ICARDA

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 the world international center for barley, lentils and broadbeans, and will serve, 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, the establishment of principles on which to base the development of farming strategies and research into socio-economic constraints that limit the actual and potential production of existing farming systems.

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INTERNATIONAL CENTER FOR AGRICULTURAL

RESEARCH IN THE DRY AREAS

Report on Research Program at ICARDA

1979-1980

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* Left ICARDA during the year.

Preface

In sharp contrast to the previous cropping season which was exceptionally dry, the 1979-80 season throughout the ICARDA region was characterised by high rainfall which has been reflected in above-average crop yields. As this report goes to press, the ICARDA staff are completing the final stages of the best harvest yet reaped by the Center at its Tel Hadya site at Aleppo.

Variability in the weather is part of the way of life where rainfed agriculture is concerned and should be noted and accepted without undue comment. Other changes may take place which are considerably more important and which demand attention in a report of this nature.

Two such changes of major significance have taken place in ICARDA's affairs during the year reviewed by this report. The first relates to the Center's Principal Research Station at Aleppo where Dr. Owen L. Brough has resigned from the post of Station Director and has been replaced by Dr. Heinrich C. Weltzien.

It is difficult to overstate the importance of the Aleppo Station to ICARDA at this point in time. It represents the only research campus of size the Center has yet developed and serves as an operational base for a wide range of ICARDA's activities. Leadership and control at Aleppo are therefore factors of great relevance to the welfare of ICARDA as a whole.

The contribution made by Dr. Brough to the establishment and quality of research activities at ICARDA's Aleppo Station is appraised in some detail in the text of the report. It is sufficient here to pay a very warm tribute to this period of service in his life when he laid an excellent foundation for the future growth and development of the Station. The thanks and best wishes of his colleagues accompany Owen and Alice Brough as they move on to fresh fields and pastures new.

The successor to Dr. Brough, Dr. Heinrich Weltzien, comes to ICARDA from the Deanship of the Faculty of Agriculture at Bonn University in the Federal German Republic. Dr. Weltzien is a plant pathologist of international repute who is specially interested in the problems of the ICARDA region. He has worked on the staff of the Faculty of Agriculture of the American University of Beirut; has travelled extensively in the countries with which ICARDA is involved; and currently assists the Federal German Government as a technical consultant to advise on agricultural matters in the Middle East. ICARDA is indeed fortunate to be able to appoint a man of Dr. Weltzien's standing and experience as a successor to Dr. Brough.

The second change of major importance relates to the termination of ICARDA's contract with the Overseas Development Group of the University of East Anglia at Norwich in the United Kingdom. During 1978 and 1979 a team from Norwich under the leadership of Dr. David Gibbon has made significant progress in developing Farming Systems Research at ICARDA to the great benefit of the Center as a whole. The time has now come for the contract to end and the team is departing, having established in two seasons a pattern of research which it is hoped to continue and further develop. The opportunity is taken to offer sincerest thanks to Dr. Gibbon and his colleagues from Norwich for their outstanding contribution to the work of ICARDA.

Harry S. Darling
Director General

Introduction

Since ICARDA began on January 1, 1977 this Center has made significant progress in its objectives of increasing the quality and availability of food throughout the West Asia-North Africa region and, consequently, improving the economic well-being and quality of life for the 300 million people who live there.

ICARDA concentrates its activities on the improvement of rainfed agricultural systems in a region which receives an annual rainfall from as low as 200 mm up to 600 mm. Predominantly cool temperatures and winter rains give way quickly to hot conditions which demand special requirements of cereals and food legumes during their ripening periods. This region of 26 countries stretches east from Morocco to Pakistan, and south from Turkey to the Sudan. Shortages of food force most of these countries to import food, with consequent socio-economic difficulties such as currency problems.

Fortunately the region is capable of large increases in production from its rainfed agriculture, and ICARDA aims to fulfil this potential. The extension and transfer of the technologies which ICARDA is developing to meet this situation, are being undertaken through active cooperation with national and regional programs, and research and training activities.

ICARDA has a measure of world responsibility for the improvement of barley, lentils and faba (broad) beans, and is a regional center for the improvement of wheat, triticale and chickpeas, and the development of improved forage, pasture and rangeland systems.

Cooperation

In cereals particularly, ICARDA has formed a close partnership with CIMMYT in which great care is taken to ensure that no duplication of effort occurs. ICARDA and CIMMYT scientists meet annually to discuss the research programs of both centers and to ensure the maximum efficiency in the allocation and use of resources.

A similar relationship exists between

ICARDA and ICRISAT in the chickpea program where, in addition to many short term visits between the scientists of both centers, two chickpea breeders from ICRISAT are stationed at Aleppo. ICRISAT pays their salaries and related appointment costs, and ICARDA meets all support charges. The breeding program is agreed by the two centers.

Despite financial and other problems, the past year has seen a number of important changes and developments.

International cooperative agreements have been signed with the Governments of Tunisia and Pakistan. Similar agreements had already been made with Jordan, Egypt, Sudan and Cyprus. A member of ICARDA's Cereal Improvement Program is now stationed in Tunis.

Close relationships are maintained between ICARDA and the Syrian Government, and special progress has been made in Lebanon at Terbol and Kfardane which, until March 1978, were under the administrative control of the Lebanese Agricultural Research Institute.

At Terbol, in particular, facilities have been improved to involve investigations in all of ICARDA's cereal forage and food legume research programs. A large germplasm research center will be built there soon.

Unfortunately, activities in Iran are at a standstill, but ICARDA realises its responsibilities to the high elevation work there and has not given up hope of re-entry into that country to discharge those responsibilities in an appropriate form.

Farming Systems

One significant change in the research program at Aleppo, has been the phasing out of the contract with the University of East Anglia whose party has made an important contribution to the basis and continuity of the Farming Systems Program; in particular to better understanding the socio-economic conditions in the region and the associated constraints which influence the adoption of improved farming practices. The Farming Systems Program has also established its major project

on Soil Water and Nutrients which have been identified as important factors in food production in the region.

ICARDA's training program has also developed greatly with a record 46 trainees from 16 countries in this year's complement. Demand for training in forage improvement has made a big advance. The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) is making a significant contribution to these programs.

An important part of ICARDA's outreach activities is its multilingual services, a number of publications, including the newsletter, being distributed in English, Arabic and French.

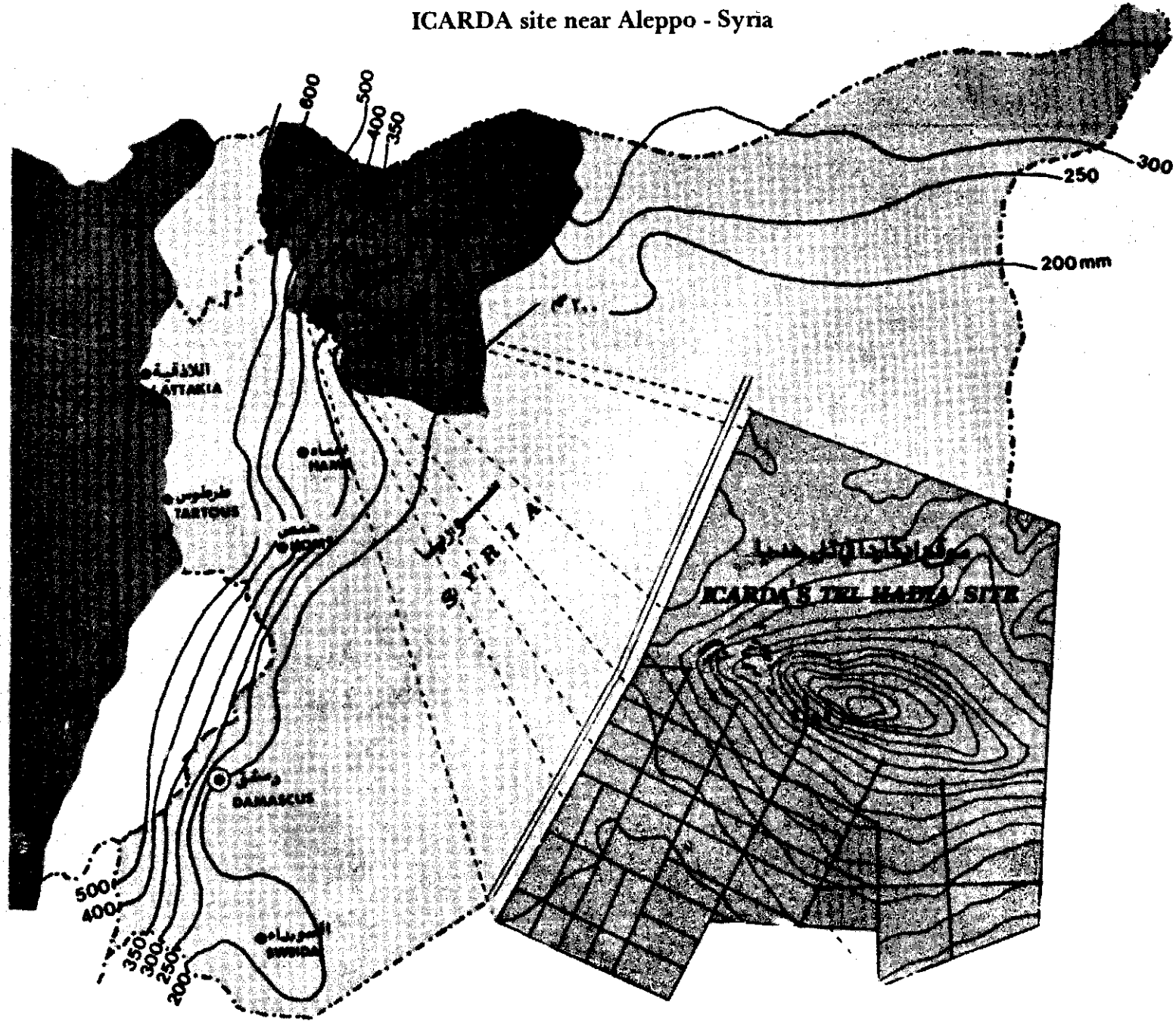
Support

The Center acknowledges valuable help and cooperation from several other international organisations including the International Development Research Center (IDRC) which has provided support for a number of food legume projects in several countries, the United Nations Development Program (UNDP) which cosponsored an important international conference on soil water and nitrogen in Aleppo during January; the Ford Foundation which is backing the winter cereal improvement project in Jordan, and the International Fund for Agricultural Development which is supporting the Nile Valley Faba Bean Project.

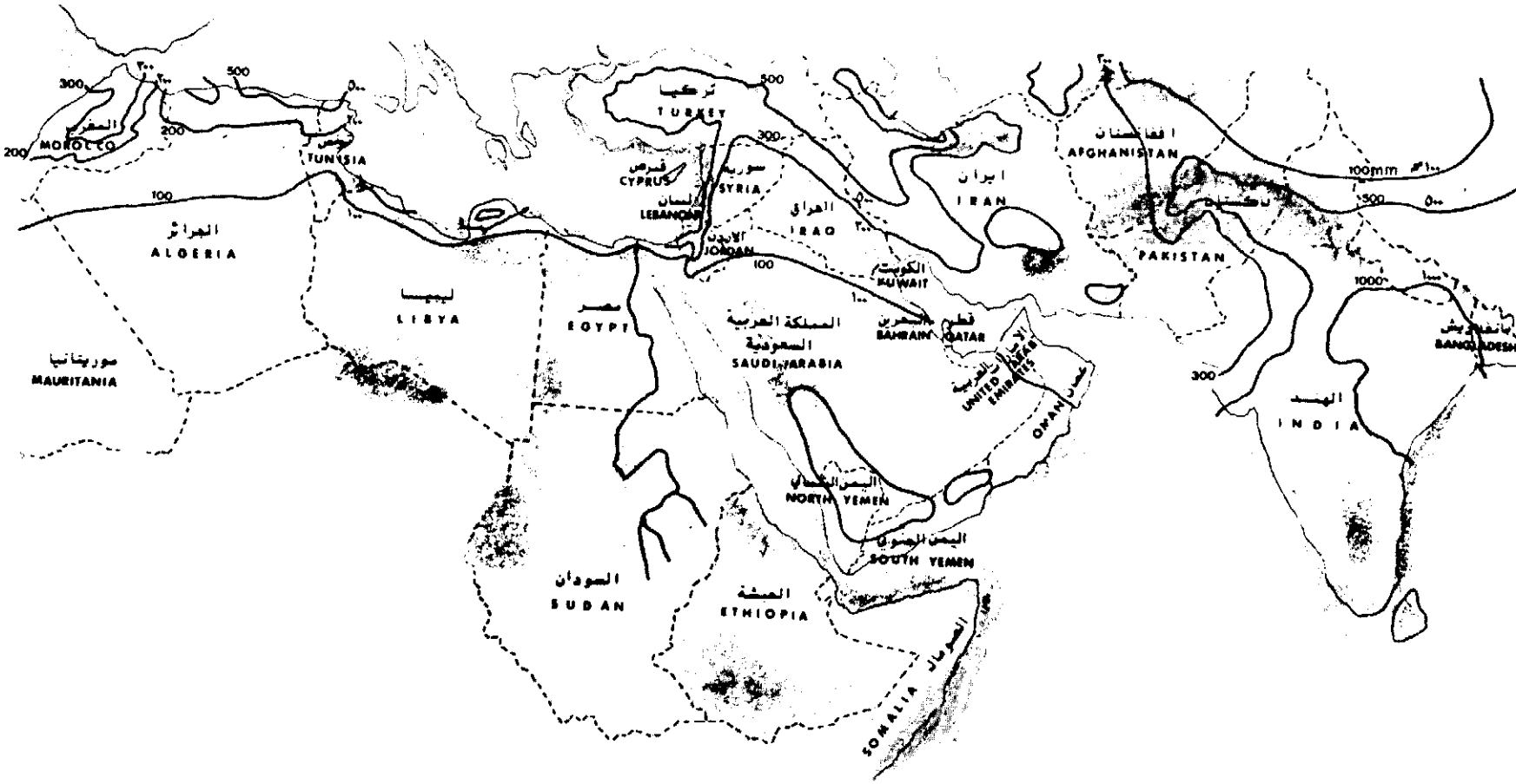
ICARDA has currently reached the stage where more facilities are essential for maintenance and expansion of the program. Unfortunately inflation now dominates the scene, making it difficult to attract and retain skilled scientists, and provide them with necessary resources.

