



Under the Patronage of the President

H. E. Mr. Elias Sarkis

## CROP PRODUCTION IN LEBANON

### Proceedings of a Research Conference

held at Chtaura, Lebanon

December 10th to 12th, 1981



The International Center for Agricultural Research  
in the Dry Areas

ICARDA

April 1982

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His Excellency Mr. Elias Sarkis**

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## PREFACE

This document attempts to summarise the proceedings of the Research Conference on Crop Production in Lebanon, which was held in the Massabki Hotel in Chtaura, Lebanon from December 10th to 12th, 1981, under the patronage of the President of the Republic, Mr. Elias Sarkis. The Conference was sponsored by ICARDA, and was attended by over 60 participants, representing a balance between scientists from national institutions in Lebanon and ICARDA staff.

ICARDA has been actively involved in research at its stations in Lebanon since its establishment in 1977. ICARDA's activities aim at increasing food productivity and the welfare of rural communities in the Middle East and North Africa region. To better achieve these aims, it was perceived by the Lebanese national institutions and ICARDA that there was a need to discuss, co-ordinate and launch a joint program of work.

To this end, this Conference was organised in order to:

1. discuss relevant past research and development which can be used as a base for future collaboration;
2. identify constraints that need to be resolved;
3. formulate collaborative research programs that can be implemented jointly by national and international institutions, including ICARDA.

As a base for discussions in the Conference a series of research presentation documents were prepared. These papers have here been summarised so that the focus on the recommendations arising out of the Conference can become more apparent, and in order to speed the process of publication. It is hoped that authors will appreciate that it has not been possible to publish their papers in full, and that they will accept the limitations of the summaries presented here. Thank you.

## ACKNOWLEDGEMENTS

ICARDA would like to acknowledge its debt to all the participants of this Conference for their valuable contributions, which enabled the Conference to result in clear recommendations for future collaborative research projects. We would also like to thank the management and staff of the Massabki Hotel Chtaura, Lebanon, for the warm hospitality and excellent facilities provided; and all others who contributed to the organisation of the Conference both within and without ICARDA.

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## **AGENDA**

**Thursday, December 10th**

### **OPENING SESSION**

Chairman: Dr. Joseph Najjar

09:30 - 09:50	Opening Address
09:50 - 10:10	Conference Objectives
10:10 - 10:30	Address
10:30 - 10:50	Status of some field crops in Lebanon
10:50 - 11:00	Closing Remarks

11:15 - 12:45	Visit to ICARDA's Terbol Station
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### **PRESENTATION OF RESEARCH ACTIVITIES**

Chairman: Dr. Raja Tannous

14:45 - 15:15	Farming Systems Research
15:15 - 17:20	Cereal Crops Research in Lebanon

**Friday, December 11th**

### **PRESENTATION OF RESEARCH ACTIVITIES (Cont.)**

Chairman: Dr. David Nygaard

09:00 - 10:15	Food Legume Crops Research in Lebanon
10:15 - 11:55	Pasture and Forage Improvement in Lebanon
11:55 - 12:45	Agricultural Training and Communi- cation Activities in Lebanon.

### **SUB-GROUP DISCUSSIONS**

14:30 - 14:45	Explanation of Procedure
14:45 - 16:30	Cereal Crops Research Food Legume Crops Research Pasture and Forage Improvement

16:30 - 17:00

Farming Systems Research

17:00 - 17:30

On-Farm Trials

Seed Production

17:30 - 18:00

Training and Communications

### **Saturday, December 12th**

#### **CLOSING SESSION**

09:00 - 09:30

Summaries of sub-group discussions

09:30 - 10:30

Discussion of proposed projects

10:30 - 11:00

Recommendations for action

11:00

Summary and closure of conference

## OPENING SESSION

### Introduction

Dr. Mohamed A. Nour  
*Director-General, ICARDA*

Mr. Chairman, Mr. Minister, Ladies and Gentlemen:

I would like to express my thanks to the Chairman of the first session of this Conference for giving me the chance to say a few words.

I welcome the representative of the Patron of this meeting. Our Patron is His Excellency the President of the Republic, and I welcome his representative, His Excellency Dr. Mustafa Dernaika, to this scientific meeting. We greatly appreciate the patronage of President Sarkis, and his interest in science and the development of agricultural research in Lebanon and other Arab countries with which ICARDA is working. And I would like to express my thanks to Dr. Mustafa Dernaika, the Minister of Agriculture, for his interest and support.

This is a historic event. For the first time since the war afflicted these lands seven years back, a conference is held and attended by so many national regional and international scientists and organisations concerned with agriculture. To hold it in Chtaura is again not without a notable meaning. We assemble in the town that can well be described as the heart of the Beka'a.

I also welcome all participants and would like to thank them for their research papers and presentations. I am grateful for their interest in the development of applied agricultural research in Lebanon. The National Council for Scientific Research and the Agricultural Research Institute have played an important role in encouraging ICARDA to sponsor this Conference. The American University of Beirut is to be equally thanked for its sustained interest.

ICARDA serves the Middle East, and Lebanon has contributed greatly, through the work and facilities provided at Terbol and Kfardan. We greatly appreciate this assistance.

I welcome also the representatives of international centers, of the Food and Agriculture Organisation of the United Nations, and of regional organisations, universities and institutions.



I would like to thank once again all participants for their attendance and participation. I now ask Dr. Mustafa Dernaika to open this Conference.

Second, the fact that we would not depend on improvised solutions and should persevere to study the problems through scientific research. We promise you, Your Excellency, that we will take good note of these points. We will make sure that the research papers presented at this Conference will be discussed and studied in order to bring out definite projects. They may not be great in number, but they should be valuable in their scientific content and application. Neither ICARDA nor any other organisation which is still growing can make big promises. But we do promise that recommendations of this Conference will be studied carefully. We consider that the Minister's promise of support sets on obligation on all of us to strengthen our co-operation. We shall study the Conference recommendations in order to accomplish, over the next three years, definite and active progress in the development of the rural life and prosperity of Lebanon.

Third, the need for collaboration with international organisations. Here I promise as Director-General of ICARDA to lay down a defined joint program of work and present it to the Minister in the very near future. In ICARDA we have five major work programs: cereal crop improvement, food legume crops, pasture and forage crop production and sheep husbandry, farming systems research and training and communications. We aim to interact in this Conference through these five programs; and we would like that one of the objectives of this Conference be to define what these five programs and their leaders and scientists could do to serve Lebanon. I stress that we have come to fully interact with the Lebanese scientists. We shall not attempt to monopolise the proceedings. We are here to help and to strengthen the Lebanese structure of agricultural research and production through co-operations with Lebanese national institutions.

It is our pleasure that we have amongst us Dr. Joseph Haraoui, who is the chairman of the Agricultural Research Institute, and also a member of ICARDA's Board of Trustees and a member of the Board's Executive Committee. I would like to say that Dr. Haraoui has been a strong defender of Lebanon, asking what can ICARDA do for Lebanon many times - sometimes asking for the impossible. As someone working in the executive and legislative committees of ICARDA's Board, he is always reminding us of our duty towards Lebanon, saying that we have to overcome all difficulties and that we have to develop our Terbol facilities in spite of all the constraints. Sometimes there was agreement on what he wanted us to do and sometimes there wasn't. Here I want to stress that what we are aiming to achieve is not a miracle, but at the same time it is more than just a beginning. We aim for a long and continuing relationship between ICARDA

and Lebanon. To date, this relationship reflected both the good and bad sides of the coin. But today I think we are taking a new, positive step. All I want from you all is that we start frank discussions. You can both praise and criticise ICARDA. It is our duty to accept your views gratefully.

The final point that I wish to make, Your Excellency, is that ICARDA is not pursuing highly sophisticated research far removed from practical application. We know that Lebanon is well advanced in agriculture. We want to learn from your agricultural experiments and experience. Much of this experience stems from the Lebanese farmers. We will also learn from Lebanese scientists as much as we can. That is why we are not simply here to give, but to help and participate in close collaboration.

Your Excellency, Mr. Chairman:

Thank you, Your Excellency, for being with us today, we are grateful for your words. It is our pleasure that His Excellency has also accepted to visit Terbol to see what we have achieved, in spite of Dr. Haraoui's criticism. We, as a group, have done both what is right and what is wrong, but we are proud of our achievements. There are many Lebanese who are quietly working with us at Terbol and Kfardan in spite of considerable difficulties. We are proud of all who work with us to serve Lebanon and its rural areas.

## ADDRESS

Dr. Joseph Haraoui

*Director-General, Agricultural Research Institute, Beirut.*

Dear Sirs, Your Excellency the Minister of Agriculture, Mr Chairman:

It is a happy occasion for me to speak at the opening of this scientific conference, organised to discuss agricultural research in Lebanon in collaboration with the international scientific community and ICARDA.

