knowledge about the Center to such a vital audience.

Visitors

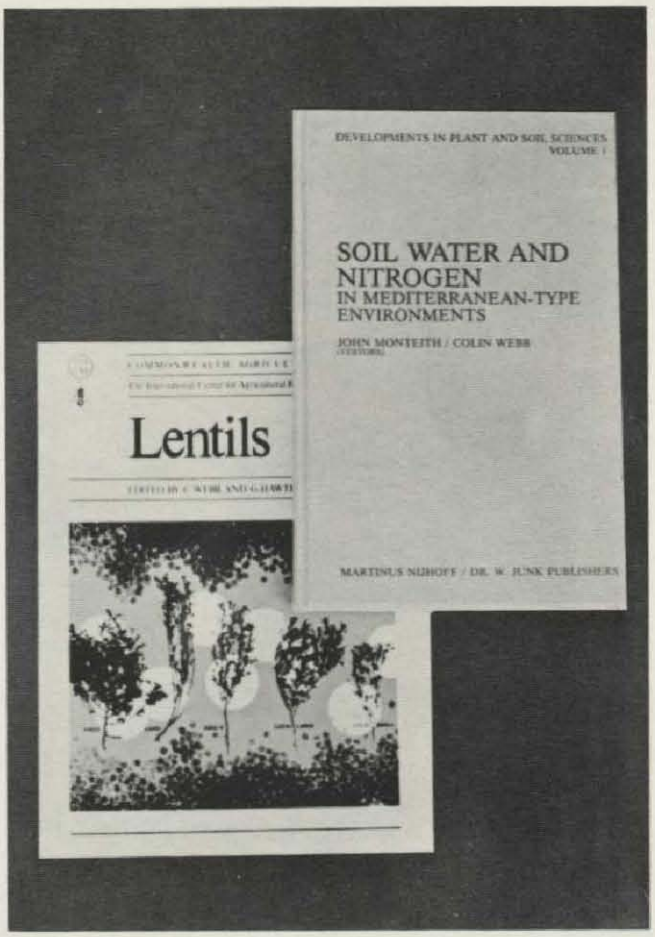
Despite the difficulties of travel in the Middle East, more than 700 people visited ICARDA during the year. The Visitors Section is performing a very useful service.

Conferences

ICARDA has organised four international conferences and workshops during 1980-81, viz., The First International Faba Bean Conference, Cairo, Egypt; the Key Figures Seed Production and Technology Symposium, Aleppo, Syria; the Barley Diseases Workshop, Rabat, Morocco; and the Ascochyta Blight (chickpea) Workshop at Aleppo.

Reference Books

Early in 1981, ICARDA published its first reference books; "Soil Water and Nitrogen in Mediterranean-type Environments" and "Lentils".



Finance

The world economic recession has seriously limited the capacity of donor agencies to increase their contribution to the CGIAR. This constraint, together with the continuing effects of inflation, has reduced the effective value of the financial support available to maintain the progress and growth of the agricultural research undertaken by the Group as a whole. To this reduction must be added the effect of the increase to 13 in the number of Centers to be supported. The funds available therefore have to be spread more thinly than would otherwise be the case.

In view of the above, it is not surprising that ICARDA finds itself under financial pressure. Though treated with as much generosity as possible by the CGIAR, the Center is still struggling to grow and develop to its full stature. Its 1982 budget proposals represent the maximum growth possible at the present time.

Recently approved expenditure for 1981 and proposals for 1982 (both years expressed in 1981 dollars) are detailed below in U.S. $1000:

	Approved 1981	Proposed 1982
Research	4,336	5,373
Research Support	2,615	3,018
Conferences & Training	859	1,024
General Administration	2,531	3,086
General Operating Costs	1,055	1,071
Contingencies and Inflation	115	2,192
Total Core Funds	11,511	15,764
Balance including capital funds required	3,021	2,717
TOTAL	14,532	18,481

The opportunity is taken to express deep and sincere gratitude to the Donors who have supported ICARDA and so made possible the progress recorded in this report.

The opportunity is further taken to welcome fresh support from two new Donors, namely Mexico and Spain, whose contributions during the year under review have given much needed encouragement to the Center.

ICARDA Donors

The National Governments of:

Australia	Belgium
Canada	Denmark
Italy	Mexico
Netherlands	Norway
Spain	Sweden
United Kingdom	United States
West Germany	of America

The Arab Fund for Economic and Social Development

The Ford Foundation

The International Bank for Reconstruction and Development (IBRD)

The International Development Research Center (IDRC)

The International Fund for Agricultural Development (IFAD)

The Organisation of Petroleum Exporting Countries (OPEC)

The United Nations Development Program (UNDP)

The United States Agency for International Development (USAID)

Farming Systems

Socio-economic studies
Livestock studies
Soil Water and Nutrients

A highlight of the Farming Systems Program last year was the completion of reports by the Overseas Development Group (University of East Anglia, United Kingdom) which directed the research of the Program during its initial phase. The reports have been valuable when considering decisions on future research priorities.

The program is now approaching full strength with the appointment of a crop physiologist/agro-meteorologist and two socio-economists. With this new resource base, more emphasis will be given to research projects outside Aleppo province.

The appointment of a soil chemist and a crop physiologist, the establishment of a comprehensive soils laboratory at Tel Hadya, and additional research equipment will add considerably to the scope and precision of future work.

During the next phase, more attention will be possible also for socio-economic and livestock issues. However, at the same time, studies into the interactions of soil water, nutrients and environment with plant growth will be expanded.

Socio-economic studies

The Overseas Development Group's report emphasised the marked contrasts in farm productivity across the rainfall transect. At one extreme, irrigated cropping systems produced five to seven times the output compared with rainfed systems in drier areas resulting in a large surplus for the urban population. At the opposite extreme, farmers in the 200 mm rainfall belt were forced to buy wheat for household consumption because the system was in deficit during the two seasons of the survey. These farmers have to seek outside employment to supplement farm income. It is suggested that extra investment will have little impact on output, and costs cannot be reduced further as they represent the base minimum needed to grow a crop.

Average investment per person in crops, and the annual rate of return from crops, exceeded that from livestock across all zones. However the comparative advantage of crops was least in the 250-300 mm zone. Sheep flocks in the driest villages were too small to compensate for poor crop net outputs. Here, in particular, livestock must be considered as a "short term investment" since they return a low rate of interest. They can be sold quickly and are associated with a fairly low risk.

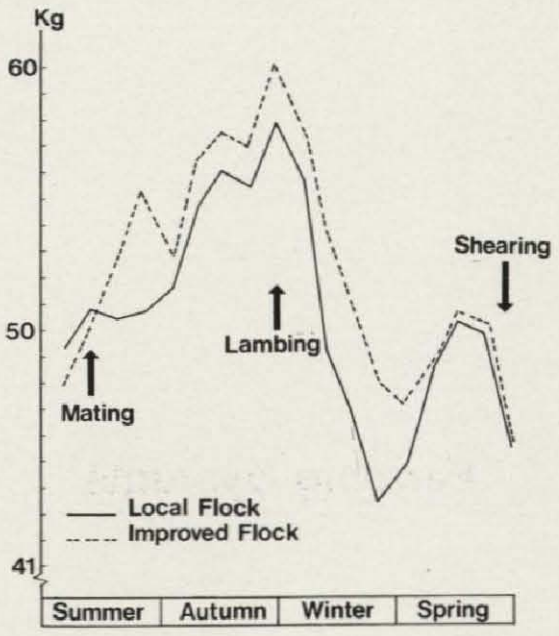
The predominant factor limiting livestock productivity and net output is the absence of forage crops in the farming system. Thus purchased feedstuffs such as barley, wheatbran and cotton-seed-cake account for 60 to 87% of expenditure on livestock.