An indication of the interest which the Center is attracting, is provided by the increasing number of visitors despite current difficult conditions of travel and accommodation. This year's total of 1700 visitors was 800 more than last year's. About 70 per cent of the visitors were from ICARDA's region. A small visitors' unit has been established to ensure smooth working of this important section of the Center's activities.

ICARDA site near Aleppo - Syria



Countries within ICARDA region.



Administration

Board of Trustees

After steering ICARDA through its initial establishment stages, the Board of Trustees has made some changes in its leadership. Drs. Taher Obaid (Saudi Arabia) and Omond Solandt (Canada) have stepped down from their positions of chairman and vice-chairman respectively, and Drs.Andreas Papasolomontos (Cyprus) and Lowell Hardin (USA) have been selected to replace them. (The opportunity is taken to express warm gratitude to Dr. Obaid and Dr. Solandt for their contributions to the development of ICARDA during the critically important early years).

Dr. Solandt, in particular, has been involved with ICARDA since its beginning, having been appointed as a consultant to advise on ICARDA affairs when IDRC was responsible as Executive Agency for the establishment of the new Center, and having served as chairman of the Site Committee.

Personnel

In Aleppo, Dr. Owen Brough resigned from his position as Station Director on April 30 after many years of meritorious service in the Middle East. After serving with distinction with the Ford Foundation, Dr. Brough played a great part in establishing ICARDA's activities at Aleppo, including the large experimental site at Tel Hadya. His initiative, enthusiasm, skill and diplomacy were responsible for overcoming many of the obstacles which naturally occur in such a situation, and the present ICARDA station at Aleppo is a worthy monument to his work. He leaves with the satisfaction of knowing that ICARDA has become an international force in a remarkably short time.

The vacancy left by Dr. Brough's departure has been filled by the appointment of Dr. Heinrich Weltzien, Director (Research) to the position of Station Director. He will continue to direct the Center's research activities. To enable him to discharge this important responsibility, much of the adminstrative work at Aleppo will be handled by Dr. Edward Matheson, Deputy Station Director, who will also continue to supervise ICARDA's high altitude research.

During the year, the high honour of the Order of the Nile: First Class, was conferred on Dr. Mohamed A. Nour, ICARDA's Deputy Director General, by the Government of the Republic of Sudan. It is particularly appropriate that this award should have been made

at a time when the Nile Valley Faba Bean Project, with which Dr. Nour is so closely involved, is gaining an international reputation of which ICARDA is justly proud. ICARDA now has offices in Aleppo, Amman, Cairo, Damascus and Tunis as well as its central office in Beirut.

Damascus and Aleppo

The Damascus office has developed in importance in view of its proximity to the Syrian Government and commerce, as well as its role as an important entry and exit center for many of ICARDA's personnel and visitors.

On the Aleppo station, progress has been made in building development. The temporary laboratories are now coming into use, but delays to the main building program due to inflation, mean that much valuable work will have to be deferred. ICARDA has no intention of reducing this development which inevitably will become several years behind schedule unless other sources of funds become available.

In connection with Tel Hadya, a notable achievement, helped by timely action by the Syrian Government, has been completion of the payment of compensation to farmers on advantageous terms for the land which became available for the experimental site. Credit is due to the Syrian authorities for their most generous attitude in dealing with the situation in such a way that developments have been able to proceed.

ICARDA's guest houses continue to provide valuable support to the general program. The guest house at Damascus has a specially valuable role for short-term visitors who come and depart through the capital, using its international airport.

The guest houses in Aleppo have a comparable role, especially in view of the comparatively insufficient alternative accommodation facilities in this city. Other ICARDA residential quarters there are essential for the training programs. The small guest house at Rayak, Lebanon, is of great assistance to people who visit the station at Terbol.

ICARDA Develops Programs with Countries in Region

A Network of Cooperative Research Projects:

Since ICARDA was established in January 1977, this international center has naturally devoted considerable time to establishing its central administrative office in Beirut, Lebanon, and its main research and associated facilities at Aleppo, Syria. The high elevation station at Tabriz, Iran, has had to be abandoned, at least temporarily, because of political disturbances.

But away from ICARDA's main experimental field at Tel Hadya, south of Aleppo, a number of verification trials have been established throughout Syria on farmers' properties; other on-farm activities have arisen through the Farming Systems Program, and close relationships have been established with the Ministry of Agriculture, Syria, and the University of Aleppo.

Joint research projects have also been established with other countries in the Region, and cooperative agreements were concluded with Tunisia and Pakistan during early 1979. Similar agreements had already been signed with Jordan, Egypt, Sudan, and Cyprus. National-level research projects usually follow such agreements; the ICARDA supported cooperative winter cereal project in Jordan, and the Nile Valley faba bean project being excellent examples.

Jordan Project

The cooperative winter cereal project had its genesis after a workshop on barley in Jordan early in 1977 when officials at the Faculty of Agriculture, University of Jordan, and the Ministry of Agriculture expressed their concern at the shortfall in Jordan's wheat production. Application of known agronomic practices could make a big contribution.

After lengthy discussions, a plan of operation was written and the Ministry of Agriculture became involved in the project with the Faculty of Agriculture. The Ford Foundation provided valuable financial support.

ICARDA was invited to complement a truly national cooperative unit in which the Ministry and Faculty could each make its own contribution.

In addition to its initial initiative and participation in the planning and administration of the project, the University provides office accommodation and the especially valuable services of its machinery workshop.

The Ministry of Agriculture with its research team led by Messrs. Z. Ghosheh and Nabil Katkhuda, and extension officers throughout Jordan, has been invaluable in arranging for farms on which the project can be conducted in three rainfall zones (more than 400 mm, 250 to 400 mm, and less than 250 mm). The Ministry will also have a major responsibility in extending the results to farmers. ICARDA is represented by Dr. William Bray, an agronomist who is the project leader and administrator of the project.

The primary objectives of the project are to develop new high yielding varieties; to work out a package of improved technology for cereal production in Jordan, and to introduce these methods to farmers who can use those elements of the package which they think can improve their production.

Criteria for sites included suitability of soils in each of the three rainfall zones, proximity to a road where farmers could inspect the plots during the year, and ownership by a farmer who would actively want to use new techniques. Above all, the project aims to demonstrate practices which farmers can apply under their own conditions. Thus the project has a low key approach with a strong emphasis on the practical application of its results.

Demonstrations

The first group of demonstrations was sown on 21 sites during October 1978. They included comparisons of barley, breadwheat, and durum varieties, time of seeding and, particularly, rates and times of application of nitrogen versus no nitrogen. In the second year of the project, the plan has included "traditional" versus "improved" practices.

It should be noted that the first two seasons have been atypical; 1978-79 was very dry; 1979-80 has had well above average rainfall. Several more years of project work will be required before recommendations can be made. However the project has provided some benefits already.

Discussions

At the suggestion of the Dean of the College of Agriculture, Dr. Subhi Qasem, about eight to ten farmers were invited to discussions at each site just before harvest time. These small group meetings were eminently successful, and became foci for dicussions about technical and non-technical matters such as incentives for growing wheat and the availability of fertilizer, farm machinery and good quality seed.

His Excellency the Minister of Agriculture, Mr. Hikmat Saket, made several visits to the sites during the 1978-79 harvest. On one of these occasions, Mr. Hassan Nabulsi, director of the Jordan Cooperative Organisation provided a mensaf, a Jordanian type of feast. This became an excellent occasion for discussion of agricultural problems, the project, and the impact which this project should have on Jordanian agriculture.

Thus the first two years of this cooperative project have been very satisfying to

ICARDA in its active participation in a co-operative national program; particularly in view of its potential in reducing, and possibly overcoming, Jordan's shortfall in wheat production.

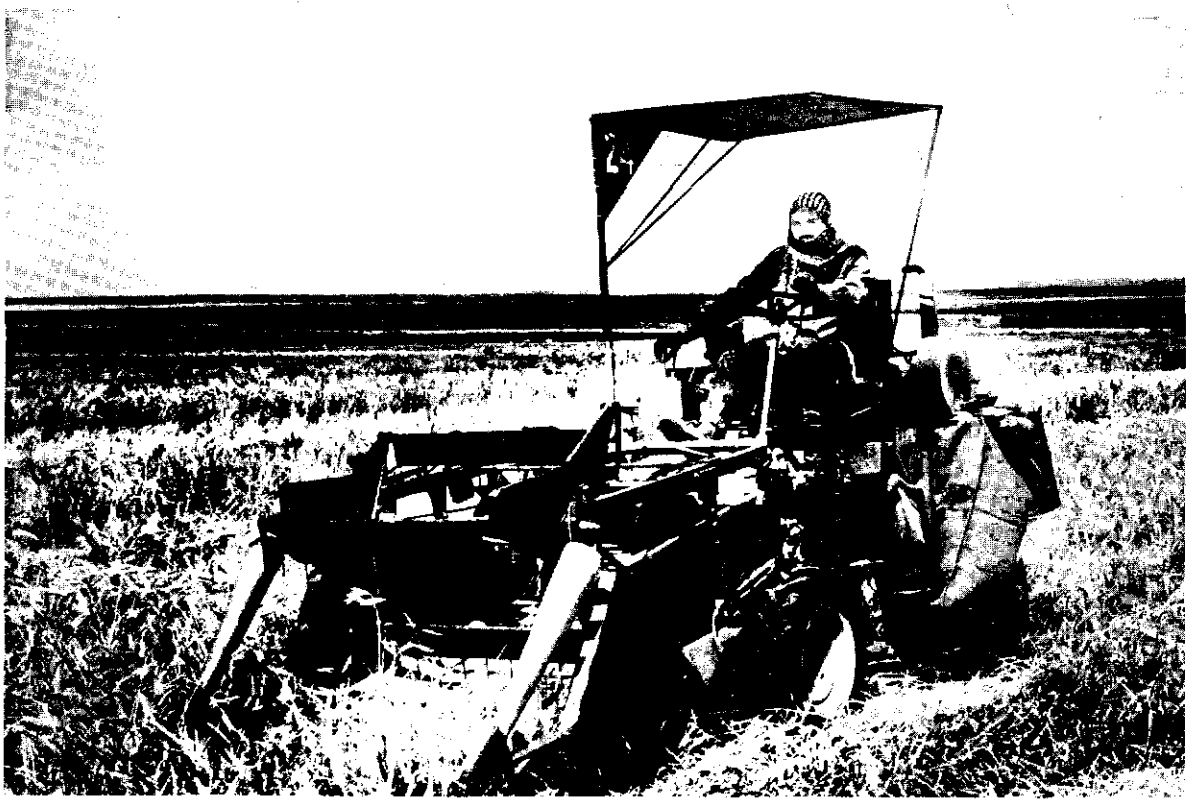
Nile Valley

Of comparable importance is ICARDA's participation in the applied research project of faba (broad) beans in the Nile Valley. This began in May, 1979 when ICARDA and the International Fund for Agricultural Development (IDRC) signed an agreement to initiate a project on faba beans in the Nile Valley of Egypt and Sudan.