I would like to take this opportunity to thank Dr. Nour, the Director-General of ICARDA, for arranging this meeting which aims at co-operation in the field of agricultural research.

Since its establishment, the Agricultural Research Institute has collaborated with international scientific research institutes, in order to establish a regional scientific center for Lebanon and the neighbouring countries. Among the institutes that have contributed to establishing and financing this center are the Ford Foundation, the Rockefeller Foundation and the International Development Research Council of Canada.

These organisations have worked with Lebanese technical staff on scientific agricultural research aimed at improving wheat, maize, forage crops and sheep breeding. This group was later called the Arid Lands Agricultural Development program, or ALAD. Following further assistance from a group of international institutes, ALAD was changed into an international center serving the Middle East, the Near East and North Africa. Thus ICARDA was established.

This Center has worked in Lebanon under difficult circumstances. Lebanon today needs assistance in scientific work, especially from the international institutes, as many Lebanese technical staff are working abroad. Lebanon is in the establishment phase in agricultural research, and we would like to thank ICARDA and other organisations who are helping us in technical fields.

ICARDA has a staff with good scientific background, who are capable of solving many of the agricultural problems existing in the area in general, and Lebanon in particular. I don't want to say that ICARDA staff can solve our agricultural problems on their own, but they can help us to work out special methods in order to study protein rich crops in the area,

as animal protein sources are decreasing throughout the world. Most of the international institutes are interested in such crops, bearing in mind possible population increases after the year 2000.

ICARDA's research programs include work on wheat, chickpea, faba bean and lentil, and aim at finding new varieties with high levels of productivity which can form a major source of protein for the people of this region.

We in Lebanon now need to recover our scientific activities, to re-establish our research stations and provide our laboratories with equipment so we can recover what has been lost during the past seven years. I realise that our possibilities are limited, particularly in terms of the number of technical staff with good scientific training who can organise and lead research. We at the ARI need to work in co-operation with technicians from ICARDA at sites such as Terbol, with technical staff from the regional institutes at the Lebanese University and at the American University of Beirut, and the National Council for Scientific Research. If we can achieve this measure of co-operation, we will then have the ability to study other areas outside ICARDA's mandate, such as fruit trees, animal diseases and other research subjects.

Lebanese farmers have suffered much during recent years, particularly through high prices of seeds, chemical fertilizers, running costs etc. The farmer is now looking anxiously to the results of this meeting, as applications of research are easier in Lebanon than in any other country. This has become apparent from the experience of scientists working with ALAD and later with ICARDA.

Mexican wheat seeds, other high yielding varieties, and new varieties of potato have been grown successfully by the Lebanese farmer. However, the cultivated area of these crops in Lebanon is small, and the farmer needs to produce much more per unit area than in other countries. Inoculants and serums which have been produced and distributed free by the ARI have contributed to a large extent to the flourishing poultry breeding industry. Lebanon has become an exporter of eggs and chickens after achieving self-sufficiency. Citrus trees resistant to some viruses have also been produced and distributed to farmers and have contributed much to containing such diseases. Other studies by the ARI included olives, insect pest control, plant diseases, soil science, experimental design for fertilization and irrigation.

Our institutes used to be venues for training of technical staff in many areas of applied agricultural research, such as seed multiplication, soil science production, and other subjects.

We in Lebanon are waiting to be able to apply a new work strategy which will arise through our collaboration in this Conference. We hope to be of service through the scientific advances we will achieve and disseminate as we have done in the past; and so help Lebanon and the region as a whole.

I welcome all the participants, and I hope we can repeat this scientific meeting in the future.

Thank you.

### **Status of Some Field Crops in Lebanon**

Mahmoud Solh

*Faculty of Agricultural Sciences, American University of Beirut, Beirut, Lebanon.*

### **Summary**

Agriculture in Lebanon contributes about one-third to the total output of the productive sector. The margin of food security in Lebanon is limited because of the low self-sufficiency ratios for basic food commodities in the human diet, namely wheat, rice, pulses, sugar, vegetable oils and red meat. Lebanon falls into the food deficit group for these commodities.

Field crops, namely cereals, pulses and industrial crops, play a minor role in Lebanese agriculture. The competitive edge lies with horticultural production which accounts for about 80 per cent of the total crop production. During the 1964-73 period, cereal production decreased by an average of 1.9 per cent; no change was observed in leguminous crops. Fruit production increased by 4.2 per cent while vegetable production increased by 2.7 per cent. Both grain acreage and production increased in the mid-seventies then continued their secular trend of decline.

However, self-sufficiency ratios for cereals, pulses, feed, fodder and industrial crops can be increased considerably if some or all of the production constraints facing these crops are removed or minimised. These constraints may be grouped under 'agricultural service support', structural and economic factors.

'Agricultural service support' factors include research and extension. Insufficient applied research focusing on field crops is a major constraint to increasing the productivity of these crops. In most field crops, availability of high-yielding cultivars as well as modern management practices is very limited or non-existent. The potential of field crops in being more drought tolerant compared to vegetable crops has not been exploited to enable them to invade drier areas. The insufficiency of applied research is much more critical for field crops compared to horticultural crops because some practical research work on the latter is being done by the private sector.

Structural characteristics of farm size in Lebanon is another constraint to increased productivity of the agricultural sector in general, and of field crops in particular. Holdings are usually small in size and badly fragmented. There is a need to adapt mechanisation to the local conditions. Individualism is another characteristic of the agricultural sector structure. Only in recent years has the idea of co-operatives gained some acceptance.

Economically, if production of field crops in Lebanon was left to market forces, the crops would disappear quickly. Short-term profit motives are blinding farmers to the long-term potential of including these crops in rotations. The very high cost of production involved with some of these crops, added to their low yield potential, results in a very narrow profit margin. Mechanisation is essential to expand or even maintain some crops like lentils. Farmers are discouraged from planting crops that are labour intensive and give low returns. Farmers are willing to adopt high-yielding field crops which require less hand-labour involvement. The high cost of producing field crops makes them uncompetitive compared to imports. Development of seed production enterprises for various field crops in Lebanon will greatly increase net profits from these crops.

The constraints mentioned here are generally applicable to most field crops. In addition, there are specific constraints for each field crop. Mechanisation of lentil and chickpea harvesting, weed control in legume crops, the *Sitona* insect pest on lentils, disease susceptibility and stem borer (*Lixus* spp.) on faba beans are only a few problems facing pulse crops in Lebanon.

Despite their great potential in the large rainfed area and in the spring irrigated area (20,000 ha), field crops are becoming part of marginal agriculture, while horticultural crops have developed into an important part of competitive agriculture. The neglect of field crops by both the public and private sectors resulted in reduced acreage and productivity. Any remedy requires decisive public sector intervention, particularly with regard to supporting applied research, creating an active extension system, *encouraging co-operatives to emphasise field crops* and initiating intervention support programs.

The long-term benefits of including field crops in rotations will be realised if demonstrated. By increasing production of these crops, Lebanon would also gain some food security instead of depending totally on imports for its basic food commodities.



## CLOSING REMARKS TO THE SESSION

Dr. Josef Najjar

*President of the National Council for Scientific Research (NCSR), Beirut.*

At the conclusion of this opening session I would like to say a few words. I know that the role of the chairman of the meeting is to be as silent as possible, and I would prefer to remain silent. But I have been asked to say a few words. And I am going to try to do so, apologising in the process for my weak English, or Arabic, language.

I would like to say first of all that I have understood from what I have heard that the principal aim of our research activities is to improve the situation of the farmers living in rural areas. But how are we going to achieve this? I think that our, or rather your, deliberations here as well as the research that we are all conducting is directed in that way. And the other principal aim that we have to keep in mind is the economic aspects of our work, the economic feasibility of the findings of our research. This is very important.

I want also to point out for our consideration the fact that to have a good standard of living the proportion of the people living in the countryside in relation to the total population of the country should be about 1 to 4, i.e. if you want to have a good level of living for all the people. I think that the proportion that we have now is 1 to 3 or 1 to 2. If we want to have a rapid change in this situation, we have to accept to move some sections of the population. But I think that this is not a good thing, because rapid change creates many social problems which have to be avoided in Lebanon. This is the first established fact.

Another aspect is the question of security. We have to think of the possibility of our food imports being restricted, especially those of wheat. I remember that during the war in 1939, we had problems. We calculated that one person consumes about 10 kilos of wheat in a month. In Lebanon we then had 1 million persons, and calculated that we needed about 120,000 tons of wheat. Now I think that we are more than 3 million people, so we need about 400,000 tons of wheat, and our production of wheat is of course very low. We have thought that one way to solve the problem is to very rapidly shift our production from vegetable production to the production of wheat, to breed top quality varieties of wheat, and to make all possible areas of the country available for wheat production. This is one way to have some security; but the overall question of food security needs consideration. This is very important.