The wheat survey in Jordan showed that only two in 254 farmers used a seed drill, and less than 10% used fertilizers or herbicides and few use new varieties. But about 80% used tractor-drawn tillage implements and about half used combine harvesters. These findings demonstrated once again how farmers adopt only elements of a package of technology. Consequently, agronomists are studying the contribution of each element to yield.

Livestock studies

The livestock studies in the Program, aim at identifying improved sheep husbandry systems which will allow the livestock sector to make better use of available resources. The studies are being conducted both off-site in Aleppo province and on-site at Tel Hadya.

The survey of livestock systems in the steppe regions of Aleppo province, with about 200 mm rainfall, has continued into its third and final year. Its main objective is

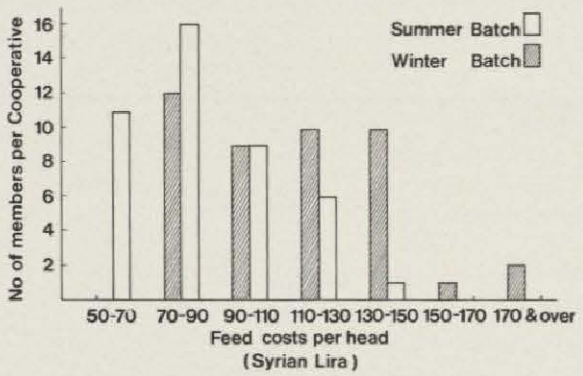


Changes in ewe liveweight throughout the 1980/81 breeding season of the 'local' flock and the 'improved' flock.

to identify the major constraints which limit animal performance such as low lambing percentage, high animal mortality, feed deficiencies and shortages of credit. One important result of this survey is that even though lambing percentages are good for an extensive husbandry system, this is only achieved by having many lambs born outside the main season. Such a spread of the lambing season makes it particularly difficult to match the feed supply to the nutrient needs of the ewe.

A new project will monitor sheep performance across the 200-600 mm rainfall transect. The quantitative measurements such as monthly records of liveweight and milk production, should make it possible to define with more precision, the importance of feeding levels, and hence body condition, on reproduction and lactation. It is also thought that sheep production in the 250-400 mm rainfall belt can be increased by greater use of forages.

The on-site livestock studies at Tel Hadya aim to develop and evaluate management practices which will enable increases in animal performance. As with the off-site work, special attention is being given to the interaction of the ewe's body condition before mating, and the lambing percentage. Emphasis on the nutritional condition during this critical period, is being investigated in three flocks which are subjected to contrasting levels of feeding and management. Two of these flocks are attached to unit farms which attempt to imitate the real farm situations. On one unit farm, forages which replace lentils or fallow in the rotation, are used to provide spring grazing for lambs and winter conserved feed for ewes. Introducing forage into the rotation has made possible an increase in the stocking rate from 2.2 to 3.0 ewes per cultivated hectare.



Feed costs (in Syrian Lira) per sheep fattened in Co-operatives, 1978-79.

Soil water and nutrient studies

During the 1979-80 season a range of agronomy and detailed soil moisture studies were conducted at five sites representing different rainfall zones in North Syria. These are located at Jinderis (550 mm mean rainfall), Kafar Antoun (450 mm), Tel Hadya (350 mm), Brida (250 mm) and Khanasser (200 mm). Barley cv. Beecher was used as the test crop.

Large yield responses to both nitrogen and phosphorus fertilizers were observed at all sites with maximum yields harvested exceeding 3 tons/ha. The moisture studies showed that although better nutrients caused barley to use more moisture, the water use efficiency with respect to total biological and grain yield was increased

substantially. Soil chemical analyses at harvest confirmed that soils at these research sites were mainly deficient in phosphorus, and differed in their nitrogen response.

Although sowing with a combine drill was shown to result in higher yields than after broadcasting in the traditional way, the effect was small and would probably not be economical for resource - poor farmers. By contrast, it was found that the seed rates which farmers used (often as high as 150 kg/ha of barley) could be reduced to as little as 60 kg/ha without any loss in yield.

A trickle irrigation scheme, laid down and initially operated in cooperation with the University of New England, Australia, at Tel Hadya, enabled studies on crop modelling to be made. These indicated that not only water supply but also high temperatures and high evaporative demand during grain filling are critical environmental factors which limit yields.

Studies on lentils and faba beans at Tel Hadya showed that water use by lentils was greater than that of faba beans, but the water use efficiency of grain production was considerably less. Both of these legumes has a lower water use efficiency than barley.

In addition tc expansion of the agronomy and soil moisture studies at the five sites, several new areas of investigation have been initiated:

^{15}N is being used to study the mean balance and transformations of nitrogen under wheat (Tel Hadya) and barley (Brida) in conjunction with detailed soil moisture and crop physiological studies. ^{15}N is also being used to assess the efficiency of fertilizer use by wheat at Tel Hadya as affected by the source of nitrogen, and the level and method of application.

A rotation trial at Brida and Khanasser (the two driest sites) has been established to examine possible alternatives to the traditional barley/fallow rotation. These include the replacement of the fallow part of the rotation with vetch forage crops, winter chickpeas and lentils.

Collaborative work has been initiated:

a. with the Food Legumes Improvement Program to study the effect of various legume crops on the residual nitrogen in the soil at harvest, and

b. with the Cereals Improvement Program to study salinity under barley and durum wheat lines which are being tested for tolerance to salt.

A detailed crop physiology and soil moisture study is examining the effect of time of planting, plant canopy, and plant population on the growth, water use and yield of chickpeas across a range of environmental conditions.

Cereal Improvement

Barley
Durum wheat
Breadwheat
Triticale
Pathology
Agronomy
Jordan Cooperative Project

The Cereal Improvement Program's steady progress has included closer links with national programs through exchange of germplasm and information, publications, visits, conferences, workshops and training courses. Collaborative programs have made notable advances in Tunisia, Syria, Cyprus and Jordan, and discussions regarding future collaboration with Pakistan and Morocco have been initiated.

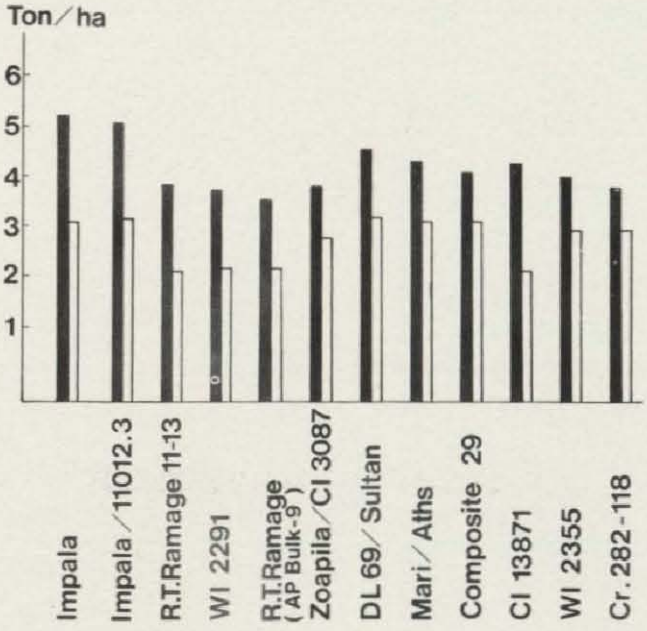
Cooperation between ICARDA and CIMMYT has been strengthened with the initiation of a joint ICARDA-CIMMYT breadwheat project; and a CIMMYT breadwheat specialist has been posted at ICARDA.

A barley and durum wheat germplasm collection of considerable size was evaluated for different characters which are needed by breeding programs. Good germplasm and data exchange relationships exist between established germplasm banks and the national programs. There is a close working relationship with IBPGR and the University of Saskatchewan, Canada, in the area of collection and evaluation of wheat and barley germplasm.