In addition to other major functions, this project provides funds for the development of staff and research facilities in the national programs, and also involves a multi-disciplinary approach to faba bean improvement in a series of "on-farm" trials. Although these trials form the focal point of the project, a number of topics have been identified which require greater in-depth studies, primarily on national and university research stations. Specific research on these topics has been contracted with individual national program scientists. The results could lead to appropriate modifications in the on-farm testing program.

This year, 22 on-farm trials were conducted in Minia province, Egypt's largest faba bean producing province. The main studies included assessment of cultivars, plant population densities, and responses to fertilizers. Two trials investigated Rhizobial inoculation x fertilizer interactions, and four trials studied Orobanche control.

Surveys of production practices began in Minia and Behaira provinces of Egypt and the Nile and northern provinces of Sudan. A study



of the current status of seed production in both countries, began with assistance from the German Technical Agency, (GTZ).

Sudan

On-farm trials on a somewhat smaller scale than in Egypt, were conducted in the Sudan. Trials were grown at five locations primarily to look at the effects of planting date, irrigation regime, weed control, seed rate, sowing method and cultivar. Additional studies of fertilizer and Rhizobial inoculation and planting date x cultivar interactions were also initiated.

Two scientists from Egypt and two from the Sudan, nominated to study for Ph.D. degrees at universities in the United Kingdom, will be supported by the project, to fit them to contribute to it more effectively in the future. Reviews of all the literature on faba beans in the Nile Valley will be published soon. At a meeting planned in Cairo for the late summer, 1980, the national programs and ICARDA scientists will review the progress of the research, and plan the work for next season.

In addition, the generosity of IDRC has enabled ICARDA to spread its activities more effectively through a series of national food legume research programs in the North Africa and West Asia region. These programs which are supported by IDRC and assisted by ICARDA include Algeria, Sudan, Egypt, Syria, Turkey, Bangladesh and Pakistan.

Each of the national programs operates independently with its objectives, priorities and plans of action determined locally by the national researchers and policy makers. The catalyst in this setup is ICARDA's Food Legume Improvement Program.

Finance

As in all sectors of the world community, ICARDA's financial situation has been dominated by inflation which has dictated a major constraint under which work has to be planned and operated.

This is very difficult in a changing situation which makes it impossible to plan precisely. In fact, recent surges in inflation have outstripped the most conservative budgets.

This has affected not only capital works but also the operating funds which should enable capital investment to be used to the best advantage.

Recent approved expenditure and proposals for 1980 and 1981, both years expressed in 1980 dollars, are (US $1,000):

	Approved 1980	Proposed 1981
Research	3,375	4,220
Research Support	1,438	2,073
Conferences and Training	812	911
General Administration	2,190	2,190
General Operating Costs	937	1,032
Contingencies	100	1,690
Total Core Funds	8,852	12,116
Balance including capital funds required	2,306	3,188
Total	11,158	15,304

As inflation is a serious problem to Donors as well as to ICARDA, the Center appreciates what its supporters continue to do, not only in financial matters but also in their associated encouragement of the work, and in the confidence so expressed.

ICARDA Donors

The National Governments of:

Australia	Belgium
Canada	Denmark
Italy	Netherlands
Norway	Sweden
United Kingdom	West Germany

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 Nations Environment Program (UNEP)

The United States Aid to International Development (USAID)

Farming Systems

Village studies
Crop:Livestock systems
On-farm trials
SWAN

Over-view

During the past year, the Farming Systems Program has made significant progress in narrowing the focus of the role that it will play in ICARDA's overall research strategy. The goals and objectives are essentially unchanged, but the structure of the Program has evolved into four main work areas:

i. Studies of existing systems and practices.
ii. Cropping and crop:livestock systems research.
iii. On-farm trials in conjunction with the commodity programs.
iv. Soil water and nutrient relationships.

The development of the soil water and nutrients project (SWAN) has certainly proceeded well during the year. It will be described in more detail after a brief review of the other work areas.

From the beginning, farming systems research has been organised in a series of inter-related work areas which involve groups of scientists from different disciplines. Economists, sociologists, agronomists and soil and livestock scientists have combined to work on different projects.

The studies of existing systems and practices aim to describe how agriculture is practiced in the ICARDA Region, and to understand why current practices are used by the farming communities. Hopefully, this understanding will indicate areas of possible improvement in these systems.

Village studies

The major part of this section of work, a study of eight villages, is beginning to show promising results after the first three years. Eighty-four families are visited monthly.

The eight villages are in agroclimatic zones which range from drier areas (200 to 300 mm annual rainfall) where the components of the system are cereals, fallow and sheep production, to the higher rainfall areas (300 to 600 mm) where cereals, food legumes, summer crops,

fruit trees and forages are important. Two villages have about half of their land under irrigation.

As the three seasons of the study have had poor, average and good annual rainfalls it has been possible to make comparisons between the seasons as well as the major systems. For example, analysis of the first two seasons' data shows that in average to poor years, the dry area systems are deficient in both wheat and livestock feed production. Such a situation increasingly forces people to find work outside their villages or if they have capital, to buy livestock and the necessary suplementary feed.

In the wetter areas, the farming systems produced an income-generating surplus above the household and livestock requirements. Nevertheless the adequacy of this surplus depends on the size of holding and the availability of irrigation. About 75 per cent of families in this zone are making a living from agriculture.

The data allow us to monitor trends in existing farm technology and resource allocation, as well as providing contact with farm families and thus access to the real farm environment. It is hoped that this opportunity will be increasingly used in the area of on-farm evaluation of technological innovations.

In addition to the village studies, other ways of gathering micro level data are being tried. For example, a more specific focus study on lentil production is being conducted in cooperation with the Food Legumes Improvement Program. More than 100 lentil producers were

visited once during the 1978-79 growing season, and are being contacted twice this year.This project aims at identifying the constraints which affect lentil yields and so will guide the direction of future research with lentils at ICARDA.

A survey on livestock, now in its second year, is being conducted in the steppe area south-east of Aleppo, where the annual rainfall is generally less than 200 mm. This study aims to gather information which will identify the socio-economic husbandry constraints to increased animal production.

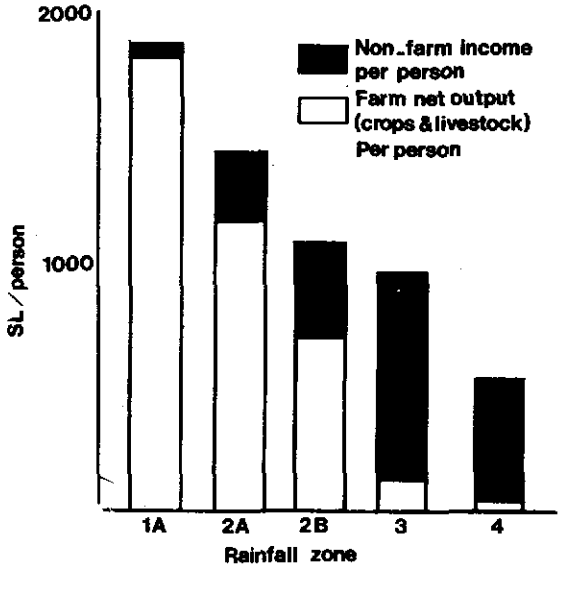
Crop:livestock systems

The second work area is cropping and crop:livestock systems research. The Farming Systems Program has its own research under way at Tel Hadya in a series of 2-year and 3-year crop rotations. While these are long term, they are vital to an understanding of the system and how individual components of the commodity programs will fit in.

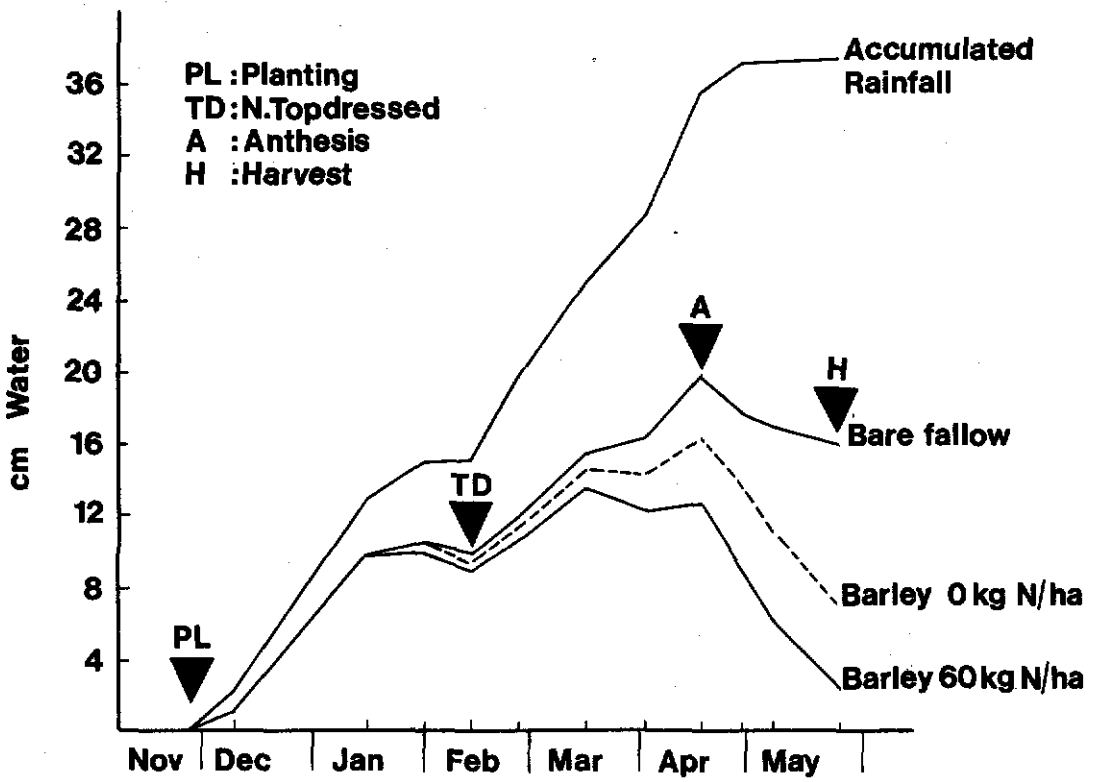
The arrival of 100 in-lamb ewes and five rams at Tel Hadya in January has made it possible to study the integration of livestock and crops. Three unit farms of 10 to 12 hectares each, are being set up for this study. A major objective of this project is to demonstrate the feasibility of increasing animal production by introducing forages into the cropping system.

On-farm trials

The Farming Systems Program is now committed to expanding its activities towards on-farm trials, testing and demonstration.



Farm net output per person and non-farm income per person in five zones in northern Syria (average of 1977-78 and 1978-79 seasons).



The effect of nitrogen application on the water use of barley (var. Beecher) at Jindiress (1979-80).

The effect of nitrogen application on the accumulated water use, the grain yield and the water use efficiency of barley (var. Beecher) at Jindiress (1979-80).

Treatment* (kg N/ha)	Accumulated water use (mm) 9/12	15/1	31/1	13/2	26/2	16/3	1/4	17/4	28/4	7/5	25/5	Grain yield (kg/ha)	Water use efficiency (kg/ha/mm)
0	9	28	43	54	81	105	144	198	237	265	308	1736**	5.64
20	10	31	49	60	91	121	162	221	265	298	335	2469	7.37
40	10	31	49	60	90	120	162	223	269	305	342	2507	7.33
60	10	31	49	60	88	114	164	232	281	315	353	2928	8.29

* Beecher barley planted at 120 kg seed/ha with 60 kg P_2O_5/ha.

** Effect of N-application significant at 1 per cent (f value 17.39).

Members have worked closely with the Food Legumes Improvement Program in the Nile Valley faba bean trials in Egypt and Sudan, and with the Cereals Improvement Program in Jordan.

Next year's plans include development, with the farming families in the eight villages in Syria with which ICARDA is working, of trials on techniques which have been successful in a controlled experiment environment and subsequently, may be beneficial to farmers.