I shall end by saying some words about the National Council for Scientific Research, because in fact there has been no very clear relationship between ICARDA and the NCSR up until now. But of course our aims and directions are very close to each other, and it is necessary that from now on the NCSR has very close co-operation with ICARDA. The NCSR is not an executive body, but it is a planning body. Our first role is planning, then orienting, apportioning and supporting research. This is the way we work. We have unfortunately very little financial means. So we have to adopt a catalytic role, and this is how we intend to co-operate.

Thus we are very interested in the results of this Conference, and we shall try to apply its resolutions and conclusions. I think it is very important to have very specific recommendations, as Dr. Nour has said, in order to be able to apply them very rapidly. So I hope that this meeting will give us ideas and projects, practical projects which are economically feasible and which we can then implement and support.

Thank you.

## PRESENTATION OF RESEARCH ACTIVITIES

### A Farming Systems Approach to Agricultural Research

David Nygaard and Alister Allan

*Farming System Research Program, ICARDA, P.O.Box 5466, Aleppo, Syria.*

This presentation describes how ICARDA defines farming systems research, cites an example that shows the advantages of such an approach, and suggest that this framework has relevance for a wide range of agricultural development projects in Lebanon.

Farming system research is perceived as a process that passes through four stages:

1. **Diagnostic stage.** This is an initial and recurring process where the complete system is studied to understand the socio-economic as well as the agro-economic environment in which agricultural production is undertaken, and to identify constraints to, or potential areas for, increasing agricultural productivity.

2. **Design and Experimental stage.** Scientists conduct research on problems which have been identified in Stage 1., either on research stations, sub-stations or on farmers' fields, in an effort to find one or more feasible solutions or strategies that will improve agricultural production.

3. **Testing stage.** Promising strategies that are developed above are tested under farmers' conditions where, initially, production decisions are made jointly by the scientist and farmer. Then trials which are managed totally by the farmers themselves are undertaken.

4. **Extension stage.** The final process involves diffusing successful technologies that have been screened above.

This process is dynamic and iterative, since we frequently return to previous stages to clarify points as we gain knowledge, confront problems and consider research alternatives. The distinction between stages is not sharply defined as there is much overlap and we work at several stages simultaneously. In essence, farming systems research can be seen as an effort to find new solutions to agricultural development problems in situations where old solutions have been shown to be less effective than desired.

Farming systems research, therefore, is not a discipline; it is not a methodology to be applied to some problems and not others; it is not a substitute for research organised along traditional lines; nor is it even something unique. It is, rather, a perspective that we think has wide applicability; indeed, one that could be used to organise research on many of the problems posed in other papers in this conference.

To show how this farming systems approach works in practice, a brief description is given of some current work on barley productivity in Aleppo province in Syria. Barley producers in six villages have been interviewed regularly over three years to gain an understanding of their systems. A detailed, more intensive survey of 150 farmers is now being made to supplement these detailed studies. At the same time, agronomic trials have been conducted to investigate the effects of different seed and fertilizer rates, times and methods of sowing, while barley breeding has developed higher yielding genotypes. On-farm trials with simple improvements in two practices, namely the introduction of phosphate fertilizer and one new variety, have been started in two of the drier villages. These trials are being continuously monitored by the multi-disciplinary group.

Farming systems Research is young and needs considerable refinement before it will gain broad acceptance. It confronts the traditional organisation of research into disciplines which are predominant in virtually every Ministry of Agriculture in the region as well as in most universities.

Lebanon has a very complex agricultural system where a multiplicity of crops and several options with respect to animal production are available to most farming families. Farm size, land quality, average annual rainfall, and socio-economic conditions vary widely, and all of these have to be considered when developing agricultural research strategies designed to improve farmers' livelihoods. Field crops in Lebanon are not competing well with cash crops, such as vegetables, and as a result of this the land allocation to cereals and pulses has been decreasing in recent years. Obviously, research on these crops cannot be done in isolation, and a farming systems approach would help us to understand the role that they play in the current system.

In addition to cultivated land, ICARDA is interested in studying rangelands, common grazing areas and marginal zones. Improving such areas would greatly benefit the livestock sector which is indeed important in this country. Again, we feel that a farming systems research approach is a feasible way to study the complex interface between livestock and crop,

particularly for a single family farm that is involved in both activities. Such farms are the rule rather than the exception in Lebanon, and thus the Farming Systems Research Program could assist the development and execution of projects in this area.

Subsequent papers and discussions on cereals, food legumes and forage crops and pasture improvement will produce a number of very interesting research possibilities. The Farming Systems Research methodology which we have presented here may help make our efforts in carrying out this research more effective. Thus, we only ask that you keep this approach in mind as the discussion proceeds, and consider using it in the projects that evolve.

## CEREAL CROPS RESEARCH IN LEBANON

### Current Status and Research Efforts Needed in Cereal Breeding and Production Technology under low rainfall.

Michel Abi Antoun

*Agricultural Research Institute, Tel Amara, Lebanon.*

Very little research has been conducted on winter cereals in the past few years in Lebanon. It has been found appropriate to test research potentials in areas of similar environmental conditions and to try to extrapolate for the large areas of the northern Beqa'a which receive scanty rainfall. In every test conducted at Tel Amara, some varieties of wheat and triticale have greatly exceeded the local check. The best varieties identified in these tests were Maya 2-Arm's' for triticale, Waha for durum wheat and S 311 x Norteno for breadwheat.

The Agricultural Research and Educational Center (AREC) of the American University of Beirut is located in a low rainfall area of the Beqa'a. Research on cereal crops has recently been reactivated. (Summaries of the observation nurseries of winter cereals and the winter cereal yield trials conducted at AREC during the 1980-81 season were presented). It seems appropriate to assume from these results that triticale might have a future place among the winter cereals in Lebanon.

Agronomic research was the most neglected field in cereal improvement until technological packages for high rainfall areas were pushed through by the 'Green Revolution'. The AREC has done many agronomic studies on land which is 'beefed up' with fertilizers, herbicides and animal manure. This can hardly represent the surrounding area.

Achievements in agronomy are influenced by one or all of the following factors:

1. Politics
2. Administration
3. Budget
4. Technology

The agronomist can do little or nothing to influence the first three factors. Technologically, it should be realised that the agronomist is not the sole agent of success in higher crop production; pathology, entomology, physiology and grain quality are interrelated with the agronomist's inputs. Integrated efforts are badly needed in the lower rainfall areas of Lebanon, especially if miscellaneous crops are to be replaced by food crops.

Renovation and expansion are needed in the following areas:

1. Training
2. Research
3. Transfer of technology to farmers
4. Seed production and storage

Areas of research needing attention are mainly in breeding and agronomy. Barley, wheat and triticale are the crops for which breeding work, done at present at Terbol and Tel Amara, would be supplemented by work at the AUB farm and Kfardan stations. These stations represent a sharp contrast of environmental conditions and could serve both Lebanon and the region. Possible areas of breeding research include: breeding for disease resistance, selection for different environmental conditions and high altitude research. In agronomy, work should concentrate on inputs that may improve yield and reduce risk. Such inputs could include nutrition, seed rates, time of sowing and other cultural practices such as weed control and tillage practices.

It is in the hands of the authorities at this conference to reinstate some momentum in winter cereals research for dryland areas and areas of higher rainfall.

### **On-Farm Demonstrations to Introduce Improved Cereal Production Technology in Lebanon.**

George Maalouf<sup>1</sup>, Nicolas Rubeiz<sup>2</sup> and William J. Russell<sup>3</sup>.

1 *Extension Department, Ministry of Agriculture, Beirut, Lebanon.*

2 *ICARDA Terbol Station, Terbol, Lebanon.*

3 *Faculty of Agriculture, American University of Beirut, Beirut, Lebanon.*

The objective of the extension service is to transfer beneficial accomplishments to farmers using the maximum of efforts and extension experience. Extension services in Lebanon have for the past 25 years been tailoring their working strategies according to the agricultural, social and technical requirements of the society in the different regions of the country. Consequently, many farmers are double cropping and making profitable yields. In many areas lack of irrigation restricts farming to a single crop during the rainy season. There is a need for higher yielding and disease resistant small grain varieties and improved production practices in regions such as the Beqa'a valley, to encourage farmers to continue to grow the small grain cereal crops.

The area planted to cereal crops in Lebanon is decreasing every year because many farmers are shifting to other crops that may give higher economic returns than cereals and may require lower inputs than crops such as potatoes and vegetables.