A substantial crossing program involving winter x winter as well as winter x spring habit barley, breadwheat, durum wheat and triticale, has begun this year to develop suitable germplasm for these harsher environments. It is hoped to screen such germplasm at Quetta, Pakistan, and at a moderate level location in Morocco.

Barley Improvement

Barley plays an important role in the economy of the ICARDA region. It is widely grown under dry conditions, and is extensively used as food for people and livestock. Barley is still the most dependable cereal where rainfall is low, the season is short, and there are soil problems.



The 12 highest yielding lines in the Advanced Barley Yield Trial, 1979-80.

After three years of testing over a wide range of environments, the line 2762/Beecher-6L gave significantly higher yields than both the local Abiad and the improved Beecher checks. The 2762/Beecher-6L has been adopted as the improved check in the 1980-81 advanced yield trials. It yielded 2565, 3773 and 3969 kg/ha, or 107, 141 and 119% of Beecher, in the 1977-78, 1978-79 and 1979-80 seasons respectively.

Valuable criteria of the rate of improvement in the program are the general yield levels obtained. The five most promising entries in the 1977-78 season yielded between 3539 and 3142 kg/ha, while in the 1978-1979 and 1979-80 seasons, the five highest yielding entries varied from 5269 to 4935 kg/ha and 7169 to 5920 kg/ha, respectively. The environmental conditions were extremely variable however, and the rainfall was 336, 246, 420 mm in the above seasons respectively.

Other important developments have included identification of high yielding genotypes under drought conditions in central Tunisia, and acceptance of two varieties for possible release; a two-row type Roho and six-row Beecher. Promising cultivars, identified in the low rainfall areas of Syria and Jordan, are possible candidates for release.

In a number of preliminary and advanced trials, several lines gave significantly higher yields than Beecher. The most promising entries in the advanced trials went on to the regional nurseries. As several lines outyielded the local check significantly at every location, it is apparent that barley yields can be improved in every country of the ICARDA region.

Naked barley continues to be improved to meet the needs of areas where it is used extensively as human food. Good straw strength, adequate disease resistance and

nutritional quality are being bred into the hulless types. Plant and seed type, in addition to yield, are taken into account in assessing promotion from preliminary to advanced naked barley yield trials.

Progress has also been made with dual purpose barleys; lines which provide grazing and recover for grain production are now available. Eight yield trials containing potential dual purpose cultivars are being conducted at Tel Hadya.

Three thousand five hundred crosses have been made this year to widen the genetic base, to increase resistance to prevalent diseases, and to introduce the short, medium and late maturity characteristics into high yielding adapted genotypes. Some crosses were made at the specific request of national programs in Tunisia and Morocco.

Special emphasis was given to the generation of germplasm for high altitude areas with a large number of spring-winter crosses and winter-winter crosses, and to the development of lines for higher rainfall zones.

Durum wheat improvement

Steady progress has been made in broadening the genetic base, disease resistance, grain quality and improved performance of durum wheats under stress conditions which are common in the region. Selection pressure for fertilizer and moisture-use efficiency has been increased. Several national programs have selected genotypes suitable for their environments, from nurseries supplied by the Program.

Waha "S" and Cr'S'-T.dic.v. Vernum-G11 'S' were again identified as superior durum lines by several countries in the region. The former responds well to good crop management while the latter appears to be adapted more widely to varying crop management levels in the region.

Almost every country to which germplasm was supplied, identified some lines for further use, based on yield, plant type, adaptability, disease resistance, and grain quality characters in their own regions. Some durum lines performed as well as the best breadwheat varieties.

Performance of entries in the initial, preliminary and advanced trials at Tel Hadya and Terbol, indicated that some of the newer lines had significantly higher yield potential than the improved check under both low rainfall and simulated higher rainfall conditions. The selected lines will be screened for wider adaptability and stability of performance by the national programs, through international nurseries.

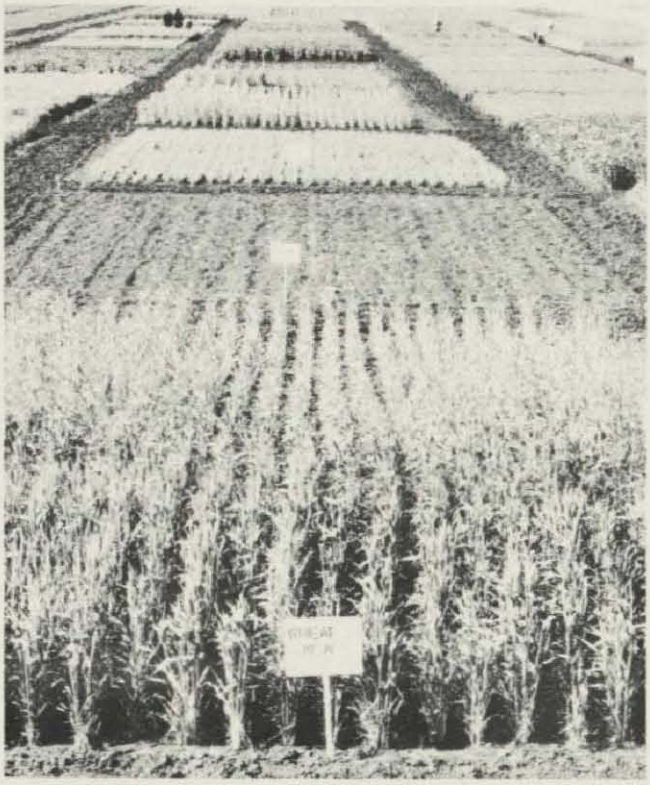
Selected advanced lines of early generation material are being planted at four to six locations for critical evaluation for agronomic characters and yield, while the yield trials have been sown at three levels of management. These lines have also been included in the key location disease screening nurseries at 10 sites in the region where disease pressure is normally high. Selected lines from these tests are included in the national durum nurseries.

A crossing block, composed of elite germplasm selected for different trials including yield, disease resistance, adaptability, combining ability, superior grain quality, drought, salt or cold tolerance and various maturity

ranges, has been provided. National programs are encouraged to use these genotypes in their crosses.

Analysis of yield, days to heading, maturity and grain development in durum varieties, reveals that the grain development period is very critical and highly correlated with yield. For example, in the 1979-80 regional wheat yield trial, average yields of 3176 and 2947 kg/ha were obtained at Irshudi in Bangladesh and Dirab in Saudi Arabia respectively, with a grain development period of 32 days. These figures can be compared to 7230 kg/ha at Sids in Egypt and 5458 kg/ha at Terbol in Lebanon, with grain development periods of 46 and 44 days respectively.

Selection pressures at sub-zones, based on agro-ecological factors, are being considered as a technique to improve selection efficiency of the breeding material in the region. Twenty-six durum genotypes,



tested for two years, exhibit an acceptable level of resistance to the hessian fly. The stem sawfly is becoming an increasing problem, and several lines tolerant to this insect have been identified.

Breadwheat

ICARDA's spring breadwheat program aims to develop germplasm and cultivars with high yield and stability for a wide range of rainfall, altitude, temperature, soil and weather patterns throughout the region. The ICARDA-CIMMYT cooperative program will considerably strengthen work towards these objectives.

Current approaches to the main problems in the region include a major breeding program to include resistance of adapted germplasm to problems such as stripe rust, *Septoria*, bunt, stem and leaf rusts, sawfly, hessian fly and aphids. This will be continued with a vigorous program of crossing and selection.

Germplasm with the potential to improve drought resistance and cold tolerance is being evaluated and included in the improvement program. Whenever suitable conditions occur, maximum screening pressure is being applied to improve these characteristics.

National programs receive germplasm for their own crossing activities through special crossing blocks which are available through the ICARDA-CIMMYT program.