Soil—water and nutrients

The SWAN project is one possible source of suggestion for new techniques to be tested in on-farm experiments. To encompass a wider range of environmental conditions under which soil moisture and agronomic studies can be conducted, this project has four semi-permanent 10 ha sites within the Aleppo Province at Jindiress (rainfall 550 mm), Kafr Antoon (450 mm), Brida (250 mm) and Khanaser (200 mm).

Each site is divided into four 2.5 ha blocks which are managed according to the prevailing local rotation. This stategy provides 2.5 ha of land, free from the residual effects of previous experimentation, and in the correct sequence of rotation, for studies on cereal and legume crops each year. It also allows assessment of the residual effect of one year's experimentation on a subsequent crop.

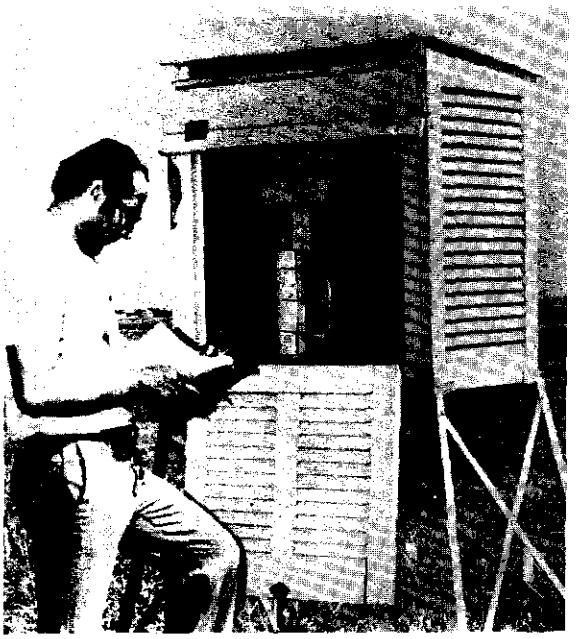
A simple meteorological station at each site records rainfall, screen air temperature, humidity and Class A pan evaporation.

These four off-station sites and another at Tel Hadya, are also the locations of the agronomy and soil moisture studies in which barley (Beecher) is being used as it is the most likely cereal to produce a yield at all locations.

The agronomic variables which are being investigated this season are method of sowing, a comparison of hand sowing with combine drilling; date of sowing; different amounts and times of application of nitrogen, with and without phosphate; and a range of seeding rates.

About 300 access tubes have been installed to enable soil moisture determination in selected treatments such as the highest and lowest seeding rates, earliest and latest planting, to obtain preliminary indications about which aspects should be studied in greater detail next season.

In the other section of this project, due to the limited number of access tubes which could be installed at 2m depth and subsequently logged by Neutron Probes, it was decided to study the effect of only one economic variable, nitrogen supply, on crop growth and moisture use. Moisture accumulation under the fallow, is also being monitored throughout the year.



This trial will run for two years; the second being used to study the effects of this year's treatments on the growth of a uniform crop in 1980-81.

In both the agronomy and soil moisture studies, non-destructive crop observations i.e. emergence and tiller counts, yields, grain numbers and 1000 grain weights, have been recorded. Destructive sampling has also been done for growth studies.

The SWAN Program has also started two cooperative studies this year.

In cooperation with the University of New England, Australia, a sophisticated trickle irrigation system has been set up at Tel Hadya to generate five rainfall regimes, ranging from rainfed to assured moisture. Three wheat varieties and Beecher barley are being grown under these "rainfalls".

This trial aims to estimate crop water requirements and to examine the effect of suboptimal water availability on the growth and yield on a range of crop maturity types. The results from this location-specific trial will give an interesting comparison with those from the off-station sites.

The other cooperative trial, in conjunction with the Food Legume Improvement Pro-

gram, aims to study the growth and yield of lentil, faba bean and chickpea under a variety of agronomic practices.

A study has also been started to examine the growth and water use of 10 varieties of faba bean which, in previous seasons, have shown differential tolerance to drought.

The appointment of a senior soil chemist and the near completion of the soil chemistry building at Tel Hadya, mark good progress in establishing this vital field of research. It is expected that the laboratory will be staffed and operational by the end of this year.

The soil analysis facilities will enable greater attention to such things as what is apparently a serious deficiency of nutrients, mainly nitrogen and phosphorus, in many soils in the drier areas. This might be limiting crop growth and yield equally as much as the supply of moisture.

Cereal Improvement

Barley
Durum wheat
Breadwheat
Triticale
Pathology
Agronomy

During the year, the Cereal Improvement Program has made some notable advances in all of its projects. New barley cultivars have been recommended to national programs based on promising data collected throughout the Region; similarily, new breadwheat varieties have been recommended for planting in Syria; steps have been taken to restore research on durum wheats to its place of importance in the Region; the possibility of breeding varieties for low rainfall conditions has become evident; tolerance to environmental stresses is being improved, and the winter cereals project in Jordan has completed its second season successfully.

However, one of ICARDA's most far-reaching and important projects is the servicing and supervision of the regional wheat, barley and triticale nurseries and the data feedback system. Although 80 per cent of the 900 sets are distributed to countries within ICARDA's Region, the remainder go to Europe, North and South America, and as far as Oceania.

The nurseries themselves which are assembled and distributed to some 200 cooperating stations in 57 countries, comprise a yield trial, an observation nursery, a crossing block and a disease screening nursery for each of the barley, durum and breadwheat crops. Triticale lines are included in the yield trials and observation nurseries. Regional Disease and Insect Screening Nurseries and a Regional Diseases Trap Nursery are prepared and distributed in cooperation with CIMMYT with which ICARDA has an excellent working relationship.

The purpose of the yield trials is to evaluate selected lines for their yield potential under a wide range of conditions. Cooperating institutions are able to make selections from these lines for further testing or for release in their own countries.

One big advantage of testing over such a wide range of conditions, is that early confidence can be placed in a variety which is superior in a number of locations. Under these conditions, it can proceed to multiplication for distribution to farmers, much faster than if it had to be tested for several years in one location to make sure that it was suitable under the

various conditions which could arise there.

Another advantage is that a variety which shows itself to be susceptible to a disease e.g. rust, in one location, can be suspected of eventually being attacked by that disease in another area which has not yet experienced that disease.

Comprehensive results, collected by the cooperators, and published by ICARDA, provide information from which countries can make their decisions.

Conditions under which the trials are conducted, range from the marginal dry areas to irrigated land in Egypt and the Sudan, and from the mild winters of some Mediterranean areas to the cold winters of Turkey, Afghanistan and Northern Iran. Thus participants can select from a number of locations with similar environments to their own, as well as across the whole spectrum of the program.

The early lines are raised at ICARDA until the F4 generation when they go into the Initial Evaluation Trial at the Center. At the same time, selected lines from CIMMYT go into the Observation Nursery and other nurseries at Tel Hadya.

The most promising lines from both of these sources are tested in the three replications of the Preliminary Yield Trial, and the best of these go on to the Advanced Yield Trial and Disease Screening Nurseries at 10 locations in six countries. Tests are also conducted in Farmers' Field Vertification Trials. The 60 Preliminary Observation Nurseries, comprising 100 lines each of barley, durum, breadwheat and rainfed durum and breadwheat have been established in 40 to 50 countries.

The Regional Yield Trials comprise (i) the Regional Barley Yield Trial; (ii) the Rainfed Wheat Yield Trial; and (iii) the Regional Wheat Trial.

However, in addition to making available to National Programs superior germplasm, allowing useful and adapted materials to become

an integral part of these programs, this project gives ICARDA the opportunity to help participating countries in a number of ways; especially by visitations and scientist-to-scientist discussions and working together.

These visits by ICARDA scientists help to expose operators to efficient methods of measurement and observation which will make their results as meaningful as possible for themselves and other participants throughout the world.

ICARDA also helps to identify production constraints on wheat and barley in the Region, and to monitor sources of disease and insect resistance and other characters.

The whole objective is to foster contact and cooperation among scientists in the Region and national programs through the exchange of germplasm, information and experience.

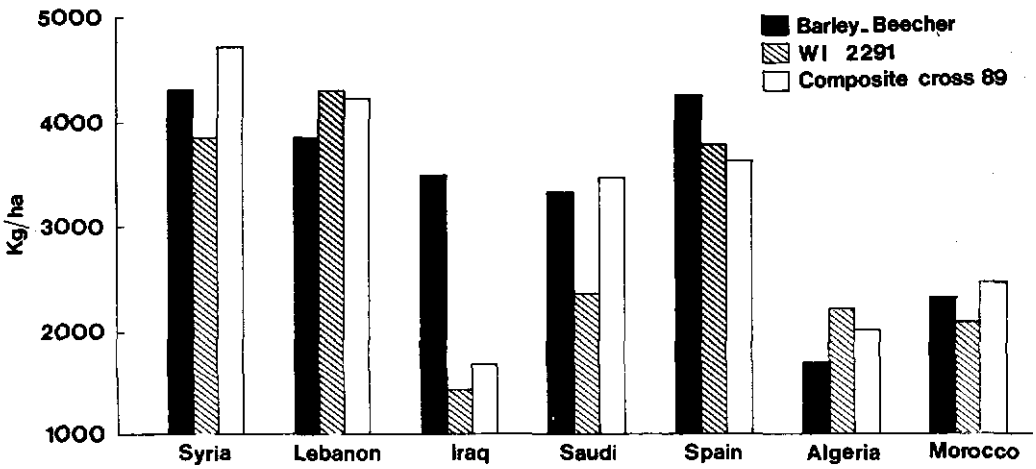
Barley

Most exciting news in the barley program was not only the acceptance of the variety Beecher in Syria, but the number of lines which had better drought tolerance that Beecher and Arabic Abiad, the most widely grown cultivar in Syria.

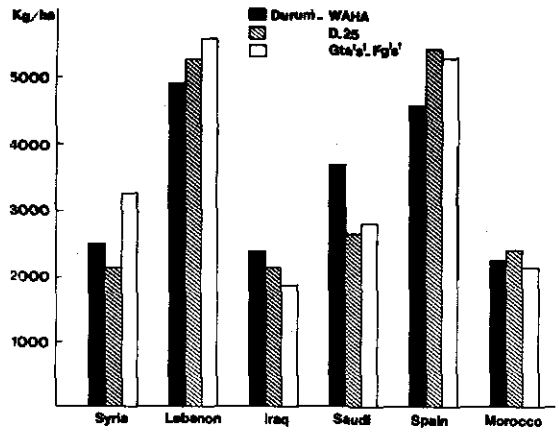
In 44 preliminary yield trials, 75 lines had desirable plant characteristics and higher yields than Beecher, and in six advanced yield trials, 92 lines had the same advantages. Eighteen of these have been promoted for testing under the various agroclimatic conditions in the Region.

In two years, Beecher has been the most promising tested cultivar in the B (350 to 250 mm) and C (less than 250 mm) zones of Syria. It is a six-row medium maturity barley, being widely adapted to West Asia and North Africa. It yields well under stress and is taller than the widely grown Arabic White variety. Beecher is resistant to yellow rust, and is moderately resistant to the common diseases of the Region.

Naked barley continues to be improved to meet the needs of areas where it is extensively



The performance of some of the promising lines of barley in Regional Yield Trials in 1978-79.



The performance of some of the promising lines of durum wheat in Regional Yield Trials in 1978-79.

used as human food. Six of the 44 lines tested had a good plant type and a yield level which equalled the Beecher check. This is particularly important because barley is the most dependable crop in the low rainfall and low fertility areas.

Progress has also been made with barleys which will provide grazing and recover for grain production. In fact six lines increased their yield after two grazings. Lodging resistance has been identified in 42 lines to combat a susceptibility which becomes a limiting factor as the use of fertilizer is increased and better management is applied. Several of these lines have been promoted for advanced testing and have been recommended to national programs as parents in improvement practices.

The extent of this program is indicated by several thousand lines which were selected from segregating populations and the 2300 crosses which were made.

Special attention is given to selecting lines with short, medium and long maturity duration to meet the needs of the Region, and while emphasis is placed on the development of germplasm in low rainfall areas, some crosses have been made to suit relatively higher rainfall barley production zones.

Durum wheat

In view of the importance of durum wheats in the West Asia-North Africa region this program is aiming specially to regain some of the acreage which has been lost to bread-wheats during recent years, with special attention to yield, resistance to diseases, and management. A major thrust is for attractive varieties of better appearance and suitability for local consumer preference as well as increased nutritive value.

Drought resistance is important to combat the characteristic moisture stress, drying winds and hot temperatures during the grain filling stage.

ICARDA is studying the need for varieties with different maturation patterns to suit the prevailing crop growth periods. In another important area of work, several varieties are showing resistance to diseases as the result of the breeding program.