Many of the new cultivars of wheat and barley are resistant to certain diseases and insect pests. To introduce some of these improved cultivars to the Lebanese farmer, demonstration plots were planted on 18 different farmers' fields during November 1981. Where possible, the demonstration plots were located beside the highway to maximise the number of people able to see them.

The objectives of these demonstrations were:

1. to demonstrate improved cereal varieties and production
2. to encourage adoption of improved cereal varieties and production practices through field days and regular visits to demonstration fields, and through discussions with participating farmers on all problems related to cereal production.
3. to improve the technical abilities and knowledge of farmers, especially concerning the importance of good land preparation and machinery use, of using chemicals for weed control and of using good sterilised and screened seeds obtained from trustworthy sources.

Farmers were selected who were willing to give the necessary time and attention to the demonstration plot to carry it through to harvest. These farmers have indicated that they will plant larger areas next year if the improved cultivars are found to be high yielding and resistant to the disease and insect pests common to the Beqa'a valley. This system offers a fast and efficient means of introducing improved cultivars to all farmers in the area.

While the first year (1981/82 season) of this project deals only with varieties as variables, the second and subsequent years will include trials on a number of production practices, such as seed rate, fertilizer, weed control, sowing method and time of sowing.



## Feasibility of Regional Cereal Seed Production in Lebanon

Y.Y. Klaimi<sup>1</sup> and M.A. Shouman<sup>2</sup>.

*1 Food and Agriculture Organisation (FAO), Tel Amara, Lebanon.*

*2 National Research Council, Tel Amara, Lebanon.*

The resumption of cereal seed production in Lebanon was initiated with the assistance of FAO. This has been provided through the TCP project. The small seed stock that had earlier been developed and made available at the Agricultural Research Institute (ARI) was increased at Terbol research station. This stock was of good quality and constituted the basis for the rehabilitation of seed production in Lebanon.

In 1978, 134 tons of foundation seeds were produced. FAO renewed its assistance to the Lebanese Government by sanctioning a new TCP project for 1979, under which seeds produced in 1978 were distributed to select growers for remultiplication. By 1979 the seed production program in Lebanon was firmly established and about 1000 tons of seed (foundation and certified) were available for multiplication and/or distribution during the 1979-80 season.

From 1979 onwards plans were made for wider and more comprehensive activities on cereal seed production, including cereal technology and seed certification. This follow-up activity is now being assumed through a new UNDP/FAO project which is funded for a three year period (1980-82). The aim of the project is to contribute to the intensification and improvement of cereal cultivation through the generalised use of improved seeds produced locally and on a regular basis. The project aims at satisfying the seed requirements of Lebanon and even at producing a surplus of certified and/or foundation seeds for export to other countries of the Near East region.

In 1980, 1785 tons of foundation and certified seeds were produced. In 1981, seeds produced have been of the basic and foundation categories. Out of the total quantity, 250 tons were processed, in order to distribute and continue the production of foundation and certified seeds. Lebanon has the possibility of producing high quality seed for export to other countries in the region.

The high quality seeds produced every year are meant to reach the farmer and to be used by him for better and more production. It is this very goal, however, that is not attained because of hindering administra-

tive routine. Very often it is the absence of a decision which delays the whole process (e.g. seed purchase and sale, price fixing, seed distribution policy, etc.). Sometimes the contract for processing the seed production is not passed at the right time, if at all; consequently the seed is either processed too late in the season (as in 1979) or even not processed at all (as in 1980).

An important seed stock of improved wheat and barley varieties (over 2000 tons) is now available in Lebanon, but it is beyond the reach of farmers because of rigid administrative and financial routine. Also, an increasing reluctance to grow seeds under contract is becoming apparent among farmers because of the delay they experience every year in getting paid for their seed stock delivery.

The following recommendations are made in order to improve the seed production program in Lebanon for the country itself and for the Near East region:

1. Some decentralisation in decision making is badly needed in order to allow timely execution of seed production operations.
2. Sufficient funds must be allocated in time for the execution of the various seed production operations and for the purchase of seeds from the seed growers, as specified in the contracts.
3. A permanent seed reception and distribution committee should be formed including members from both the ARI and the GDCSB.
4. Reception of seeds must start immediately after harvest.
5. An alternative and even better solution would be to finalise the seed processing contract with existing private firms before harvest.

Two advantages occur from such an arrangement:

- significant economy in time and handling charges, and
  - assurance that the seeds will be conditioned and made available in time for distribution to farmers.
6. Every effort should be made to pay the contracted seed growers without delay for the stocks they deliver.
  7. It is highly desirable that a small seed processing plant, of an output of 2.5. to 3 tons per hour, be acquired and installed at Tel Amara.
  8. The seed produced is to be used by farmers for better and more protection - therefore the sale price of seeds must be fixed before the start of the sowing season so that actual distribution could start no later than October each year.

It is therefore suggested that the Government of Lebanon considers the possibility and feasibility of exporting wheat and barley seeds to other countries of the Near East region. The wheat and barley varieties produced in Lebanon if selected carefully can qualify for export to many countries in the region, where, in any case, they have been already thoroughly tested through the Regional Wheat and Barley Nurseries.

### **Cereal Research and Production activities in Lebanon and their impact in West Asia and North Africa.**

J.P. Srivastava, A.H. Kamel, M.S. Mekni and M. Nachit  
*Cereal Improvement Program, ICARDA, P.O. Box 5466, Aleppo, Syria.*

The Cereal Improvement Program at ICARDA seeks to assist national research institutions in the region in increasing wheat and barley production through the development of improved and stable varieties with higher yield potential, better resistance to pests and pathogens, together with improved management practices for their cultivation. The new technologies go to national programs where they are first tested at research stations so that local adjustments can be made. National institutions are encouraged to verify the new technologies with local adjustments on farmers' fields.

The priorities of wheat and barley research in West Asia and North Africa include the improvement of crop yield potential and stability for rainfed areas (2000 to 600 mm), disease resistance and grain quality. However, there is considerable agroclimatic diversity within the region, and thus drought and frost tolerance, winter hardiness, earliness, lodging, disease and insect resistance all figure amongst the factors requiring special attention.

The Agricultural Research Institute (ARI) at Tel Amara and the American University of Beirut (AUB) have been co-operating with ICARDA in fulfilling these objectives. The ARI at Tel Amara, also hosted ICARDA's program in Lebanon during the early stages of ICARDA's development, and many of the selections made in Lebanon have shown good yield potential on a regional basis.

The general evolution in yield levels of barley among the lines in the advanced yield trials of the previous three crop seasons shows that yield varied from 3868 to 4486 kg/ha in 1978-79, from 4203 to 5234 kg/ha in 1979 and from 4923 to 5963 kg/ha in 1980-81. It is worth mentioning

that some of these lines were selected in Tel Amara. Among this elite material lines are selected and promoted to the international nursery system and made available to national programs in the region.

The gains from selection in material generated in the international nurseries showed a similar trend. The mean yields across locations of the best barley lines were 3378, 4150 and 4931 kg/ha for the years 1978-79 to 1980-81 inclusive compared to 2719, 3414 and 4521 kg/ha for the improved national check. This material also includes some of the crosses or selections made in Tel Amara. This increase in yield is also associated with an increase in the level of resistance to the major diseases. However, intensified efforts need to be continued in this respect.

It is also worth mentioning that one of the barley lines tested in the field verification trials in Syria, namely 2762-Beecher-6L, was originally selected in Tel Amara. This line has been named 'Badia' and identified by national Syrian scientists along with ICARDA, and is being increased prior to distribution to farmers.

The work on the development of dual purpose barleys (grain and grazing types) and naked barleys also includes some of the selections previously made in co-operation with Tel Amara research scientists.

In durum wheat, the aim is to develop improved varieties and production technologies for use in the various agroclimatic conditions in the region. The germplasm developed should possess the genetic potential to perform well under limited soil moisture levels, as well as the capacity to respond well when water and nutrients become less limiting. Lack of soil moisture, high temperatures and hot winds at the time of anthesis and grain development are the most common stresses that the plant has to withstand in order to produce good grain yield. Salinity of the arable and land is also an increasing problem in many arid and semi-arid areas of the region.

The results show that the newly selected durum lines are slowly catching up with breadwheats in grain yield, disease resistance and adaptability in the region. Yield data for the last five years in the Regional Wheat Yield Trials (RWYT) shows the rapid progress in this respect. The picture in the Regional Rainfed Wheat Yield Trials (RFWYT) during the same period also shows the same trend. Data from Preliminary Observation Nurseries-Durum (PON-D) shows that a majority of the lines selected by national programs in the region on the basis of superiority in yield po-

tential, disease resistance, plant type and local adaptability came from crosses made in Lebanon or Syria. Sahl and Waha durum varieties are performing very well in the region and they are being multiplied in both Syria and Lebanon for release to the farmers.