The results of the regional trials for the past three years, indicate a gradual improvement in yield compared to Mexipak and the high yielding national checks. The two best yielding new selections ranked higher than the checks, and the frequency with which they appeared in the top five varieties of the experiment, was better than the checks. This result is illustrated by the following data from the regional wheat yield trials:-

Variety or line	Yield (kg/ha)		
	1977/78	1978/79	1979-80
Mexipak	3278	3510	4004
national check	3477	2830	4139
best breadwheat	3477	3180	4134
No. of locations	24	31	20

A summary of 44 preliminary yield trials at Tel Hadya in 1979-80 reveals that 37 lines significantly outyielded Mexipak in the rainfed section, and 35 under irrigation. Twenty-six of these lines were spring x winter crosses for both sets of trials.

Triticale

The best high yielding triticale genotypes with wide adaptation, disease resistance, water use efficiency and high protein content, were those with a complete set of rye chromosomes and/or with Turkish rye background in their pedigrees. Crosses with primary triticale or those of spring/winter material, were also identified as valuable background for the ICARDA region.

Since rye germplasm seems to play an important part in the triticale genotypes in the region, the incorporation of different sources of rye into the ICARDA triticale program is essential.

ICARDA is improving the rye populations by selecting the types that show high fertility, shorter stature, good seed weight and size, low hetero-chromatin material, better adaptation to problem soils, greater tolerance to dry and cold conditions, and resistance to diseases and insects.

The octoploid forms of triticale (bread-wheat/rye), and especially those obtained from combination with wheat lines, are adapted to the region. They may lead to improved seed type and baking quality, straw strength, plant type, and additional earliness in the existing triticale germplasm.

ICARDA is starting an extensive screening program to identify genotypes and good technological and nutritive quality for use as human food.

Many triticale lines from ICARDA, CIMMYT and other organisations, are being evaluated for their dry matter production, grain and hay protein content, yield and capacity for regrowth.

Cereal Pathology

Identification and use of new resistance genes and sources of broadbased and long lasting resistance provide the backbone of ICARDA's cereal pathology program. Its thrust is to develop genetic stocks with genes for resistance to the main cereal diseases, along with building germplasm with multiple disease resistance.

In this respect, the breeding lines generated in the regional nurseries and key location disease nurseries under a wide range of environmental conditions, are categorized for their resistance to specific diseases in hot spot locations. Crosses are then made to combine the different groups of resistance genes and F_1 plants given to breeders for their use in top and double crosses.

The new sources are used to upgrade the level of resistance in the breeding program. They are also made available to national programs in the region.

Studies are underway to identify and use other types of resistance e.g. tolerance or slow rusting. The program is also identifying effective fungicidal doses for controlling priority cereal diseases.

Cereal Agronomy

A number of agronomic practices have been developed to increase the production of grain and, where applicable, straw. Research against drought resistance has been intensified, and tolerance to salt is being studied on a highly saline site.

Responses to nitrogen and phosphorus fertilizers have been found in all rainfall zones in Syria and Lebanon. Arabic Abied ('local' barley), Arvand and Yecora 70 (breadwheats) have shown their ability to produce large amounts of grain at low soil nitrogen levels. Arabic Abied and C-63 ('improved' barley) have shown their ability to be highly productive for grain after grazing.

Current studies for drought resistance include measurement of soil water depletion by a range of cereal varieties, as well as plant characteristics such as leaf temperature, diffusive resistance and transpiration which may prove to be valuable screening aids.

In the field verification trials, a number of breadwheat lines outyielded both check varieties. The improved durum was outstanding. Where the rainfall was lower, the improved breadwheat check was best but a new durum variety outyielded the checks. A new barley line was also promising. A new line also gave the highest yield in Zone C where only barley is grown.

More than 5000 lines of barley, durum wheat, breadwheat and triticale were sown in a highly saline site near Aleppo to screen them for salt tolerance. Several selections which had indicated some field resistance to salt previously, were sown in bulk populations.

In addition to the continuation and expansion of present activities, future proposals include provision of information on on-farm trials of the relative effects on grain yields of the various farming practices. This would help farmers to determine priorities for the adoption of 'improved' practices. Emphasis will be in the low fertility, low rainfall areas of the country where the need is greatest.

Cooperative winter cereals demonstration research program, Jordan.

After the very dry first season, a year of above average rains gave contrasting results in this joint project between ICARDA, the Ministry of Agriculture, Jordan, and the Faculty of Agriculture, University of Jordan. All trials are on farmers' fields.

Yields were typical of those expected in Jordan under reasonable growing conditions. Several important cereal varieties were identified for each of the three zones. It seems that grain yields could be improved in both medium and low rainfall zones by growing barley instead of wheat.

The most productive seeding rates were 140 kg/ha and 100 kg/ha in Zones A (<250 mm rainfall) and B (250-300 mm) respectively. In view of the wet season after the drought, it was hard to reach conclusions about the value of nitrogenous fertilizers.

Phosphorus fertilizers produced a significant increase in straw production as well as grain. The digestability of straw is being investigated.

Food Legumes

Off-station projects
Faba beans
Lentils
Chickpeas
Germplasm
Nile Valley Project

While the Food Legume Improvement Program maintained a strong research content at Tel Hadya, off-station projects within Syria and in other countries including Lebanon, Jordan, Egypt, Sudan and Turkey, were a feature of the year's activities.

Off-station projects

The Nile Valley Applied Research Project on faba beans consolidated its good start when five 'multi location' trials were planted during 1979-80 in Sudan, and 26 'on farm' trials in the Minia/Province of Egypt. This project is discussed more fully on page 38 .

With lentils at higher elevations, early sowing gives considerable yield advantage over normal spring sowing but the cultivars must be cold tolerant. Screening at two sites in Turkey where the plants were covered with snow for at least three months and the lowest air temperature was $-26.8^{o}C$, revealed that most cold tolerant accessions were from India or Pakistan; none from Egypt or Ethiopia.

Studies at Terbol, Lebanon, and Kfardan, Syria, confirmed those at Tel Hadya in which date of planting emerged again as the most important factor affecting lentil yield. The significance of advancing the date of planting over the one which farmers use was also confirmed in nine 'on-farm'trials and at four Soil Water and Nutrient (SWAN) sites covering a wide range of conditions.

In the search for wider adaptability in lentils, accession No. 74TA 19 performed better than the local checks in Lebanon, Syria and Turkey.

Winter planting of improved kabuli chickpeas again proved to be far superior to spring sowing. The yield increases were 51% at Tel Hadya and 56, 38 and 48% respectively at Jinderis, Kafar Antoun and Terbol.

In a series of on-farm trials, planned and jointly conducted by ICARDA and the Syrian Department of Agricultural Research, chickpea ILC-482, planted in winter, produced, on an average, 113% more grain than the spring-sown Syrian Local cultivar. The trials also confirmed that Syrian Local or any other cultivar which is susceptible to *Ascochyta* blight, is unsuitable for winter planting.

Lattakia was again an excellent site for disease work on all legumes. Shawbak in Jordan was used for off-season plantings of faba beans and lentils and Terbol for chickpeas to achieve a rapid turnover of generations. The SWAN sites proved invaluable in extending the range of environments and drought tolerance studies.

Faba beans

In yield experiments with faba beans, 24 entries at Tel Hadya and 14 at Terbol in the irrigated preliminary trials significantly outyielded the local check, but results were rather disappointing in the international trials where only one entry exceeded the local checks by a significant margin. Few entries from the breeding program have advanced to the international yield trial so far. It is expected that greater advances will be made when more breeding lines are promoted.