In its general durum breeding program, ICARDA is producing a wider range of genotypes because durums are restricted in their genetic range and, consequently, are vulnerable to attack-e.g. by disease.

Breeders are aiming at new durum varieties which are better suited to moderate to low rainfall conditions at modest economic inputs. Desirable durums will do well under low rainfall but will have a built-in capacity to respond to more favourable conditions. Many lines made at ICARDA are looking very good.

A range of genotypes will be tested locally in national programs, some of which can be selected from early generations. ICARDA is giving special care to programs which have had less experience as well as to others who have already developed competence. The Center is also continuing to encourage national programs to evolve production technology for local conditions through field verification trials.

Future plans include a hope to include cold tolerance in spring wheats to buffer against late frosts.

Breadwheat

Highlight of the breadwheat program is the possible release of its first variety in Syria after three years of farm trials. This variety, S. 311-Norteno, has attractive white seed and outstanding yield, acceptable breadmaking quality and is resistant to diseases. ICARDA has recommended it to the Syrian Ministry of Agriculture which is multiplying it on farmers' fields. It does well under both high and low rainfall conditions in zones A (more than 350mm) and B (250 to 350 mm).

In addition, 30 to 40 different lines coming out of the breeding program are averaging six per cent higher yields than the standard Mexipak, and are 32 to 46 per cent better than the local check Florence Aurore. They resist drought, have good baking quality, and do well under rainfed conditions.

The general breeding program, involving some 1500 crosses a year, is aimed at producing genotypes which have improved Water Use Efficiency over different stress levels. A change in selection procedure has involved a swing from concentration on earliness to new medium-late varieities with well filled grain. There is also the possibility of a spring-winter wheat cross to do well under drought conditions.

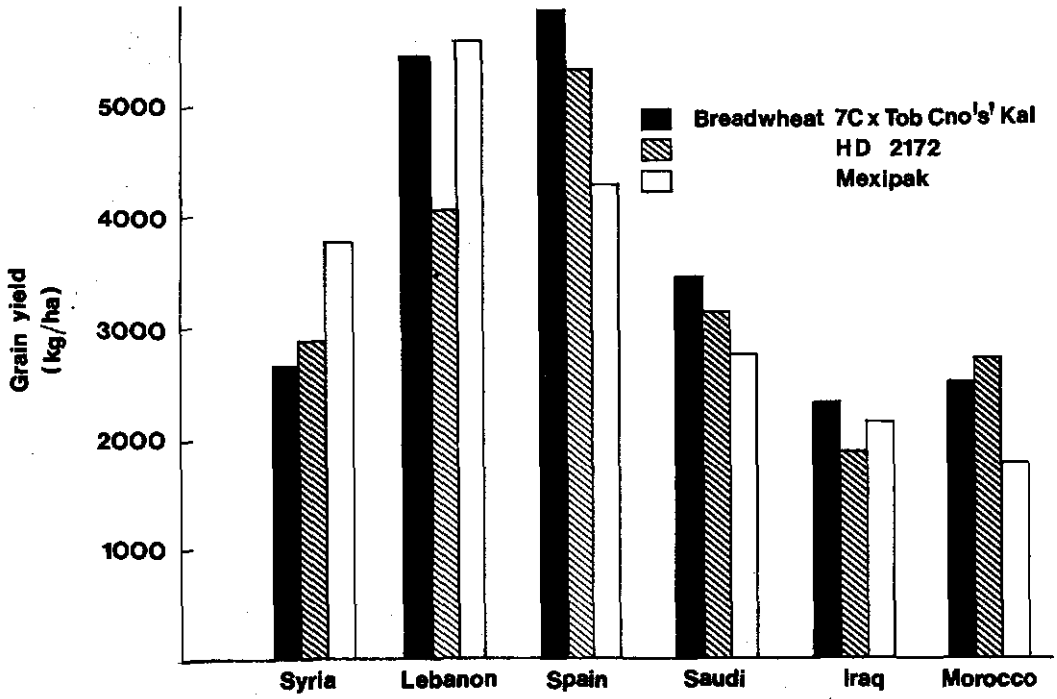
Regional yield trials are conducted in 50 to 60 locations; the breadwheats giving the best yields in most places.

Cereal pathology

The main emphasis in cereal pathology is on resistance to disease, particularly in barley and durum wheat. One approach involves the use of germplasm with different genes for resistance against specific diseases, the other builds germplasm with multiple disease resistance. Priorities are against barley yellow dwarf virus, scald and net bloch. Work against powdery mildew is being intensified and more resistance is being built up against bunt disease.

Nine hundred and fifty crosses have been made against 11 diseases in barley; 900 against nine diseases in durum wheat; and 600 against 12 diseases of breadwheat.

ICARDA is looking forward to facilities such as controlled environment chambers which will enable a Regional Virulence Gene Survey of wheat and barley rusts. Ultimately



The performance of some of the promising lines of breadwheat in Regional Yield Trials in 1978-79.

this will enable advance warnings to be given to national programs when genes against specific races of rust are no longer effective.

Triticale

And after an excellent season for selecting in 1979, the triticale program has made significant advances towards its objectives of producing lines with good disease resistance, high yielding capacity and specific adaptation to the comparatively harsh environments of the ICARDA Region.

Apart from desirable agronomic characteristics, emphasis is being placed on selection for drought resistance, heat tolerance in the seedling phase of development, cold tolerance performance on shallow soils, and straw production to meet the particular needs of the Region. Consequently, ICARDA is interested in much taller plants than those which grow under more favourable conditions. In this year's particularly cold winter at Tel Hadya, triticale was outstanding among the cereals in its ability to withstand the conditions.

Although the initial program was based on selection from material supplied by CIMMYT, advances have been made with ICARDA's first secondary crosses last year and first primary crosses this year. Germplasm from Australia, Kenya and Argentina has been used to widen the genetic base, and attempts are being made to introduce adaptable wheat and rye characteristics.

Local tests are being conducted over a progressive range of rainfall at Khanaser, Brida, Tel Hadya (deep and shallow soils) and Terbol (Lebanon). Lines are being screened for disease in Kenya and selected "hot spot" disease locations.

The current principal aim is for a grain for feeding to animals, and also as a flour diluent. ICARDA scientists hope to assess the suitability of triticale flour, pure and in blends, for making flat breads and semi-flat breads. Another line of investigation is the value of triticale for forage. In this case the Cereal Improvement Program interfaces with the Forage Improvement Program.

This year, we are hoping to get a measure of the productivity of several Argentinian lines which made very much vegetative growth last season. Crosses have been made with a view to developing a program of grain growing dual purpose lines. Further afield in ICARDA nurseries around the Region, triticale has indicated

a good yield potential relative to the breadwheats.

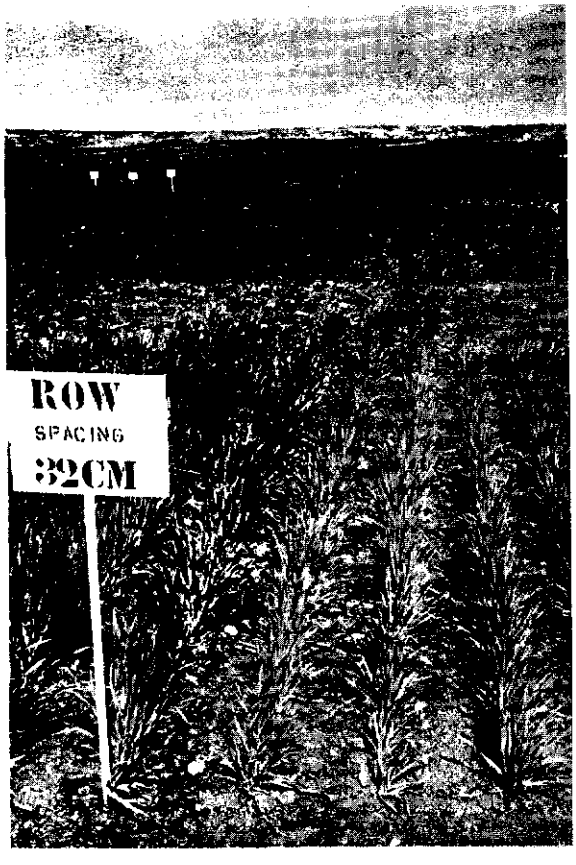
Thus this newest cereal is showing great promise of becoming adapted as a very useful plant to the particular needs of ICARDA's Region.

Cereal agronomy

The response of Arvand, a breadwheat which has been bred for poor conditions, to low amounts of nitrogen points to the possibility of breeding varieties which are suitable for low fertility conditions and which will not need large amounts of fertilizer - a commodity which few farmers in such areas can afford. This low cost technological improvement

would be a significant contribution to many developing countries.

Another big advance in agronomy has been the decision of agronomists at a meeting at ICARDA to set up a program of cooperative experiments in which all countries in the Region could participate to answer some of their most important questions in production technology. Countries would be able to choose experiments which would be applicable to their special circumstances. Subjects which have been proposed for investigation include fallow and tillage systems, crop rotations, crop nutrition (including interactions between water and nutrients), mechanical, chemical and cultural control of weeds, and varietal responses to environmental conditions.



ICARDA also has a big program of familiarization visits to countries in the Region to discuss matters of mutual interest, and ways in which the Center can help.

On-farm work has been principally done in Syria and Jordan in such practices as methods of sowing, varieties, fertilizers and weed control. Experiments are being conducted in each rainfall zone and under irrigation. Plots are being established both under farmers' conditions and at "improved" levels of technology.

Field physiological studies also include the reaction of cereal varieties to grazing, drought and low levels of soil nitrogen.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Food Legumes

Lentils
Chickpeas
Faba beans
Nile Valley Project

With ICARDA's world mandate for faba (broad) beans and lentils, and regional responsibility for chickpeas, food legumes play an important part in the Center's program for the improvement of food production in the West Asia- North Africa region.

An outstanding achievement during the past year has been the development, in association with scientists from ICRISAT, of new genetic materials of chickpeas which are suitable for winter planting. This has become possible after five years of thorough and rigid breeding and agronomy work.

Desired genetic qualities such as high yield, cold tolerance and resistance to Ascochyta blight disease have been identified in germplasm, and the painstaking task of combining the various desirable genes is well under way.

Experiments, since 1974, have revealed that winter-planted chickpeas produce substantially higher yields than spring-sown chickpeas in the Mediterranean region. But, until now, lack of Ascochyta blight resistance and insufficient winter hardiness have caused sowing of this crop to be delayed until the spring.

Major reasons for higher yields from winter planting include a longer growing season, permitting development of larger biological structure; more favourable soil moisture and temperature conditions during reproductive growth; better nodulation and less damage from insect pests.

As significant yields were recorded in the winter-planted crop last year, when the total rainfall was only 240 mm, the earlier sowing date may encourage the cultivation of chickpeas in drier areas where they are not now grown.

In summary, four years of work have revealed:

- Many chickpea lines can withstand the cold weather of the low and medium elevation winters, and can produce substantially higher yields than the spring-sown crop, with a better plant stand and nodulation.
- Winter planting would require protection of the crop from Ascochyta blight disease, pre-

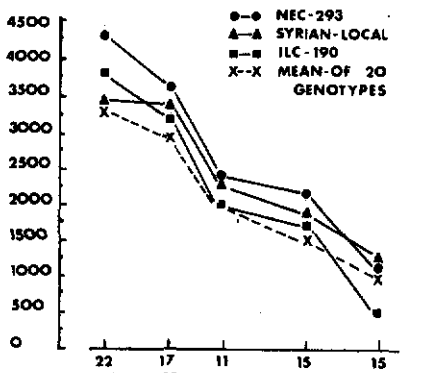
ferably through resistant cultivars, but would possibly need back-up from fungicides. Control of Ascochyta blight is essential to the success of winter planting.

-The damage from leaf miner and pod borers is not as severe as when the crop is planted later.

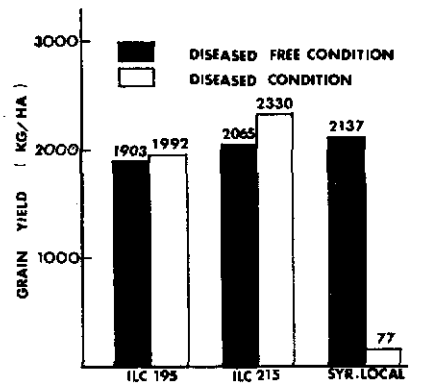
- Winter planting would enable the crop to be raised successfully under a much lower rainfall than has been traditionally practised.
- The crop responds better to increased plant population.
- Even advancing the planting date from late spring to early spring, gives a considerable yield advantage.
- The winter-sown crop has a greater need for weed control measures.
- When planted in non-conventional areas, chickpeas may need to be inoculated with Rhizobium culture.