The work done so far on screening for salt tolerance indicates that the three most promising lines of durum wheats came from crosses made in Lebanon based on the adaptability and performance of the parents in the region.

The objectives of the breadwheat program are the development of suitable breadwheat varieties and production technology for the lower rainfall areas of the region, and the stabilization of the productivity under high rainfall and irrigated conditions. The program has also benefited from the work done at Tel Amara, Terbol and Kfardan in previous years, and the same trend as in the case of durum wheat is apparent.

Yield data of the top yielding breadwheat lines in the Regional Wheat Yield Trials in Lebanon during the crop seasons 1976/77 to 1980/81 inclusive shows that some breadwheat lines gave an average yield of about 19 per cent more than Mexipak (the widely grown variety in Lebanon) and 14 per cent more than the national improved check. In the Rainfed Wheat Yield Trial (RFWYT) during the same period, the top yielding breadwheat line showed an increase of about 18 and 16 percent over the yield of Mexipak and the improved national check respectively. S311x Norteno, a breadwheat line selected in Lebanon, has performed very well in the region and is being multiplied by Syria and has been named 'Golan'.

The triticales improvement program aims at:

1. The development of genotypes with greater yield potential, yield stability, disease and insect resistance and adaptation to the different agro-climatic conditions prevalent in the region.
2. The development of high yielding and stable genotypes with industrial and nutritional qualities.
3. The development of dual purpose triticales with high dry matter and protein content, good regrowth capacities and high grain yields after cutting or grazing.

Triticale lines are tested for their potential at Tel Hadya (Aleppo) under rainfed conditions, and at Terbol, a higher rainfall environment. They are also screened at five more locations representing different agroclimatic conditions.

The evaluation of the resistance of wheat and barley material to diseases has always been a major component of the breeding programs. This work is continuing and expanding, and Terbol is now being used as one of the testing sites for disease screening through the Key Location Disease Nursery (KLDN). This nursery includes all promising advanced lines of barley, durum wheat, breadwheat and triticale at the different stages of yield testing in ICARDA's breeding programs, and is planted in Morocco, Tunisia, Egypt, Syria, Yemen, Turkey, Pakistan, Ethiopia and Kenya.

Disease data when combined from these locations give a good coverage of the diseases prevalent in the region. This information helps selecting lines with different genes for resistance to particular diseases as well as lines with multiple disease resistance.

The data generally show that the level of resistance to the major barley and wheat diseases is improving in the new germplasm developed.

Emphasis is now being given to developing more plastic house facilities at Terbol where disease can be multiplied and used for artificial epiphytotics. The information collected will be of utmost importance for the Lebanese national program and the region alike.

In an earlier presentation, the role of Lebanon in producing certified seeds to countries of the region has been emphasized. Only high yielding varieties with adequate disease resistance and adaptability should be multiplied, as there will be no demand for susceptible genotypes.

In brief, ICARDA, ARI (at Tel Amara) and AUB are involved in cereal research in Lebanon. Closer co-operation between the three institutions and further increases in breeding, agronomy and pathology activities will benefit both Lebanon and the region. However, additional resources and personnel are needed to improve the existing research efforts.

## Co-operation between the Lebanese Agricultural Research Institute and ICARDA.

Adnan Alameddine

*Head, Plant Breeding Department, Agricultural Research Institute, Tel Amara, Lebanon.*

Through this co-operation to date, some excellent work has been done in cereal improvement and in the development of agronomic practices. The previous presentation clearly indicated the advantages of this co-operation. New varieties of wheat and barley have been developed, which are now performing better than the existing ones and exhibiting better disease resistance. In fact some of these varieties which have been selected through our joint program are performing well not only in Lebanon, but also throughout the Middle East and North Africa region. This is only the start of this fruitful collaboration. I hope the co-operation between the two institutes is strengthened in the future.

The Agricultural Research Institute has several technicians working both with cereals (wheat and barley) and food legumes (lentils, chick-peas and faba beans) who have been trained at ICARDA and who are now continuing their work in Lebanon in spite of the difficult situation. Currently, however, the Institute is lacking research facilities and equipment, as well as motivation and incentives. If these constraints can be minimised, then the co-operation between the Institute and ICARDA can become much more fruitful. I feel this point should be emphasised.

At present, there are a number of local varieties, along with the improved durum wheat, breadwheat and barley varieties, being grown in Lebanon. Some of these varieties have become outdated and susceptible to diseases, and need to be quickly replaced. Research efforts should be strengthened particularly in the following areas:

- crop improvement
- disease resistance
- grain quality
- agronomic research

The best lines should be tested on farmers' fields, following their performance in demonstration plots. The varieties that perform well in the on-farm trials should then be officially released and handed over to the seed multiplication bureau of the Cereals and Sugarbeet Office.

There are two main areas of work in Lebanon to which I believe a joint program of research work can contribute significantly. These are:

1. testing at multiple sites under high and low rainfall conditions, and
2. disease resistance work in general.

I sincerely hope that this co-operative work will be strengthened through additional resources and manpower, for the benefit of both Lebanon and the region.

### **Cereals in Lebanon: History, Cultivation and Production.**

Raji Bissat

*Agricultural Engineer, Grain and Sugarbeet Office, Ministry of Agriculture, Beirut, Lebanon.*

Lebanon is a relatively small country, with a land area of one million hectares. It enjoys a Mediterranean climate. Along the coast, the temperature is mild and frosts are rare. The climate of the eastern mountains and of the Beqa'a valley is more continental, and here summers can be extremely hot and dry, and winters very cold. Along the coastal plain, rainfall ranges from 700 mm in the south to 850 mm in the north, and in the Beqa'a valley from 600 mm in the south to 200/250 mm in the north. Eighty-five per cent of the rainfalls between November and March, most of this from December to February.

The cultivated land area in Lebanon covers only 38 per cent of the total area of the country. Fifty-five per cent of the cultivated area is cropped annually, while the remaining 45 per cent is kept fallow. The area cropped annually constitutes only one fifth of the total area of the country.

Cereal crops have declined in area in recent years; the proportion of the total cultivated area covered by cereals has fallen from an average of 46.8 per cent in the period 1956-58 to 28.2 per cent in 1970-72 and 20.0 per cent in 1981 (estimated values). The total annual production of wheat and barley has fallen from 83,000 tons in 1956 to 71,000 tons in 1972 and 35,000 tons in 1981. The value of production of cereals in Lebanon as a percentage of the total for all agricultural product groups has fallen from 11.8 per cent in 1956-58 to 7.2 per cent in 1963-65 and 4.0 per cent in 1970-72, the latter being the most recent statistics available. This downward trend is due to the increasing competition for the limited amount of arable land from other crops such as vegetables and fruits.



In recent years, the demand for breadwheat in Lebanon has ranged from 300,000 to 360,000 tons. Most of this has had to have been imported. Also in recent years, and just before the events started in 1975, feed grain consumption increased tremendously to reach a record level of 410,000 tons, most of this going to poultry. Since then, consumption of feed grain has dropped to half that record level due to the poultry industry being adversely affected by the events.

It is clear that Lebanon's capacity to increase wheat production is rather limited. It can be increased, but materially, and certainly not to a level of self-sufficiency.

Lebanon has limited useable land, limited water resources, and very attractive alternative products to be grown on the land. The aim of encouraging wheat production in relation to other crops is justified because on irrigated land the yield of wheat can be as high as 5 to 6 ton/ha. Another reason is that cereals should be included in crop rotations in order to improve the land.

In addition to this overall policy, cereal production may be helped by implementing irrigation projects, developing wheat varieties that require less water, land repair and reclamation of land that has not yet been cultivated.

It is important to remember that during the recent tragic events in Lebanon it was the agricultural sector that continued to contribute to the national economy. It would therefore make sense for the Government authorities to give more attention and support to agriculture in Lebanon.

The objectives of the Cereal and Sugarbeet Office (CSO) as laid down in law are:

- to stabilise supply.
- to develop grain and sugarbeet without adversely affecting the interest of the consumers.

The CSO seeks to achieve these objectives by supporting local production of cereals, controlling the government subsidy for bread prices and by producing wheat and barley seed for breeding purposes.

Support of local production of cereals, especially that of wheat, is arranged through a price support system. This program was introduced in 1963, and applies to both wheat and barley. In 1968 corn was included in this program, which has however been generally active only for wheat.