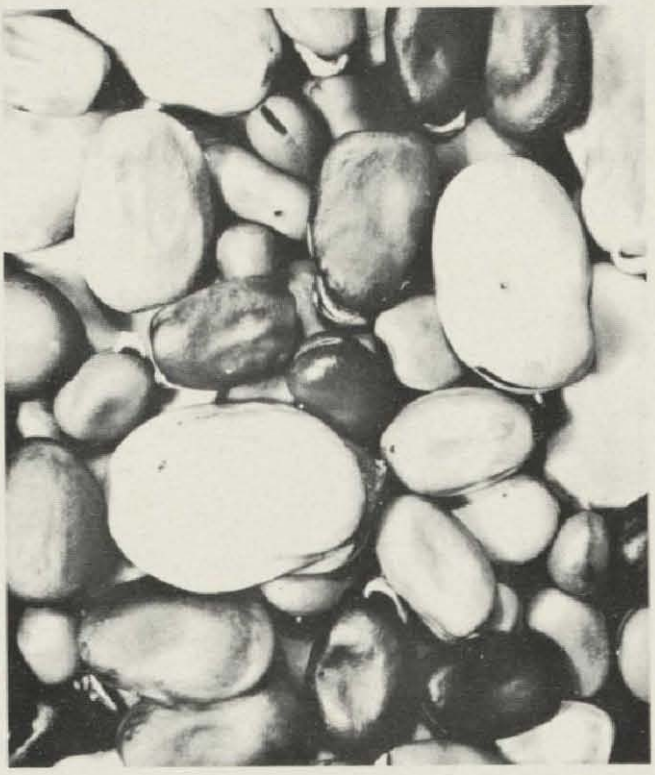
Screening at Lattakia has produced promising results in the major breeding effort against *Ascochyta* blight (*Ascochyta fabae*) and chocolate spot (*Botrytis fabae*). The line BPL 2484 has continued to hold its resistance to *Ascochyta* blight and has been found to have a degree of resistance to chocolate spot. It is being used widely in the hybridization program.

Single plant selection was made in 21 F_2 populations involving crosses with *Orobanche* resistant/tolerant parents. The F_3 progenies are being evaluated in an *Orobanche*-infested field at Kafar Antoun.

Studies at Tel Hadya confirmed that planting from the end of October to mid-November gave the highest yield, and that further delay reduced production conspicuously.

However while early planting is exposed to greater frost risk, as was seen in 1979-80, the local well adapted ILB-1814, Aquadulce and New Mammoth showed less damage and better recovery than other types such as Express, Giza 2, Giza 3 and Hudeiba 72.

Faba beans responded very well to phosphorus fertilizer where the available phosphorus in the soil was low, but did not benefit where the available phosphorus was 7.5 ppm. or more. A foliar spray at advanced reproductive growth was not effective.



At Tel Hadya, green bean yields exceeded 16 t/ha in the best lines, with two pickings. The heaviest yielding entries with desirable pod characteristics, are now in replicated trials. About half of the 95 large seeded crosses were from long poded parents considered most suitable for green bean production.

Significant correlations between dry seed yield and green bean yield indicate that selection based on dry seed yield alone should also result in genetic advance for green bean productivity.

Twenty-seven lines selected for drought tolerance, increased at Shawbak, Jordan, are being studied at Tel Hadya.

In rainfed trials, 12 selections yielded significantly higher than the checks. However the heaviest yields (more than 3 t/ha) were still about 40% below those under irrigation.

Given adequate drought tolerance, rainfed faba beans seem to have a potential for giving a higher economic yield and better water use efficiency than lentils under conditions at Tel Hadya.

Using ^{15}N labelling for fertilizer nitrogen and wheat as a non-nodulating check, the contribution of symbiotic nitrogen to total plant nitrogen under rainfed conditions was assessed as 94 and 85% for Local Large and Local Medium faba bean landraces respectively.

Lentils

Research associated with mechanical harvesting of lentils has been directed at developing a tall erect non-lodging growth habit with pods borne high off the ground. Selections for increased height have been made following irradiation of Syrian Local Large and Small landraces.

As it has been shown that lentils can recover from very severe defoliation at the seedling stage, it is most unlikely that direct damage to leaves by adult Sitona weevils affects yield. However the Sitona larvae attack lentil root nodules severely which may restrict nitrogen fixation.

The insecticide carbofuron when applied at the rate of 1.5 kg active ingredient/ha before planting protected the nodules from the larvae of Sitona weevil; damage being more than 80% without the insecticide. The resulting yield increase was about 25% with the insecticide.

Response of lentils to phosphorus has varied according to the amount of phosphorus in the soil. There was a positive response to 50kgP_2O_5/ha at Jinderis and Brida where available phosphorus in the top 15 cm of the soil was less than 5 ppm, but there was no response at Tel Hadya with an available phosphorus status of 7.5 ppm.

In research for lentils which are tolerant/resistant to the parasitic weed *Orobanche*, 62 accessions had a maximum of two emerged shoots of parasite/m^2, and one entry, ILL 3165, had no emerged shoots in any of its four replicates.

Several genotypes which have proved relatively insensitive to extended photoperiod, should be a good source for breeding work for higher adaptability. Studies on drought tolerance by creating variations in soil moisture in the field are being made.

Chickpeas

Advancing the date of planting to early-spring, mid-winter and early winter again resulted in conspicuous yield increases at Tel Hadya, Jinderis, Kafar Antoun and Terbol.

In addition to ILC-482 which has spreading plants, several other genotypes with *Ascochyta* resistance/tolerance and tall growth habit significantly outyielded the local check in the international winter planted trial at several locations.

Although yields appeared to increase up to the highest level of 50 plants/m^2, the optimum appeared to be around 33.3 plants/m^2. Winter planted chickpeas responded positively to inoculation with appropriate *Rhizobia* in a field at Tel Hadya which seems to have a low population of *Rhizobia*. The yield increased by about 82% ; nodule number 30 times; and dry weight by 162% . Senescence of leaves was conspicuously delayed.

Several spring planted entries exceeded the yield of the check at Tel Hadya and Terbol by a significant margin.

Exposing the crop to longer light periods by using artificial illumination, resulted in good reproductive growth and uniform maturity of lines of all maturity groups in the off-season multiplication.

There is a preference for large seed size in several chickpea growing countries. A number of large seeded types exceeded Syrian Local Large; many producing more than 2t/ha. A large seeded international yield trial has been initiated, and 31 sets are being evaluated in 18 countries.

The possibility for obtaining desirable genes in a kabuli seed type from bi-parental crosses appear to be slight, and other methods are being investigated.

Germplasm

The base collection of faba bean germplasm is now 2300 entries, with a pure line collection of 2500 accessions. One thousand pure line accessions are being evaluated in the field at Tel Hadya.

National programs are being encouraged to collect seed in priority areas which have been established for the exploration of cultivated lentils. The world collection now comprises 4711 entries from 47 countries, following 107 new accessions from Argentina, India and Nepal.

More than 3000 lines of chickpeas were evaluated for cold tolerance at Haymana near Ankara, and Erzurum on the Anatolian plateau of Turkey. Many lines which survived at both locations, produced higher yields than the spring sown chickpeas. This is encouraging for the future development of cultivars adapted to winter planting at high elevations.

Nile Valley Project

In Egypt, yield gaps between farmers' practices and recommendations in the trials were more than 1 t/ha where farmers' inputs were low, but were reduced when farmers' inputs were raised. The contribution of plant population to this gap ranged from 0.4 to 1.0 t/ha, depending on the levels of inputs of other factors. The contribution of fertilizers

was from +0.85 to −0.39 t/ha, according to whether farmers' rates were less than or more than the recommended ones.

No clear advantage of Giza 4 over Giza 2 (the farmers' cultivar) was established. *Rhizobium* inoculum apparently contributed positively to the seed yield at four sites, as did increasing irrigation frequency during early growth.

Irrigation frequency was a most important factor in the Sudan where, except at Siliam, no advantage was conferred by early sowing which was detrimental in many cases because of the high incidence of root rot and wilt diseases.

Method of planting had relatively little effect except at Khartoum where poor soil inflitration resulted in waterlogging and consequently very poor stands with flat planting.

Other activities in Egypt included a socio-economic survey of production practices and constraints in Minia Province, and back up research on pathology, weed control, breeding, agronomy, fertilizers, nitrogen fixation and water relationships.