Future work will focus on the development of cultivars and agronomic practices for winter planting and demonstration of these to farmers through national programs.

The three most promising resistant lines, ILC 195 originating from USSR, ILC 215 (Iran) and ILC 482 (Turkey) are being evaluated on



2. GRAIN YIELD OF CHICKPEA GENOTYPES AS AFFECTED BY DATE OF PLANTING IN 1978-79 AT TEL HADIA



EFFECT OF ASCOCHYTA BLIGHT ON LOCAL AND RESISTANT CULTIVARS OF CHICKPEA YIELD DIFFERENCES BETWEEN DISEASED-FREE AND DISEASED CONDITIONS

24 farmers'fields in Syria in cooperation with the Ministry of Agriculture. The testing of these lines on farmers' fields, in other countries, notably Jordan, Lebanon and Turkey, in cooperation with the national programs, is also under consideration.

While this winter-sown chickpea has been a major achievement in ICARDA's program, the bulk of work with food legumes has proceeded steadily and progressively.

Without detracting from this continuing work, we present short descriptions of several particular areas of interest which indicate the breadth of this program and the developments which are underway.

Lentils

A number of accessions have been added to ICARDA's germplasm collection which has been evaluated for various characteristics. The 1673 new accessions in 1978-79 brought the total lentil collection to about 4600; comprising 3800 small-seeded and 800 large-seeded entries.

Observations over various numbers of accessions included seed size which ranged from 1.07 to 8.55 g/100 seeds; days to maturity,

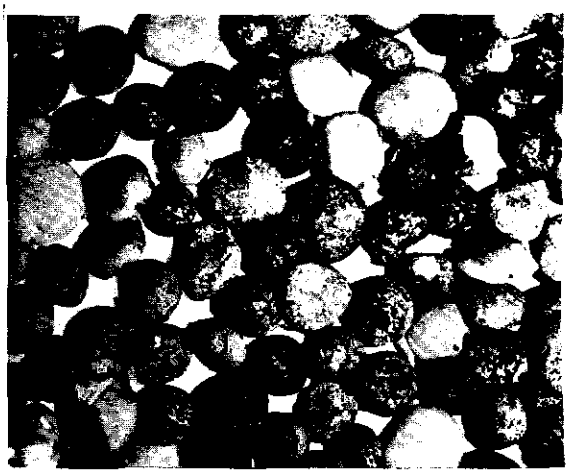
154 to 197; harvest index, 0.74 to less than 0.10; and the number of primary and secondary branches which had ranges of 1.8 to 7.8 and 1.0 to 7.2 respectively. A total of 116 entries outyielded adjacent check entries. More than 300 accessions were observed to be highly susceptible to natural infestations of root rot.

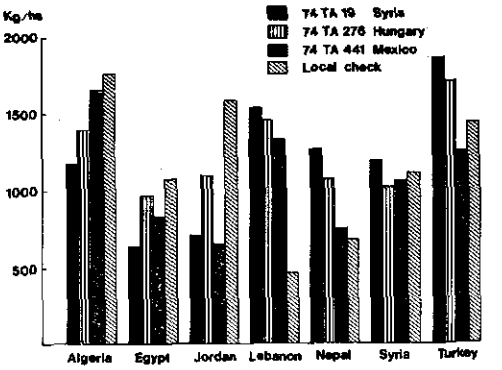
A supplementary project was aimed at developing plant types which are suitable for mechanical harvesting.

The Canadian cultivar Laird, (ILL 4349) was identified as being tall (45 cm) and erect with a strong stem, large seed and desirable seed colour. However it was relatively late and low yielding. A number of crosses are being made with this cultivar.

Considerable variability has been identified in the germplasm for height of the lowest pod above the soil surface, which ranges from 6 to 27 cm. Also variability in pod dehiscence and pod drop has been evaluated and these characters will be engineered in new types through crossing and selection.

Steps have been taken to initiate a project on the mechanization of lentil production. In





The grain yields of three widely adapted lentil lines, and the local check, in seven countries.

September 1979, ICARDA hosted a seminar on the technology of lentil harvesting, which was attended by experts from Syria, Jordan, Germany and the United Kingdom. A consultant visited ICARDA this year to help to define priorities for this project.

Plasticity, the ability to compensate for the yield reduction at low plant population levels by increased per plant yield, has been evaluated in 500 germplasm accessions. Five genotypes were identified as having relatively high plasticity; a desired quality under dry conditions. Supplementary studies have revealed that the plasticity decreases as the soil fertility and moisture supply improve. The local large seeded cultivar has high plasticity.

Several advanced lines, bulk populations and introductions were evaluated in regional and international yield trials to identify genotypes having wider adaptability. Four genotypes and one F3 bulk showed relatively wide adaptability. Forty-four crosses were made to introduce this character. The photoperiodic response of 36 diverse genotypes was studied in the plastic greenhouse and six genotypes were identified as being relatively less sensitive to long days. These will be used for crossing to

develop wider adaptability.

Lentil agronomic studies have established the superiority of early planting, i.e. in November, over the late winter or early spring planting. Genotypic differences in the sensitivity to delay in planting have been identified. A higher seed rate of 160 kg per ha and row spacings of 30 to 45 cm have been found optimum for the large seeded local cultivar. Optimum depth of planting was 4 cm for the small seeded, and 8 cm for the large seeded local cultivars, both of which yielded better when planted in hills rather than by continuous drilling.

Phosphate application at 50 kg P_2O_5 per ha gave an economic increase in yield, and band placement was superior to broadcast application. Response to phosphate was higher under limited soil moisture supply than under assured moisture conditions. Phosphate fertilized lentils have shown their value in the two course rotation with wheat.

Weeds reduced the lentil yield by 60 per cent, and the period 60 to 90 days after emergence was most critical for weed competition to the crop.

A high proportion of lentil cultivars responded to inoculation. A yield increase of 46 per cent was recorded under the best Rhizobial strain and lentil genotype combination. Damage to root nodules by the larvae of Sitona weevil has been found to be very widespread. Fortunately a very effective control has been achieved by soil application of the insecticide carbofuron (trade name).

Agronomic studies are now being conducted at the four SWAN experimental sites and on some farmers' fields to identify the interactions between the varied agro-ecological conditions and agronomic practices.

Chickpeas

In spite of the striking increase in yields possible through the winter planting of Ascochyta blight resistant cultivars, because of the lack of resistance in local cultivars, chickpeas are still planted almost exclusively during the spring by farmers in the Mediterranean region. Research efforts under conventional planting dates have resulted in the identification of a line, ILC 263, which has averaged 15 per cent higher yield than the local Syrian cultivar over the past two years of trials. It is currently being evaluated on a large number of cultivators' fields in the major chickpea growing regions of the country.

Another aim of the chickpea program is to develop tall and erect types which will be both easier to harvest, and responsive to increases in plant populations.

Twenty-four tall lines are being investigated at two population levels, viz. 333,000 and 500,000 plants per hectare, to study their performance at closer planting. Segregating populations from F2 to F6 are being grown with a view to selecting high yielding and disease resistant lines.

In view of the preference of many importing countries for very large seed, with the consequent possibilities of premium prices ICARDA is investigating the possibility of developing high yielding large seeded chickpeas with a heavier 100 seed-weight than 40 g; resistance to diseases, including root rots; and acceptable seed quality. Early results are promising.

ICARDA is receiving strong help from ICRISAT in its investigations against the diseases and pests of chickpeas. Early this year, a pathologist from ICRISAT spent three months studying Ascochyta blight at ICARDA, and an entomologist from ICRISAT spent one month at ICARDA, looking at the pest problems of chickpeas.

Faba beans

Most faba (broad) beans in the region are raised under higher rainfall conditions (more than 450 mm annually) or with irrigation. The major emphasis of the work on faba beans is thus to address the problems of increasing and stabilizing production under such conditions. Yields of irrigated faba beans in excess of 4.5 and 7.0 tons per hectare were recorded in the best entries in yield trials at Tel Hadya and Terbol respectively.

Faba beans raised with assured moisture, yielded much higher when planted at the end of October, and yields were lower as the date of planting was delayed. Yields increased linearly as the rate of phosphate application was raised up to 75 kg P_2O_5 per ha. Response to Rhizobial inoculation was better in exotic cultivars than in the cultivars from the region. Tribunil (trade name) herbicide controlled weeds satisfactorily and had the least adverse effect on the nodulation.

In an attempt to develop alternative growth habits, interest was centred around the 'top-less' types in which the apex terminates in

a flower. Thirty crosses were made to a determinate mutant from Sweden, and 51 determinate plants were selected in an F3 population from Denmark. Supplementary studies on the significance of branching patterns and determinate growth habit, as achieved by detopping and debranching at appropriate stages of growth, revealed that branching was an important character in this environment and about three main branches per plant were ideal.

As with lentils and chickpeas, ICARDA has a special program with faba beans in its disease screening nursery south of Lattakia. Very promising sources of resistance to Ascochyta blight have been identified and have been included in this year's crossing program. A number of lines, under both this year's and last year's screening conditions have indicated a lower susceptibility to Botrytis.

After two years screening of germplasm, 16 of the most promising sources of resistance to Orobanche have been distributed to nine countries in the region for further testing in various environments.

Another project aims to develop high yielding and stable faba beans which may produce an economic yield of dry seed under 300 to 400 mm of annual rainfall. The desired cultivar will have resistance to major diseases, insect pests and Orobanche, an efficient growth habit, resistance to pod shattering, and adequate nutritional value. A number of accessions have been evaluated. The best entry in the rainfed yield trial produced more than 2.5 t/ha; outyielding the local check cultivar by 36 per

cent. The selected genotypes are now being evaluated under different rainfall conditions, and differences in their soil moisture extraction pattern are being evaluated.

There are indications that the yield of rainfed faba beans can be increased to some extent by such operations as dust-mulching and foliar sprays of an anti-transpirant or surface reflectant. The screening of a large number of Rhizobial strains under rainfed conditions has lead to the identification of strains of Rhizobium which appear to be more drought tolerant.

A project on the development of faba beans for green vegetable use was initiated. Five hundred and forty accessions from the pure line collection and 260 large-seeded accessions from the base germplasm collection were rated for green bean production. The most promising entries are being re-tested this year. Twenty-five lines were evaluated in a replicated yield trial. Yields in excess of seven tons per hectare of green beans were recorded following continuous pod picking.

In another trial, yields in excess of 9.5 tons per hectare were recorded following picking on three occasions from plants grown at a population of 20 plants/m^2. Yields were lower at lower plant population levels. In a date of planting trial at Lattakia, green bean yield from a single picking was higher from November and mid-December than October plantings. The earlier date resulted in excessive vegetative growth and a build-up of various foliar diseases.

Forage Improvement

Temporary pastures
Germplasm
Legumes
Inoculation
Mechanisation

Continuing rapidly rising populations in the countries within ICARDA's mandate are placing increasing pressures on cultivated areas and rangeland. In fact the rangeland is specially vulnerable because crops are advancing into marginal areas and thus restricting the land which is available for grazing. At the same time, stockowners are still endeavouring to increase their numbers of sheep and goats.

As a result, soil fertility is deteriorating rapidly and soil erosion is already acute and widespread in some parts of the Region. Unless this decline in land resources can be arrested, particularly by more productive forage plants, lower yields are going to worsen the situation.

The social and economic implications of this are important because shortfalls in production must be met by increasingly expensive imports. As animal protein, which is essential to people, is one of the most expensive imports, every endeavor must be made to maintain current national production levels in meat and dairy products especially.

Provision of forages to make this possible, involves the identification of the more productive species and lines, and the development of appropriate management systems.

One facet of research to accomplish this, involves the improvement of rangelands and permanently grazed areas where there is low rainfall or poor soil.

Temporary pastures

Another important approach, and one which is emphasised, is the identification of productive species for temporary pastures in the farm system; replacing the fallow. Such a use of pasture would introduce a new period of productivity into the crop rotation and, particularly if legumes were present in a pure or mixed sward, would improve the soil fertility and structure, reduce erosion, and increase the yield of the following crop.

Although such systems have been found to be useful in other countries, particularly Australia, environmental differences, particularly temperature, soil conditions and pests and

diseases, mean that methods which have proved successful elsewhere are not necessarily applicable in West Asia and North Africa. Hence commercially available lines from Australia are not necessarily well adapted to this Region.