Since 1971, wheat imports have been handled exclusively by the CSO. Purchases of wheat are made either under long-term state to state agreements, such as the existing agreement with the Canadian Wheat Board, or through international tenders. The CSO distributes the purchased wheat to the mills under a quota system at predetermined and subsidised prices. The mills are in turn committed to deliver the flour produced to bakeries at fixed maximum prices in order to keep bread prices at levels established by the government.

Since its establishment in 1953, the 'Wheat Office' (the predecessor of the CSO), in co-operation with the Ministry of Agriculture, has provided seeds by distributing, advancing or selling them at reduced prices to the farmers. This program is credited with introducing new improved varieties of wheat and barley, such as Florence Aurore and Senator Cappelli in the late '60's, Mexipak in the early '70's and Jury in the late '70's. In 1978, in co-operation with the Agricultural Research Institute and FAO, the CSO started to produce varieties of wheat and barley other than those listed above. In 1979, 800 tons of wheat and barley seed were produced in Lebanon; this quantity was doubled in the following year. The aim is to increase production of wheat and barley breeding seeds to 4000 tons, and to study the possibility of exporting any quantities in excess of Lebanon's needs if such exports prove economically feasible.

Lebanon's single main elevator is situated in the port of Beirut. Its storage capacity is 120,000 tons and its handling capacity 10,000 tons daily. Its principle function is to facilitate the loading and unloading of bulk shipments. However, because of the shortage of storage facilities elsewhere in Lebanon, the Beirut elevator is being used for extended and not temporary storage, thereby limiting its handling capacity.

## LEGUME CROPS RESEARCH IN LEBANON

### On-Farm Demonstrations to Introduce Improved Production Technology in Lebanon.

George Ma'alouf <sup>1</sup>, Pierre Kiwan <sup>2</sup>, and William J. Russell <sup>3</sup>.

<sup>1</sup> *Extension Engineer, Ministry of Agriculture, Beirut, Lebanon.*

<sup>2</sup> *Research Technician, ICARDA, Terbol Research Station, Terbol,*

<sup>3</sup> *Extension Agronomist, Ministry of Agriculture, Beirut, Lebanon.*

During the past two years extension service agents of the Ministry of Agriculture have conducted farm surveys in some villages of the northern Beqa'a valley. The aim of these surveys has been to study the farmers' methods of crop production, to determine the farmers' needs and to identify the problems that constrain crop production. Surveys have also been carried out by students of the American University of Beirut. These results have also been summarised. Results have shown that the biggest problem facing the farmer is the lack of an irrigation system providing water during the summer months. Other problems include the inflationary prices of seed, fertilizers and land. Marketing of farm produce is also seen as a problem.

Fresh vegetable crops as well as potatoes require high inputs, in terms of fertilizers, seeds, water, weeding and harvesting. Without the benefit of an irrigation system, farmers are left to grow winter-planted crops to coincide with the winter rainfall. Some short season vegetables are planted in late winter, and these are able to utilise stored soil moisture and the water from the few late rains.

Some food legumes, such as chickpeas and lentils, are also planted in early spring. However, these are often attacked by diseases and insect pests. Yields are also reduced by lack of moisture, inadequate weed control and fertilizer use. These constraints, coupled with the high labour costs for harvesting chickpeas and lentils, restrict the number of farmers interested in producing these crops on a commercial scale.

Research carried out by ICARDA scientists has led to the identification of improved strains of chickpeas and lentils which are high yielding and can be planted in the winter to coincide with the rainy season. The chickpea cultivars are winter hardy and resistant to the more common types of disease such as Ascochyta blight. Some of the genotypes are tall growing, producing pods high enough off the ground to enable harvest by

machine, using either a cutter bar or, possibly, a combine normally used for harvesting soybeans.

The Ministry of Agriculture extension agents are co-operating with ICARDA to evaluate these new cultivars under farmers' field conditions in the north Beqa'a valley; it is also hoped to demonstrate their potential to the farmers. Demonstration plots were planted on ten different farmers' fields during November, 1981.

The objectives of these trials are as follows:

1. to evaluate the yield potential of improved chickpea and lentil cultivars and certain production techniques under farm conditions.
2. to introduce improved cultivars and certain production techniques to participating farmers through demonstration trials and to encourage adoption using different extension communication methods with groups of legume-growing farmers.
3. to introduce improved cultivars to a large number of farmers through general meetings, field days and conducted field tours.
4. to give participating farmers the opportunity to discuss and exchange their ideas concerning the benefit of the demonstrations, the problems they face and to encourage scientific thinking in finding solutions to problems.
5. to improve the technical ability of not only the participating farmers, but all farmers attending the general meetings and field days.
6. to make farmers aware of the importance of developing and improving current agricultural methods.

Demonstration trials were distributed according to the recognised climatic zones, based on the amount of precipitation in each zone. Farmers were selected based on their willingness to give the necessary time and attention to the demonstration trials and to carry them to successful completion. These farmers are progressive and are ready to try innovations and new crop cultivars. A general meeting is planned for each climatic zone, at which specialists and farmers will discuss improved crops and technology. Conducted tours in co-operation with ICARDA will be arranged by the Ministry extension service. Small groups of farmers will be taken on study tours to observe the crops in the trials at different locations in the Beqa'a valley.

## Review of the Past Research in Food Legumes in the Beqa'a Valley and Future Projections.

M.C. Saxena, Farouk A. Elsayed, Willie Erskine and K.B. Singh  
*Food Legume Improvement Program, ICARDA, P.O. Box 5466, Aleppo, Syria.*

Faba beans, lentils and chickpeas are amongst the most important food legumes in Lebanon. They serve as a major source of dietary proteins, particularly for the lower income group of the population. The crop improvement research in these legumes has been primarily carried out by the Agricultural Research Institute (ARI) and the American University of Beirut (AUB) with collaborative inputs from several international organisations including, in the past, the Arid lands Agricultural Development (ALAD) program. Since its establishment in 1977, ICARDA has played an increasing role not only in sustaining the research thrust developed during the ALAD period, but also in expanding and diversifying it. Food legume research is being carried out by ICARDA in the Beqa'a valley, at the Terbol and Kfardan stations, which represent two different but major agro-ecological regions typical of the legume production areas in Lebanon.

The aim of the Food Legume Improvement Program is to obtain a consistent increase in production per unit area and in economic returns through the introduction of improved genotypes and management techniques. Specific constraints to current production are seen as the lack of yield potential in existing land races, their susceptibility to common diseases and pests, competition from weeds and the increasingly uneconomic method of harvesting by hand.

The major faba bean breeding objectives are to develop high and stable yielding genotypes which also combine resistance to major diseases and pests such as *Ascochyta*, *Botrytis*, stem borer (*Lixus* spp.), aphids and *Orobanche* and have acceptable seed quality. Considerable progress has been made to date. Studies on the response of faba beans to dates of planting have revealed that timely planting is very crucial for obtaining high yields. Planting before the onset of a severe winter has consistently shown increased yields. Studies on starter nitrogen dressing, phosphate and potash fertilization and seed inoculation with *Rhizobium* at Terbol have shown no advantage from any of these treatments. Effective control of weeds in faba bean fields was obtained with pre-emergence application of methabenzthiazuron (Tribunil) at 2.5 kg a.i./ha. Volunteer cereals were controlled by applying pronamide at 0.5 kg a.i./ha.

For lentils, specific constraints to production are the lack of high yield potential in existing land races, damage to nodules by *Sitona* weevils, competition from weeds and the high cost of hand harvesting. The aim of the lentil breeding program is to produce cultivars with an improved yield potential and stability, together with acceptable seed quality and characters which facilitate a mechanical harvest. Clear progress is being made in increasing yield in the small seeded group, while some selections of the *macrosperma* types at both Terbol and Kfardan have shown great promise. Date of planting is one of the major management factors affecting the performance of lentils in the Beqa'a. Data for two seasons from Terbol and one season from Kfardan show that early planting in November to early December gives heaviest yields of grain as well high total shoot phyto-mass. In view of the importance of mechanisation of harvesting and threshing of lentils, a study was made at Tel Hadya, Syria, in co-operation with the American University of Beirut. The results highlighted the potential of the bean blades in lentil harvesting and showed that tall, unlodged lentils could be successfully harvested by combine. The aim is to test these methods in Lebanon.