In Sudan, trials were conducted as part of a back-up research program on agronomy, water relationships, weed control and viral diseases.

The first international faba bean conference was held at Cairo, Egypt, on March 7-12, 1981. This was attended by 136 scientists from 16 countries.

Forage Improvement

Germplasm
Selection and Breeding
Marginal Land
Agronomy
Animal Husbandry
Nitrogen Fixation

The Forage Improvement Program has the important responsibilities of increasing plant growth for animal production and halting the degradation of land due to heavy grazing pressure.

These aims are particularly important in view of the increasing demand for animal protein because of the high population growth, and the need for maintaining and improving soil fertility in the cropping program. Rehabilitation of stony and shallow soils is also a major consideration.

Meat production is especially important in view of the financial and other difficulties of importing animal products into many countries within the Region.

The Forage Improvement Program's research activities to achieve these aims, range from the collection and acquisition of forage plant germplasm to the final evaluation of developing forage species and cultivars by studying animal performances.

Germplasm Collection, Multiplication and Appraisal

Since 1977, ICARDA's Forage Germplasm Collection has expanded nearly threefold from 5636 to 14,356 accessions. Advantage was taken of the high 1980 rainfall to collect species of annual *Medicago, Vicia* and *Lathyrus* which have been earmarked for exploitation as suitable forage crops.

Of the 2542 accessions of *Vicia* spp., 37 lines have been tentatively identified with non-shattering pods, an agronomic feature which is of considerable importance in seed production and pasture management. Of these 37 accessions, 16 are *V. sativa*; a species which has been considered important for cereal/legume rotations.

All of the high yielding medic lines were collected in Turkey, Iran, Iraq and Syria in 1977 and 1978.

Nursery row appraisal of germplasm will continue to be a major activity. Observations

will also continue on several hundred lines of alfalfa, sainfoin and grasses in nursery rows and spaced plant populations.

Controlled environment facilities are needed for the vegetative propagation of germplasm and selected breeding materials.

Forage and Pasture Plants Selection and Breeding

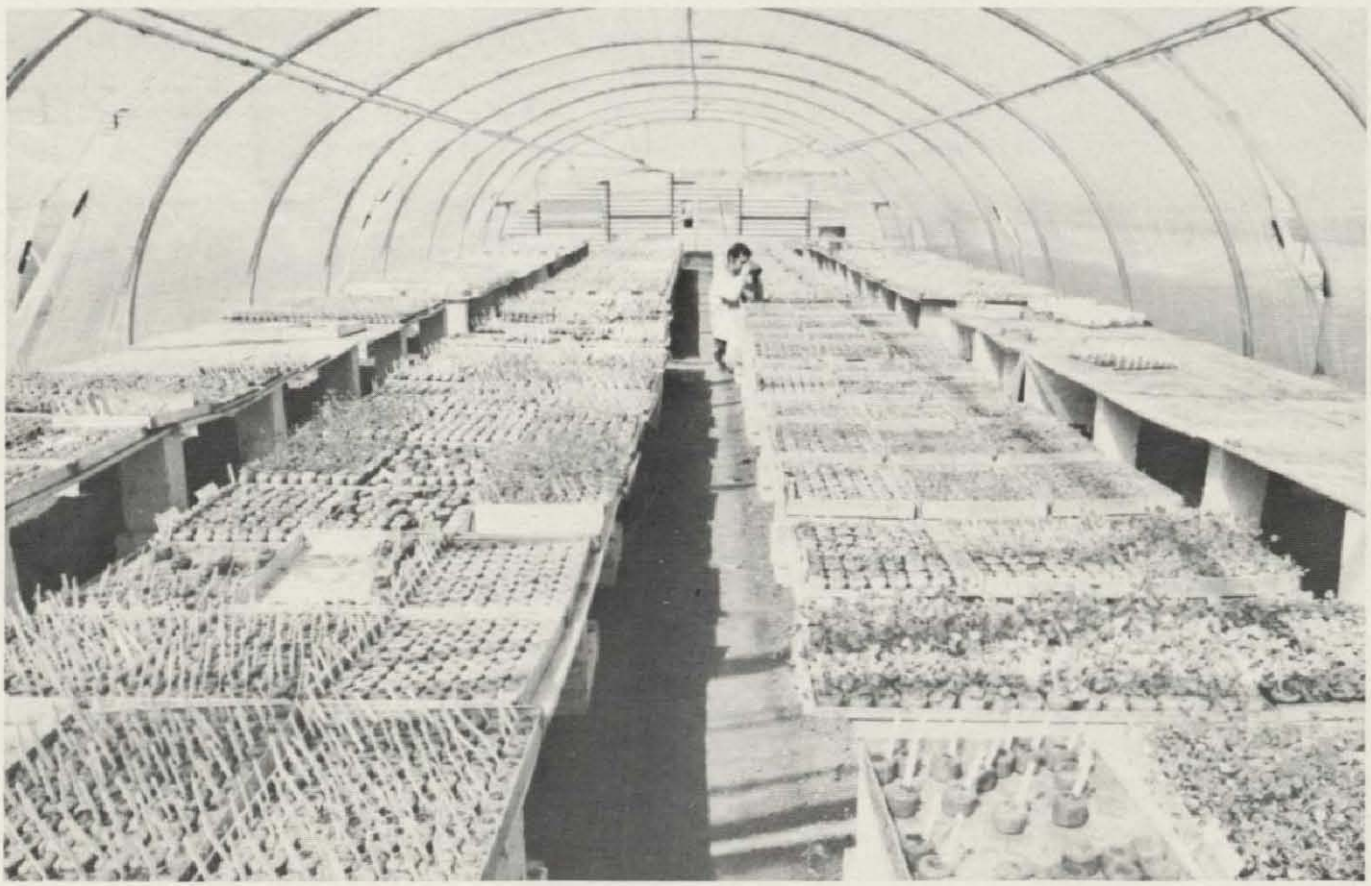
The best performing medic lines are being evaluated for hard-seededness; an important character for pasture regeneration in a legume/cereal rotation system.

Medicago rigidula and *M. aculeata,* promising for cold tolerance, have continued to perform the best, and will definitely be exploited for the Aleppo-type environment. *Vicia sativa, V. dasycarpa* and *Lathyrus* have been selected for more intensive research.

High priority will be given to the development of *Pisum sativum* and *P. arvense* which continue to produce high dry matter yields and compete very well in mixtures with cereals. As *Pisum* spp. are severely affected by diseases and insects e.g. Sitona weevil, help from a pathologist and an entomologist is needed. A suitable harvester for medic plots is also a necessity.

There is an increasing demand from national programs for seed, and there is also a need to expand off-station work. Laboratory studies will be initiated to determine forage quality.

Of the perennial forage and pasture plants, *Agropyrum elongatum, A. intermedium* and *Festuca arundinacea* appear to be the most promising for further experimentation. *A. repens x A. spicatum* combines a

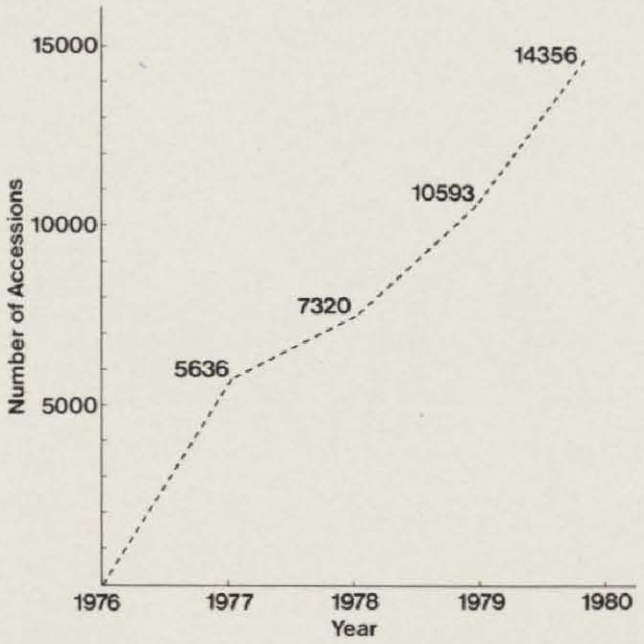


high leafiness score with a longer growing season and a high dry matter yield. This interspecific cross will be fully exploited.