Thus the role of the Forage Improvement Program is to determine the part that commercial cultivars can play in the Region and to provide better adapted lines and related management systems.

Germplasm

During the first two years of the Program, work has concentrated on building up the germplasm collection which has reached about 10,000 lines with accessions collected by ICARDA and from other germplasm resource centers.

Seed of all of this material has to be increased and sown in nurseries where growth patterns can be examined. Accessions are being grouped according to their responses to the Aleppo area environment at Tel Hadya, the Center's main experimental station. Current emphasis is on the following annual and perennial leguminous genera: Medicago, Onobrychis, Vicia, Pisum, Lathyrus and Trifolium.

Forage cereals, mainly barley and triticale, and perennial grasses are also being tested. Regular 3-weekly observations are being made of the nurseries, microplots and agronomy trials. Single plant and line selections are made for rapid early and cold season growth, leafiness, length of growing period and resistance to pests and diseases. Selections have been made from about 15,000 lines of barley established by the Cereals Improvement Program.

Pests are particularly damaging to the Pisum species, but can also severely inhibit the growth and seed production of Vicia and Medicago spp. The annual legumes particularly are affected by species of Sitona which attack the nodules as well as the leaves of the plants. Bruchus species can be serious pests of the seed crops of legumes. Onobrychus is susceptible to powdery mildew, and ICARDA scientists have identified some resistant lines.

Small sward trials, microplots, with two replicates, are used to screen accessions after selection as single plants or as lines in the nurseries. These are harvested to determine dry matter and seed yields.

And so the initial program is largely a matter of accessing material, screening it, and testing and building up desirable lines. Barley has an initial advantage because farmers have been grazing it for many years. Triticale, a newer cereal, is undergoing a parallel program.

Legumes

A very important part of the program is the integration of the legumes into the cropping system, and an intensive study of the agronomic factors which maximise production and, at the same time, maintain and build up soil fertility.

In addition to the general run of agronomic experiments such as rates of seeding, times of planting, response of grazing, and so on, emphasis is being placed on the response of cereals and forage crops not only to phosphatic fertilizer but also to chemical nitrogen in comparison with the nitrogen which is fixed in the soil by

such legumes as Pisum sativum and Vicia dasycarpa. Natural supplies of phosphorous and nitrogen are very short throughout the Region. Seeding rates of these forage plants and cereals are being tested to establish desirable combinations, as well as to test responses to nitrogen.

Another important project is the testing of vigorous lines of barley and triticale for their response to both artificial grazing in which plots and rows are cut, and to mob grazing by sheep, to test not only the comparable growth throughout the season, but also the recovery for grain or hay.

Inoculation

And still another important section of the Program is seeking the overall improvement of nitrogen fixation for different forage legume crops by finding and introducing more effective strains of Rhizobium bacteria by artificial inoculation to contribute to dry matter production as well as increase the amount of residual nitrogen which will be available to subsequent crops.

This project also aims to identify and solve problems which are associated with nitrogen fixation in forage legume crops. Another study deals with the effect of the insecticide Carbofuran (trade name) on the nodulation of Pisum sativum which has been inoculated with a number of strains of Rhizobium which have been collected in the Middle East and North Africa.

In addition to the work at ICARDA's experimental site at Tel Hadya, south of Aleppo, the Forage Improvement Program has off-site experiments elsewhere in the Aleppo district, and also at Lattakia, Salamieh, Damascus, Izra'a and Kamishley.

Last year the Australian medicago cultivars made very vigorous growth in yield trials near Lattakia and Kamishley where soils are better

than at Aleppo and rainfall was higher. The climate is milder, especially at Lattakia. These tests are being repeated in this year of above average rain.

Lines of barley and triticale which were vigorous in Aleppo and Salamieh or Kamishley in 1978-79, have been chosen for further testing this year. The experiments have been designed to enable choice of the highest yielding hay varieties after response to chemical nitrogen or with Vicia dasycarpa as the source of nitrogen.

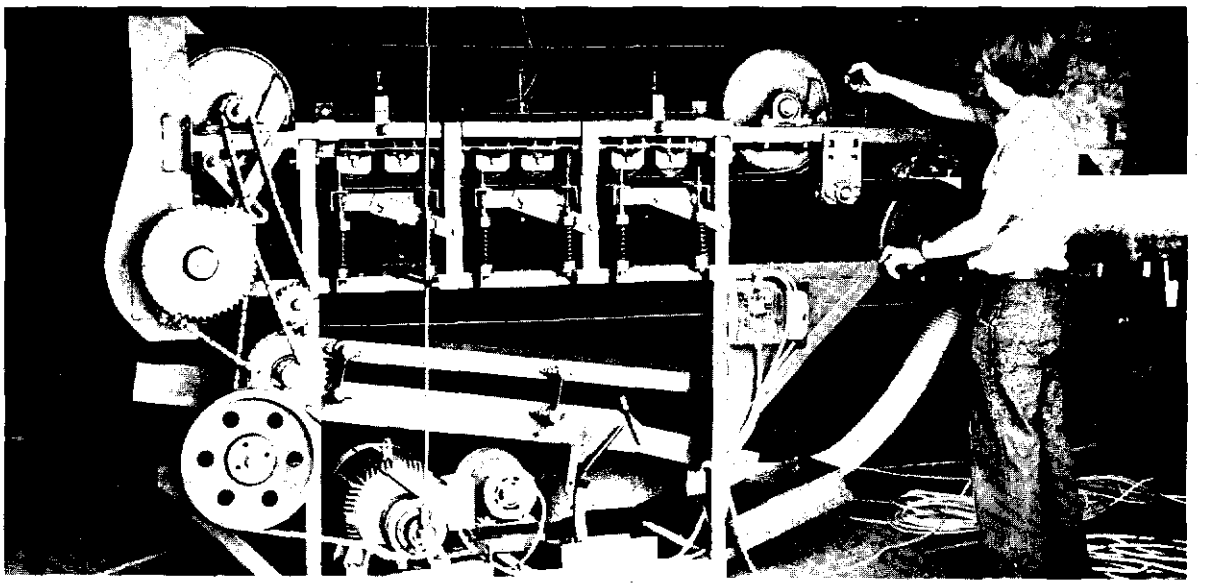
Dry matter production of Medicago sativa (alfalfa, lucerne) lines is being tested, and an experiment near Damascus is investigating whether the presence of a forage legume in barley swards under such low rainfall conditions as the Damascus area, could increase the value of the fodder and perhaps the total dry matter produced.

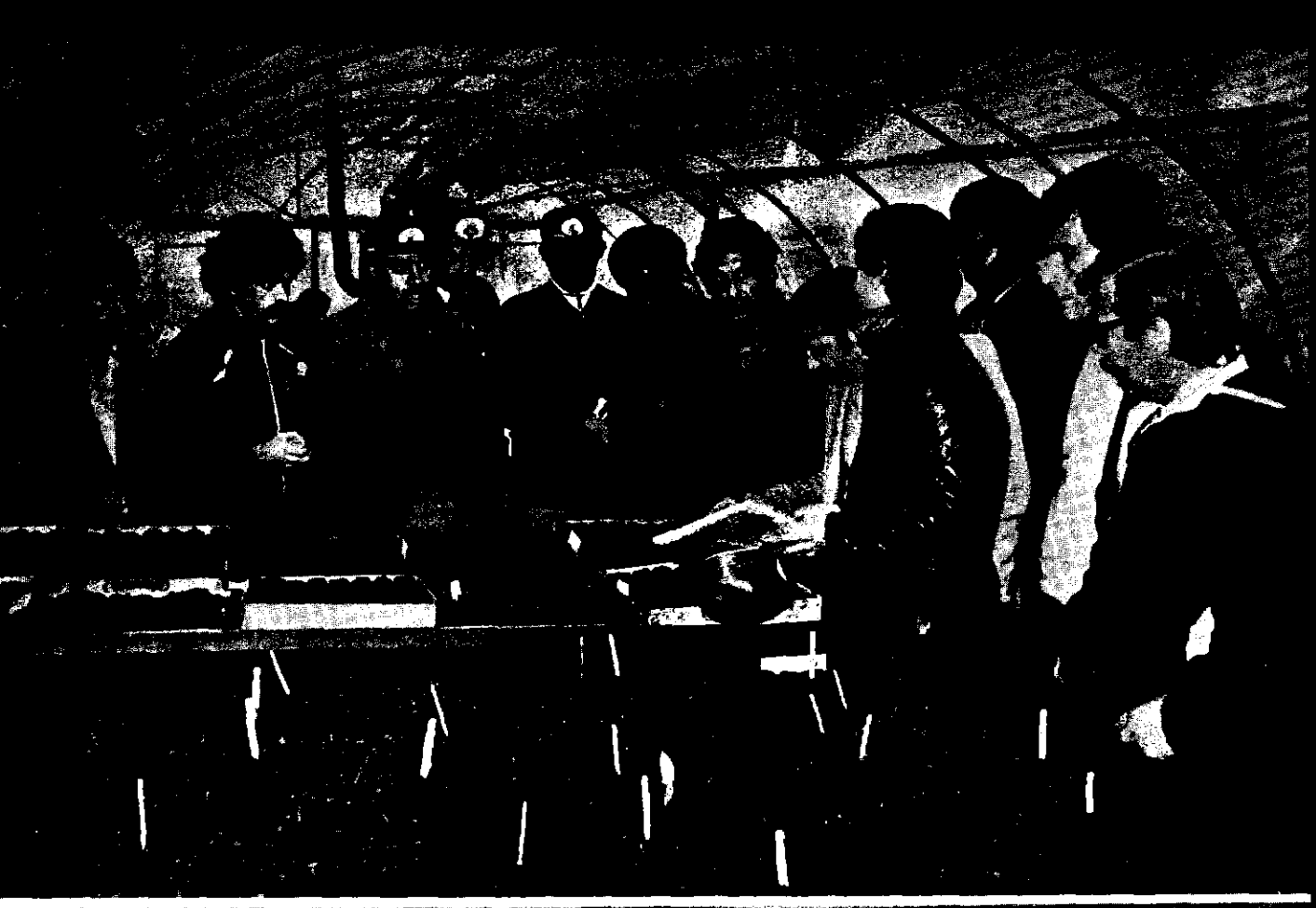
Mechanisation

The Forage Improvement Program now has three machines which will facilitate harvesting considerably; replacing the old methods which were much slower and more expensive. These machines are a belt thresher, a suction harvester and a forage plot harvester.

The recently acquired medic belt thresher, developed by the South Australian Department of Agriuclture, will accelerate the threshing of medics considerably; being a great advance over the previous slow acting machine. The suction harvester is particularly useful for seed of single plant medic lines, and the Hege forage plot harvester saves considerable time and labour by cutting a swathe of total forage and weighing it in the same operation.

Thus while the establishment of a needed forage program throughout the Region is necessarily a slow process, ICARDA is well into the initial stages from which desirable species and management may develop.





Training and Communications

Training courses
Manuals and publications
FABIS
Reference books

For the Center's objectives to be achieved effectively in the Region, it is essential that both the results of research and the new technologies which are based on them, should be communicated suitably to national programs. These programs will assess the Center's findings and, where necessary, will do further adaptive research before the results are extended to farmers.

However, effective work at the national level is impossible in the absence of adequately trained people to not only extend the results of research but also to design and conduct experiments under local conditions, make the necessary scientific observations, and take full advantage of such accessions as improved varieties of seed.

Unfortunately, the seriously inadequate number of trained people for these important tasks, is one of the greatest barriers to increased food production in the Region.

For example, ambitious national seed production programs have been wasted because local people have not had the training to conduct them. In other cases, valuable cultivars have not even been sown, experiments have not been designed and conducted, scoring for resistance to disease has not been possible, and untrained people have been unable to understand the terminology of instructions for new developments.

Short term visits, such as consultancies, are very helpful, but in cases such as these, it is a great advantage to have trained resident people who understand the conditions and needs of each country. Training for exacting local conditions is essential. Communications with ICARDA have been inadequate because of the limited personal links between the Center and national programs.

In some countries, the number of trained personnel is quite out of proportion to the area of crops which they are expected to serve. Because of this deficiency, rangeland production, for example, is at a low ebb although this type of land occupies a large proportion of some countries e.g. Saudi Arabia, 95 per cent;

Jordan, 90 per cent; Iraq 70 per cent.