The chickpea improvement work in Lebanon aims at the development of high yielding and disease resistant cultivars with acceptable seed quality, and the development of associated technology for increasing the chickpea production. The chickpea varietal improvement work which started with ALAD Program has now been considerably expanded, and a large number of entries are being tested in advanced and preliminary yield trials. In the past two years many new lines have been developed through hybridisation - these newly synthesised lines are at various stages of testing. The Chickpea International Yield Trial has been conducted in Lebanon for the past three years. Considerable progress has now been made in developing chickpea cultivars suitable for winter sowing. Some of the major advantages of winter sowing over spring sowing are substantial increases in grain yield, the possibility of growing chickpeas in areas much drier than conventional chickpea growing areas, and less damage from insect pests and birds. Among the diseases affecting chickpeas, *Ascochyta* blight (*Ascochyta rabiei* Pass. Lab.) has been found to be the major problem, especially during the winter season. Sources of resistance to this disease are being utilised in a hybridisation program for the development of resistant cultivars. The results of cold tolerance screening at Terbol, which represents well the thermal regimes of large areas in the 'lowland' zone, are very interesting. They reveal that the cold conditions of winter months in this zone can be tolerated by the majority of accessions, and therefore that the cold conditions of the region are no barrier to the introduction of chickpeas as a winter planted crop.

As part of its international testing program, the Food Legume Improvement Program has been furnishing a set of nurseries and trials on different food legumes to the co-operators from the Lebanese national program. It is hoped that this program will expand further and the material generated by national programs in Lebanon will also be entered in some of these nurseries.

Current efforts to develop superior genotypes and breeding stocks with stable yield and a reasonable level of adaptability across environments, resistance to common diseases and pests will continue at Terbol for all three crops, and at Kfardan for lentils and chickpeas. An increased participation of national scientists in these activities is envisaged. Superior performing genotypes will be included in the regional yield trials which will be evaluated in different food legume regions of Lebanon through the co-operative work of the national program.

Special emphasis in the future will be placed on identifying sources of resistance in faba bean to stem borer (*Lixus* spp.) and incorporating these in a superior agronomic background. Lentil improvement work will emphasise the development of superior genotypes with a growth habit permitting mechanised harvesting, incorporating resistance to *Sitona* weevil, and tolerance to drought late in the season. The introduction of winter chickpeas could open new vistas in chickpea production in Lebanon. If the area of the crop expands, as a result of the introduction of winter chickpeas, Lebanon could become an exporter of the crop.

The on-farm trials program will expand to cover the following:

- on-farm trials of superior genotypes and agronomic practices in lentils, winter chickpeas and faba beans
- on-farm trials of superior harvesting methods for lentils and chickpeas.

Studies will also be carried out on the economic importance of *Sitona* spp. in lentils, and *Lixus* spp. in faba beans, and on screening methods for detecting the genetic differences to insect damage.

To develop genotypes for higher elevations, there is a need for the evaluation of faba bean, lentil and chickpea genotypes under more severe winter conditions. An exploration of the possibility of using high elevation sites in Lebanon for this purpose, in collaboration with the Lebanese national scientists, is required.

There is also a need to evaluate the significance of food legumes in the cropping systems in different agro-ecological regions in Lebanon.

## Some Research Aspects of Chickpeas, Lentils and Faba Beans in Lebanon: A Review.

Mahmoud M.B. Solh

*Faculty of Agricultural and Food Sciences, American University of Beirut, Beirut, Lebanon.*

The food legumes commonly consumed in Lebanon are chickpeas (*Cicer arietinum* L.), faba beans (*Vicia faba*), lentils (*Lens culinaris*), peas (*Pisum sativum*) and common beans (*Phaseolus vulgaris*). The first three are the most important both in Lebanon and in the region. Current production levels of these three crops do not, however, satisfy the domestic demand in Lebanon. This is mainly due to their low productivity and the inefficient traditional technologies practiced in their production. Such operations are labour intensive. The combined effects of high labour costs and low yields have made food legume crops, in particular lentils and chickpeas, unprofitable for the Lebanese farmer. Future research efforts should, therefore, consider these facts and in particular the current production problems facing farmers growing these crops. Planners of future research should be aware of the research work that has already been done on various aspects of these crops, namely *breeding, agronomy, pests and seed quality*. All research work cited here was carried out in the Faculty of Agricultural and Food Sciences of the American University of Beirut.

The planting of chickpeas in the Beqa'a valley is done in March and early April. Chickpeas are raised mostly on residual moisture as a spring crop. In seasons where *Ascochyta* blight disease is serious, Lebanese local cultivars planted as a winter crop will be wiped out easily. If the superiority of the winter chickpeas (ILC 482 and ILC 484) is verified on farmers' fields, these varieties will probably have a great impact on chickpea production in Lebanon.

Population density is a very important variable to consider for increasing yield per unit area of tall, erect chickpea cultivars in order to compensate for their generally low yield per plant. The interest in tall, erect cultivars is mainly due to their great potential for mechanised harvesting. However, the small seed size of these chickpea types should be increased before further studies continue.

Fertilizers are seldom applied by the farmers on any of the three crops (chickpeas, lentils and faba beans). Studies on fertilizer applications have not given conclusive recommendations for these crops. Further stu-



dies are needed to determine the response of these crops to fertilizer elements, particularly phosphorus.

Weekly, and to some extent biweekly, irrigation of spring chickpeas is uneconomical under the Beqa'a valley conditions. Farmers usually grow spring chickpeas as a rainfed crop; few farmers practice supplementary irrigation. Further studies are needed to identify critical periods in chickpea growth and development when supplementary irrigation would be economical under Beqa'a valley conditions.

Weeds in lentils, chickpeas and faba beans contribute both to low yields and high costs of production. Weed control when practiced is done by hand. Several herbicides are being evaluated in co-operation with ICARDA, some of which have proved promising under Beqa'a valley conditions. Research on *Orobanche* is also being done in co-operation with ICARDA. Effective herbicides for chickpeas, lentils and faba beans will have a great impact on the productivity of these crops in Lebanon.

The new trend in Lebanese agriculture is towards more intensive cropping. This is partly due to the increase in the irrigated land area by more than 25 per cent since 1970. Several patterns of multiple cropping are being practiced, the most common being double cropping whereby two crops are grown successively in one year. Lentils and green faba bean crops are short season winter crops and are ideal for double cropping if early cultivars are available.

Further agronomic studies should be continued on population density, fertilization and inoculation, the economics of supplementary irrigation, weed control and multiple cropping. Studies on mechanical harvesting and threshing, tillage practices, seed production, seed technology and seed storage should be initiated.

Breeding work has so far concentrated on evaluating introductions and screening germplasm for stress conditions. Incorporation of *Ascochyta* blight disease resistance into a Lebanese local cultivar was started last year and F<sub>2</sub> populations will be screened for resistance this season. Recent introductions have included ICARDA's international screening nurseries and yield trials of the three crops. A wide range of variability for various characters exists in this material. Breeding objectives in the three legume crops should aim at developing high yielding cultivars to fit different agro-climatic conditions and various cropping patterns adopted in Lebanon. These cultivars should be mechanically harvestable and be resistant

or tolerant to the prevailing serious pests, including diseases, insects and parasitic weeds.

Pests contribute greatly to serious yield losses in faba beans, chickpeas and lentils. Research efforts on pests of food legumes have concentrated on general survey work, seed health testing and isolation and identification of certain causal organisms. Seed transmission of plant disease is of great economic importance because it introduces diseases into new areas. In addition, infected seeds will serve as a source of infestation throughout the crop stand and may result in serious crop losses. Seed certification programs for these legume crops should be introduced. In addition, there is a need to establish a port entry quarantine service, based on modern seed health testing techniques, for all imported seeds intended for planting. Seed treatment must be carried out before planting to minimise yield losses due to disease pests carried on the seed. The identification of causal organisms and the means of transmission is an important aspect of pest control. Also the evaluation of the economic importance of pests is essential in identifying research priorities in pest control.

Research work on the quality and utilisation aspects of lentils, chickpeas and faba beans has emphasised the value of these crops as protein supplements in various food preparations, as well as their cooking quality, particularly in the case of lentils.

Research work on the role of lentils, chickpeas and faba beans in the farming systems of Lebanon is so far deficient. There is an urgent need for a thorough and comprehensive survey to fully understand this role. Such a survey will sharpen research objectives and identify research priorities. Some of the research work reviewed in agronomy, breeding, pests and seed quality is insufficient so far, and follow-up work is needed. Some promising results need to be confirmed in on-farm field verification trials before recommendations can be made to the farmers. Increasing the productivity of lentils, chickpeas and faba beans can be achieved in the near future through agronomic work and pest management. Breeding work, particularly on drought tolerance in the three crops and on winter planting of chickpeas, will have a great impact on crop productivity.

## PASTURE AND FORAGE IMPROVEMENT IN LEBANON

Pasture and Fodder Development on Irrigated and Rainfed lands in Lebanon (1967-74).