Fifteen accessions in a non-replicated grass nursery have been identified for drought tolerance characteristics. *Onobrychis* is being evaluated for powdery mildew and drought resistance, leafiness and leaf rolling. Lines of alfalfa are showing promise on very shallow soils and under rainfed conditions.

Early growth, vital to the establishment of a new pasture crop, will be studied in *Bromus inermis, Hyparrenia hirta, Festinca ovina, Agropyron desertorum, A. elongatum, Dactylis glomerata* and *Lolium perenne.*

Other 1981 research projects include observations on *Onobrychis* sp. for cold resistance and spring growth; evaluation of spring regrowth, drought and cold resistance of alfalfa; and studies of seedling resistance which is very important for the early establishment of plants under stress conditions.



Development of ICARDA's Forage Germplasm Collection.

Marginal Land Grazing and Management

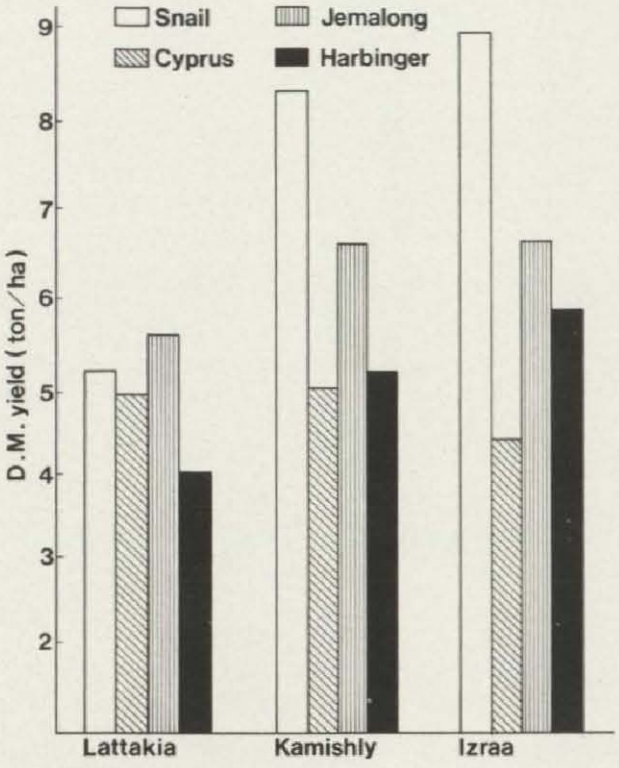
Establishment of 20 grass cultivars on a stony hillside was satisfactory, and large differences were obtained for summer dormancy. New *Atriplex* and *Medicago arborea* accessions are being evaluated and are being watched carefully in relation to revegetation of very sloping lands.

The effect of nitrogen and phosphorus is being investigated on the potential of *Dactylis glomerata, Bromus inermis* and two accessions of *Festuca arundinacea* and *Agropyron desertorum,* to rehabilitate original land.

Brachypodium pinnatum, a wild grass species characterized by highly competitive and colonizing ability is being investigated.

Forage and Pasture Agronomy

Investigations relating to forage production and agronomy are very important as information is needed to form the necessary guidelines to translate research findings in terms of forage production on farmers' fields.



Pod yield of four Medic cultivars, 1979-80.

Pisum sativum has given the highest dry matter and seed yield and, with *Vicia dasycarpa,* was the most responsive species in the range of 0-40 kg/ha of P_2O_5.

Mixtures of barley and *Vicia dasycarpa* did not respond to nitrogen fertilizer. The dry matter from a single cut was higher both for barley and total yield, than total dry matter with two cuts.

The overall effect of raising the sowing rate of either *Pisum sativum* and local barley in mixtures, was an increase in the dry matter yield of that species and a corresponding decrease in the companion species.

Since information is lacking on the competitive ability of *Lathyrus sativus* and *Vicia sativa* when grown in mixtures with barley and triticale, 20 vigorous barley and triticale lines are being evaluated, both in pure stands and with the legumes.

Animal Husbandry

A number of lines of barley and triticale have performed better under artificial grazing (cut with a mower) than the controls. They are now being evaluated under actual grazing.

Other annual forage crops, *Avena, Secale* and *Lolium multiflorum,* are being evaluated. Alfalfa and sainfoin, as nurse crops with barley, oats and rye, will be examined in a preliminary experiment, as a tool to avoid excessive grazing pressure on an established pasture.

Also being investigated in a long term experiment, are the evaluation and persistence of perennial grasses and legume species under grazing pressure as well as the growth rhythm of sheep grazing on improved pasture compared with animals on a native pasture.

Nitrogen Fixation

Collection trips in Egypt, Sudan, Morocco Libya, Syria and Jordan have yielded 40 strains of *Rhizobium* for different forage species. Five of these have been selected for further evaluation.

Medic species have differed considerably in response to inoculation with various strains of *Rhizobium. M. truncatula* has responded more to artificial inoculation than the other species.

In general, *Vicia narbonensis* has responded more to artificial inoculation than *V. ervilia* and *V. sativa.*

Carbofuran insecticide against Sitona weevil attack on *Pisum* sp. did not influence the number of nodules, but it significantly increased the nodule weight and forage yield, both with and without inoculation. Forage dry matter yield increases were 262.75 to 490.15 per cent respectively. There is an urgent need to identify and develop Sitona-resistant lines of forage *Pisum.*

Off-station Activities

Off-station activities have been conducted at Kamishly, Lattakia, Salamieh and Ezraa in Syria and at Terbol in Lebanon. Seed of *Poterium sanguisorba, Onobrychis* and *Medicago sativa* has been multiplied at Terbol. At Lattakia, Kamishly and Ezraa, *Medicago scultella* cv. Snail has proved more productive for forage and seed yield than *M. trunculate* and *M. littoralis* over the three locations.

Yields of triticale-*Vicia dasycarpa* and barley-*V. dasycarpa* mixtures have generally been higher at Tel Hadya than at Kamishly and Salamieh.


SOIL WATER AND NITROGEN IN MEDITERRANEAN-TYPE ENVIRONMENTS
CGIAR
PLANT AND SOIL
Lentils
FABIS
INTRODUCTION TO WHEAT AND BARLEY IN THE NEAR EAST AND NORTH AFRICA
ICARDA

Training and Communication

Training Programs
Communications
Newsletters
Documentation

In order to reduce, and hopefully eliminate, the deficiency in scientific and technical expertise in many developing countries, and hence remove a serious constraint to increasing production, ICARDA has a strong training program for national scientists, to complement its more traditional communications services to countries within its region and further afield.

This deficiency within the region is delaying not only the application of research results but also the development of similar national research which is a vital extension of ICARDA's work over a large area.

There is still a critical level of basic data, technical expertise and research skills, especially in the developing world where theoretical and background information and a comprehensive understanding of crops, including forages, are essential prerequisites for fruitful research.

In view of the advantages of adaptive and location-specific research and the consequent need for national programs to have a leading role in the entire process in their own environments, it is essential that international centers such as ICARDA should stimulate, strengthen and increase the involvement of national scientists in research.

Training Programs

ICARDA is providing such training in several ways. This year's six months cereal training course catered for 15 participants from Bangladesh, Jordan, Morocco, Sudan, Syria, Tunisia and South Yemen. Essentially applied in nature, with some theoretical studies, and covering the full growing season, this course involved a large percentage of field work.