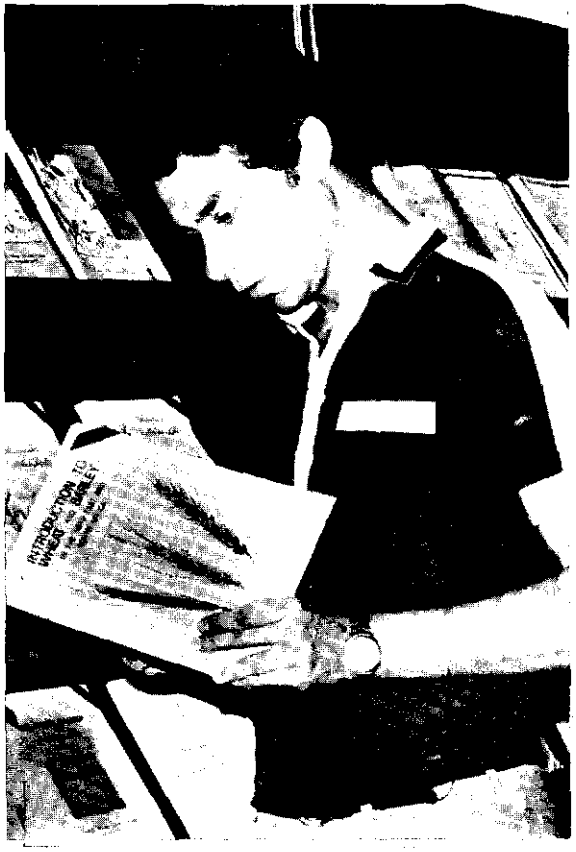
Technical personnel from several countries have been unable to make estimates of ground cover, and have not appreciated such things as the environmental changes, often including new weeds and diseases, which have accompanied the improvement of rangeland.

Training programs

Most countries are aware of these deficiencies, and have asked for more training programs. In fact, all countries at the recent ICARDA workshop on the program for the collection, evaluation and management of wheat and barley germplasm, stressed the urgent need for trainees.

ICARDA is doing its part to reduce this deficiency, and consequently stimulate food production throughout the Region and neighboring countries, by organising training and providing news services to national programs, scientists and other people.

The five areas of training activity are (i) group residential courses, (ii) short-term training, (iii) individual training, (iv) graduate degree training and (v) national level training.



The six-month courses which cover most of the growing season, are provided at ICARDA in cereal production, food legume production and forage crops. They have been characterised this year by a tremendous increase in the enrolment for training in forage crops, the number being 16, compared with 9 in 1979 and 4 in 1978.

Enrolments in the other courses this year are cereal production, 15, food legume production, 15.

Courses are based on the need for an ap-

preciation of the importance of (i) a well balanced approach to research, (ii) an understanding of the cropping systems and practices which farmers use, and (iii) a recognition of the limitations of research station studies and their application to farmers' conditions.

Specific areas in which deficiencies are most acute include, for example in faba(broad) beans, weed control, pathology, entomology, breeding, seed tecnology, hybridisation techniques and tolerance to drought and cold stress. Other less urgent needs include training in soil studies, genetics for breeders and anti-nutritional factors.

Three years of training courses at ICARDA point to the next step of national training programs in the Region, especially now that valuable links have been established through trainees from many different countries. While such national courses would be led initially by ICARDA's training officers, previous trainees could play a very important part, both in the organisation and conduct of the studies.

ICARDA's training officers also see a need for further emphasis on an integrated approach to agricultural research, so that the trainees are aware of the long term benefits of a multi-disciplinary approach to development, and increased emphasis on experiments which are conducted on farmers' fields.

Future courses may also aim to reduce a marked deficiency in communication, and incorporate discussions on ways in which researchers can strengthen their links with other agriculturalists in their field.

If communications between research workers, extension workers, information workers and farmers are clouded, the results of research could be doomed to get no further than

PARTICIPANTS ATTENDED ICARDA'S TRAINING COURSES HELD AT ALEPPO IN 1978, 79, 80

	Cereal	Food Legume	Forage	Total
AFGHANISTAN	3	1	2	6
ALGERIA	1	4	3	8
BANGLADESH	2	2	-	4
CHILE	-	1	-	1
CYPRUS	1	-	2	3
EGYPT	3	2	-	5
ETHIOPIA	1	1	-	2
INDIA	1	2	-	3
IRAN	-	2	-	2
IRAQ	3	1	-	4
JORDAN	5	4	2	11
LEBANON	1	3	-	4
LIBYA	2	1	-	3
MOROCCO	2	3	3	8
OMAN	2	-	-	2
PAKISTAN	1	1	1	3
SAUDI ARABIA	1	-	1	2
SOMALIA	-	-	2	2
SUDAN	2	4	1	7
SYRIA	14	11	8	33
TUNISIA	4	6	2	12
TURKEY	1	8	1	10
N. YEMEN	3	-	1	4
S. YEMEN	2	-	1	3
	55	57	30	142

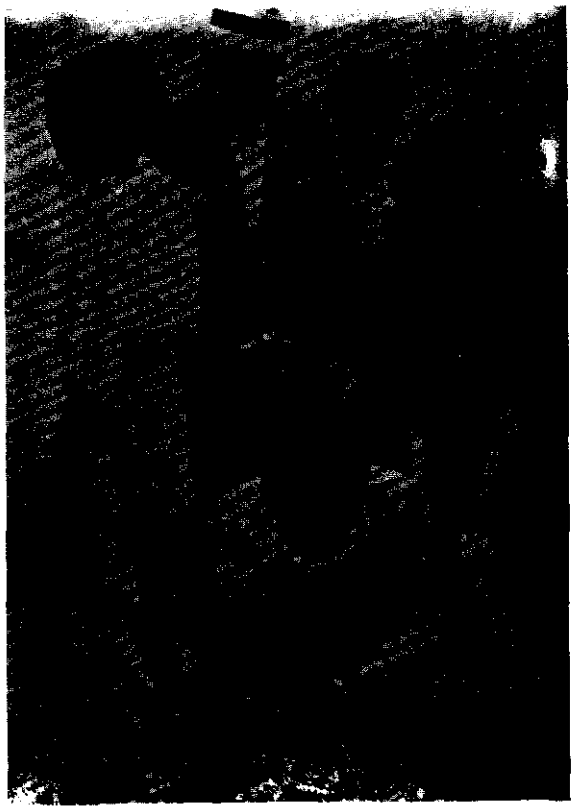
the researchers' immediate sphere of collaborators.

Manuals

The training courses are considerably strengthened by the production of manuals which undergo continuous improvement as the result of evaluation by participants in each course. These manuals are experiencing a wide demand from countries within the Region and elsewhere.

The requests from high level institutions such as agricultural colleges and universities has placed a strong responsibility on ICARDA to produce top quality material.

Manuals which have been produced this year include:-



- Introduction to Wheat and Barley in the Near East and North Africa.
- Introduction to Statistics and Experimental Design.
- Introduction to Seed Science and Technology.
- Crop Physiology of Food Legumes.
- Insect Pests of Cereals.
- Introduction to Genetics (updated).

A number of lecture notes for workshops, conferences and meetings have also been produced.

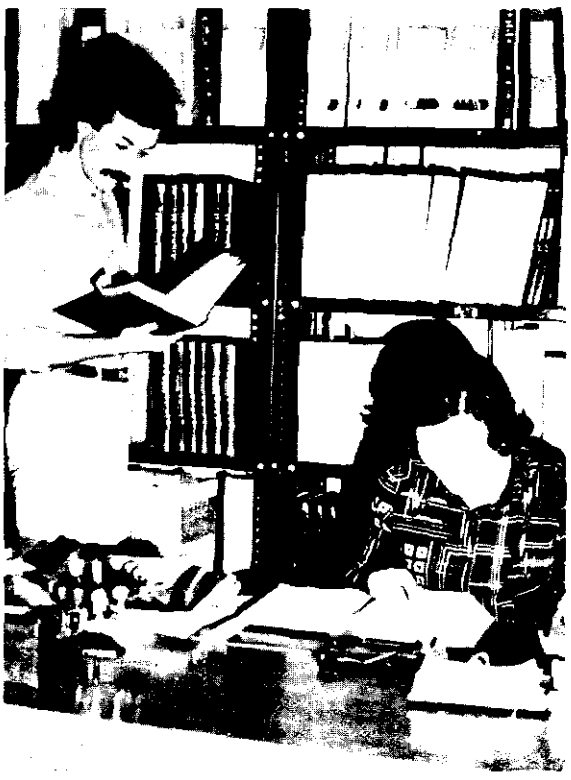
Links with scientists throughout the world have been strengthened considerably by the establishment of the newsletter FABIS, the first issue of which in 1979 attracted many favourable comments from a wide readership

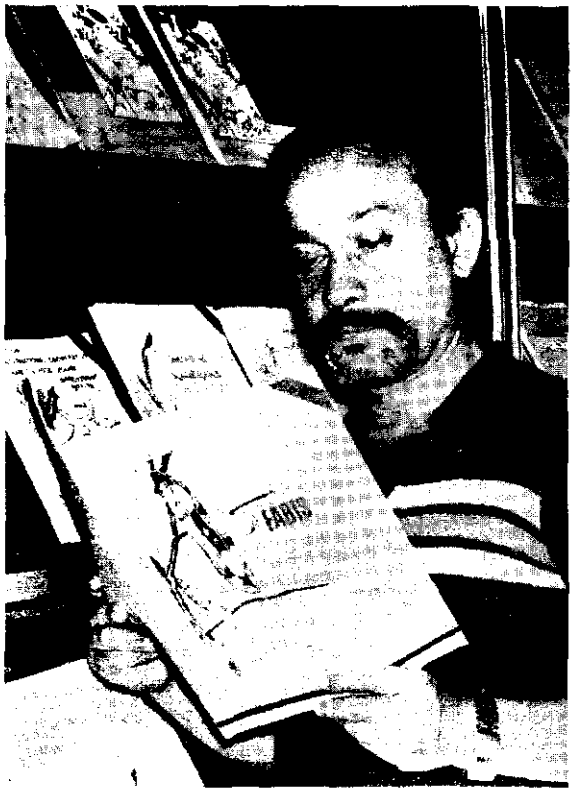
of people who work with faba (broad) beans. The considerably enlarged 1980 edition includes several new sections: In-Press abstracts which summarise articles which have been submitted for publication in journals; Institution Reports; Letters and Announcements.

The current mailing list includes 522 names from 60 countries including 26 countries in the Near East and North Africa.

ICARDA plans to extend its links with scientists in lentils. The possibility of publishing LENS, a worldwide newsletter on lentils, in conjunction with the University of Saskatchewan, Canada, is being explored.

These services should help to bridge the gap in information about these food legume crops which scientists in national programs claim has been largely responsible for the slow pace of knowledge transfer at the national level.





Reference books

Arising from a workshop on Food Legume Improvement and Development at the University of Aleppo, ICARDA is publishing the first comprehensive reference book on lentils which has been written in the English language. Contributors include specialists from a number of countries.

The Center is also publishing a reference book on Soil Water and Nitrogen; being a collection of the review papers which were presented at the ICARDA/UNDP workshop on "Increasing the Effectiveness of Water and Nitrogen in Rainfed Farming Systems in Medi-

terranean-type environments" in Aleppo, Syria, on January 13 to 18, 1980. This book will be complemented by the publication of all the papers presented at the workshop in the journal 'Plant and Soil'.

The Center has been in close touch with the Commonwealth Agricultural Bureaux (CAB) in England regarding the publication of scientific abstracts, and is preparing a special annotated bibliography on lentils. Six hundred and fifty lentil abstracts have been obtained from CAB, and 650 additional references from IDRC, FAO and other sources. Three thousand faba bean abstracts have also been obtained from the Bureaux; and annotated bibliographies are being prepared by consultants in Egypt and the Sudan for a Nile Valley Project publication.

During this year, ICARDA has designated 16 categories of publications. These include the quarterly newsletters about activities and achievements of the Center, project reports, research papers, discussion papers and lecture notes which are published as required. News items have been sent to daily papers.

Much information is published in English but, where appropriate, translations are also made in French and Arabic. An Arabic subcommittee of the Editorial Committee has been established. Translations into Turkish are under consideration.

ICARDA has acquired equipment which will enhance the ability of the printing shop to produce publications and manuals of good quality; thus reducing the Center's dependence on commercial firms for much of its printing requirements.

Thus ICARDA has expanded its training and communications activities considerably during the year and, in doing so, has taken significant steps to increase the chances of improved production throughout the Region. Through better communications, the Center has also expanded its sphere of influence, especially in faba beans, lentils and barley for which it has a world mandate.

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