Since 1978, more than 160 trainees have participated in such courses, and it is gratify-

ing to see some of them playing an important part in their national programs. These ex-trainees are also considerably increasing the links between ICARDA and the national programs.

This network is being strengthened, too, by individual scientists who are invited for a full season's training period to conduct research jointly with ICARDA's scientists. Participants are also involved in communications activities such as workshops, seminars and literature reviews. The 10 individual scientists this year are from Chile and China as well as within the region.

An important development was the first national training course at Hudeiba Research Station, Sudan, in January 1981 as part of the ICARDA/IFAD Nile Valley Project, on important aspects of faba bean production. The curriculum, designed by Sudanese and Egyptian scientists on a general basis, was planned to meet the needs of the 14 technicians from both countries who participated.

A fundamental need was to fill the gap for well qualified technicians to give good research support. It is harder to fill this void at ICARDA where training courses are of a more specialised nature. ICARDA training officers helped to design and coordinate the course at Hudeiba and provided some of the training materials. Ex-trainees helped with the teaching. Being held in the area, the course was able to concentrate on the situation in the Nile Valley.

The course provided an excellent opportunity to link with the training departments of Egypt and the Sudan and with the training officers at ICARDA. The training department can now be confident of coordinating similar activities elsewhere.

And finally, the course helped to develop a strong network between Egyptian and

Sudanese scientists. This was done through meetings, seminars, field visits and discussions about each national program and how both of them could be linked.

This year, four M.Sc. students, registered at the University of Aleppo, are doing their thesis research at the ICARDA Research Station under the joint supervision of University and ICARDA staff. They are studying soil and water relationships and the improvement of crops. The Ford Foundation has granted scholarships to cover expenses.

Several Ph.D. students, registered at European universities, are doing research at ICARDA on food legume crops. These form an extension of the joint research that is done in collaboration with European and other universities on work which helps to back up applied research in basic subject areas.

A slide set with synchronised sound in English and Arabic which has been produced mainly for information about the center, could be the precursor of the use of such techniques for structured training.

During the year, five members of the Program visited ICRISAT, India, and IRRI, the Philippines, to study visual aid facilities and to discuss wider issues related to the training, communication and information components.

These visits are being followed later in 1981 with a study of the library and documentation services at IDRC, Canada; CIAT, Colombia; and CIP, Peru.

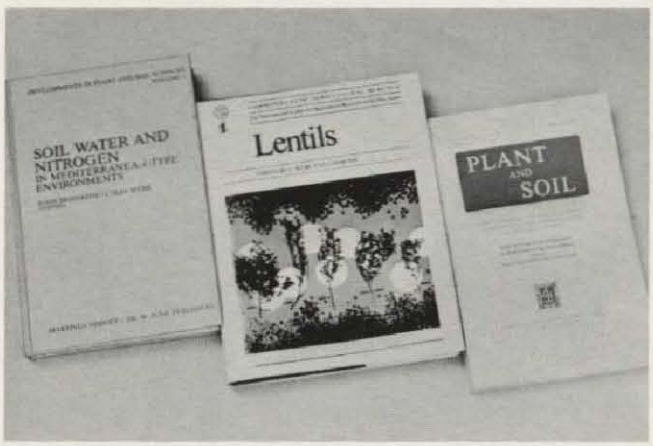
Communications

In close association with the training program, ICARDA communicates with

several important audiences including the general public, donors, policy makers and scientists as part of a dynamic integrated campaign which complements research in delivering, utilizing and monitoring the data, information and knowledge which it generates.

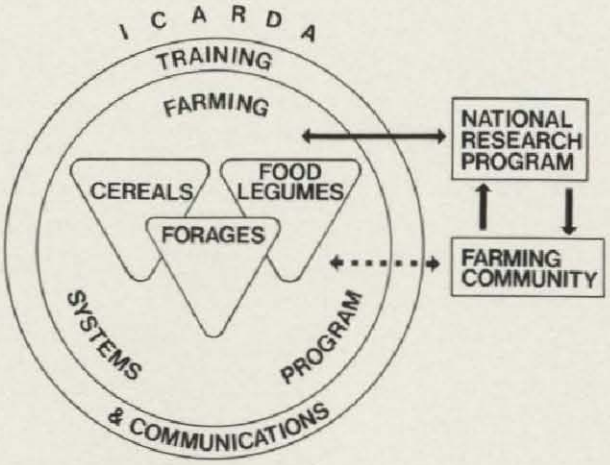
Communication is particularly important in advising scientists as soon as possible of new results and developments and consequently hastening adoption. Such communication is valuable, too, in spreading knowlege of specific crops about which little has been written.

During the year, ICARDA has published the world's first reference book in the English language on lentils which is one of this Center's mandated crops. As lentils are grown in several countries outside the region, this publication will have a wide influence. It arose from an international seminar at ICARDA in May 1979.



Arising from an ICARDA/UNDP workshop at Aleppo in January 1980, a reference book has been published on "Soil Water and Nitrogen in Mediterranean-type Environments". This, too, will have a wide application. Other papers presented to this workshop have also been published in a special edition of "Plant and Soil".

Following the international conference on faba beans at Cairo, Egypt, in March 1981, it is hoped to publish "Faba Bean Improvement" as a reference book by the end of 1981.



A conceptual view of communications at ICARDA

Other communications projects due for completion in 1981, include proceedings of the ICARDA/USAID/CIMMYT/University of Montana Barley Diseases workshop at Rabat, Morocco; the ICARDA/Royal Netherlands Government Key Figure Seed Production Symposium at Aleppo; and the ICARDA/ICRISAT Ascochyta blight and winter sowing of chickpeas workshop at Aleppo.

In addition to these and a large number of internal documents, three more discussion papers, highlighting the village level studies of the Farming Systems Research Program have been published.

Newsletters

Newsletters during the year have featured off-station experiments, developments in Saudi Arabia, and food quality testing and livestock research at ICARDA. Six technical

training manuals have been translated into Arabic.

The Editorial Committee has monitored standards and clarified publication guidelines. A number of issues of the internal newsletter "Al Yaum" have been circulated.

FABIS with a circulation of 800, has continued to be a valuable newsletter for faba bean breeders throughout the world. It is possible that it will be joined by LENS, a newsletter for lentil breeders, in conjunction with the University of Saskatchewan, Canada, and CAN, a cereals activities newsletter for the Near East and North Africa region, by the end of 1981.

The Production Unit now has colour separation reduction equipment. IBM card composer machines have been installed and the Program hopes to do its own bookbinding by the end of 1981; giving it full control of the publishing process.

These activities are very much associated with the Library and Information/Documentation service. During the year, the Library Committee has aimed to give good guidelines for the long-term development of ICARDA's library and related activities. The Committee has agreed that ICARDA has a role as a center for agricultural information for the Near East and North Africa region and that the Library, Information and Documentation services should develop as a work area under the coordination of a senior information scientist.

Documentation

Projects during the year have included the cataloguing of books, journals and other documents in the Library, in Program collections and those held privately; revision of ICARDA journal subscriptions; preparation of a card collection of 1750 references on lentils, 800 with abstracts; and collection of about 25,000 abstracts on the following key areas of interest to ICARDA-soils, water and nutrients, barley in developing countries, durum wheat, farming systems and livestock/sheep in the region, chickpeas, faba beans, *Orobanche,* brassicas, kale, turnips and forage crops.

Recently, Faba Bean Abstracts and Lentil Abstracts have been published jointly by ICARDA and CAB; the FABIS Directory of Faba Bean Research and the FABIS List of Genetic Variation within *Vicia faba* have been produced, and a list of ICARDA's publications and internal documents has been prepared.

Projects for the near future include the first issue of the Cereal Activities Newsletter (CAN), development of a current awareness service for ICARDA's researchers, including a weekly screening of periodicals, preparation of card collections and index classification of abstracts, and small displays/exhibitions for the Library.

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Ghiyath Ala'a El Deen

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