Ghattas B. Akl

*Head of the Forage and Animal Development Department, Animal Production Office, Beirut, Lebanon.*

Lebanon covers an area of 10,400 km<sup>2</sup> of which 86 per cent is grazed by livestock for some period of the year. Eighty-one per cent of the land grazed supports natural vegetation, and 19 per cent is cultivated land. Rangelands are in a poor condition due to decades of overgrazing and improper management practices. The area under forage production is small and produces only a fraction of the total needs of the livestock population. The low productivity of natural ranges and the scarcity of lands under forage production have forced the country to import most of its animal feeds at high prices. As a result, milk, milk products and the meat industry have been badly hit by the rising feed costs.

The Lebanese Government has in recent years shown a great interest in promoting a policy aimed at the rapid development of the milk and meat industries. The basic part of this policy is to increase fodder production from irrigated and rainfed lands and to improve the deteriorated natural rangelands.

The Office of Animal Production, the Ministry of Agriculture, which was established in 1967, is the government agency responsible for pasture and fodder development in the country. In 1970-74 FAO and UNDP gave support through one of its projects, and a second FAO project has recently been centred at the same office to help in strengthening the milk and meat industries in the country.

This work has had the following objectives:

1. to conduct experimental trials for the selection of suitable high-yielding pasture and forage crops on both irrigated and rainfed lands in Lebanon under different climatic conditions.
2. to establish suitable grass-legume pasture mixtures for rotational grazing on irrigated lands.
3. to find out the best agricultural practices that could maximise yields from lands under forage cultivation.
4. to identify the most suitable crop rotations which include forage for the different regions of the country.

The following are the introduced forage crops which are now spreading in the four provinces of the country:

1. Pasture mixture of tetraploid Italian ryegrass and red clover. This high yielding pasture proved to be very efficient in feeding sheep and dairy cows in the Beqa'a province. It constitutes the tetraploid Italian ryegrass (*Lolium multiflorum* Lam.) and red clover (*Trifolium pratense* L.) seeded in a mixture at rates of 20 and 15 kg/ha respectively.

2. Alfalfa El Unico (*Medicago sativa* L.).

This variety was introduced into Lebanon in 1969 and is now expanding on a total area of about 300 ha/year in the Beqa'a province and in south Lebanon. If properly managed and fertilized, it produces a yield of 20-25 tons DM/ha/year and hence is superior to Hairy Peruvian and Provence which were previously grown for many years in this country.

3. Berseem Multicut (*Trifolium alexandrinum* L.).

This clover was first introduced in Tripoli, north Lebanon, in 1969. It is an annual winter leguminous forage crop. It has been found to be effective in building up the poor soils of the newly reclaimed areas of south Lebanon.

4. Hybrid corns (*Zea mays* L.).

The high yielding corn varieties which have been tested and recommended are: Pioneer 368 A, United 600, Acacia and Jaquoana. These varieties are mainly used for silage production.

5. Bird-resistant hybrid grain sorghums (*Sorghum vulgare* Pers.).

6. Hybrid sorghum fodder (sorgo x Sudan grass).

Sweet Sioux 1 and Sweet Sioux 2 give high forage yields; they produce an abundance of leaves and sweet, tender and juicy stalks that are highly nutritious.

7. Yellow sweet clover (*Melilotus officinalis* Lam.) and Sulla (*Hedysarum coronarium* L.).

These two forage crops have proved to be tolerant to the high calcium carbonate concentrations of the soil of the Litani Dam Project area in south Lebanon. They are very useful as soil improvement crops, particularly on this poor type of soil which lacks organic matter.

**8. Japanese millet (*Echinochloa crusgalli* var. *frumentacea* Wight) and Foxtail millet (*Setaria italica* L. Beauv.).**

These millets were found to be very successfully adapted to the calcareous soils of the Litani Dam Project area.

Most of the work on rainfed lands was carried out in the Hermel area in north Lebanon, where transhumant people rely primarily on animal husbandry activities as a basis for their existence. The Government of Lebanon in 1971 allocated \$20 million to carry out a seven-year comprehensive development plan for the semi-arid area of Casa. The forage crops used in this project are:

1. Woolpod vetch (*Vicia dasycarpa* L.).
2. Hairy vetch (*Vicia villosa* L.).
3. Common vetch (*Vicia sativa* L.).
4. Black-eyed Susan fodder peas (*Pisum arvense* L.).
5. Barley Tel Amara 25 (*Hordeum vulgare* var. *distichon* L.).
6. Barley Beecher (*Hordeum vulgare* var. *hexastichon* L.).
7. Tarteos oats (*Avena sativa* L.).
8. Tall wheatgrass (*Agropyron elongatum* L.).
9. Crested wheatgrass (*Agropyron cristatum* L.).

Work on pasture and fodder development in Lebanon since 1967 has resulted in the identification of some high yielding varieties suited for irrigated and rainfed lands. On the calcareous soils of the Litani Irrigation Project in south Lebanon, these forage crops have shown remarkable adaptation to this poor type of soil. Under the semi-arid conditions of the Hermel area in north Lebanon, several high yielding rainfed forage crops have been successfully grown.

**Germplasm evaluation and varietal development of alfalfa and ryegrass for dryland areas in Lebanon.**

George Ma'alouf

*Extension Department, Ministry of Agriculture, Beirut, Lebanon.*

The present situation of rangeland in Lebanon can be described as heavily overstocked (fiercely grazed), mismanaged, continuously eroded, and dominated by thorny and unpalatable species. It is astonishing to observe sheep put on to land with little and sometimes nothing to graze.

Marginal lands can be improved if the genetic potential built by natural selection over a long period of time can be used by further selection to produce adapted and improved varieties.

The eroded and barren mountain slopes of both the western and eastern ranges in Lebanon and the large area of unused agricultural land (approximately 170,000 ha) are valuable land resources that can be used to increase animal production and, indirectly, the national income and the earnings of individual poor farmers. Ecological changes in the future brought about by the revegetation of marginal areas will also improve the environment. For these reasons, the Lebanese Government, represented by the National Council for Scientific Research (NCSR), ICARDA, represented by the Pasture and Forage Improvement Program, and the Welsh Plant Breeding Station, represented by its General Director, have co-operated to initiate a grass and legumes breeding project. This project began in August, 1979 with the aim of developing improved and adapted varieties through selection and breeding of indigenous ecotypes of alfalfa and grasses collected in Lebanon.

The research work was initiated by making collections of indigenous material from different locations ranging from the temperate region of Mount Lebanon to the semi-continental region in the Beqa'a. Ninety ecotypes of alfalfa (*Medicago sativa*) and 83 ecotypes of ryegrass (*Lolium perenne*) were collected from forest areas, river and canal banks and roadsides. Seeds of these plants were studied and seedlings evaluated for tillering and leafiness to determine the existing variation during the establishment period. Subsequent field studies of these plants in 1980 consisted of assessing their variation in:

- tillering
- leafiness
- plant dimensions (height and spread)
- growth habit (erect for hay, prostrate for pastures)
- leaf dimensions in ryegrass, and tillering characteristics in alfalfa
- drought resistance
- summer dormancy
- digestibility
- seed yield in alfalfa, and a count of headed plants in ryegrass
- summer and autumn forage dry matter yield in lucerne and ryegrass.

In 1981, winter and summer forage dry matter yields were measured in ryegrass, and in the summer the dry matter yield in alfalfa was determined. Flowering date and persistence were studied in a second phase to select for both elite early flowering ecotypes, and elite late flowering pasture ecotypes that are prostrate in growth habit.

A high variability for many agronomic characters has been found in ecotypes of both species. These differences form the basis for the current screening of elite genotypes. Field observations and preliminary results indicate that there is enormous potential in this material, and that opportunities exist for the development of adapted and highly productive varieties for different areas in Lebanon.

The elite plants selected will be divided into two groups. One group will be used for the development of varieties by mass selection procedure, and the other group will be utilised for varietal development utilising poly-cross technique.

### **The relevance of ICARDA's forage research to pasture and forage development in Lebanon.**

B.H. Somaroo

*Pasture and Forage Improvement Program, ICARDA, P.O.Box 5466, Aleppo, Syria.*

An effective integrative land use system which promotes production of both food crops and livestock can maximise productivity per unit area and stabilise and improve the environment. Integration of livestock and crop production can be achieved by selection and by developing a range of multi-purpose forage species for different climatic ecozones and encourage pasture and fodder production on both cropping areas and on marginal lands.

The Pasture and Forage Improvement Program was established as one of the principal thrusts of ICARDA's strategy to improve animal production and promote a rational and effective land use system. The Program is firmly committed to improving the overall levels of seed production and utilisation efficiency throughout the region. The strategies which have been conceived and planned for this program seek to stimulate real and sustained increases in animal production by exploiting and developing feed resources that are available from:

- fallow areas in arable farming systems
- natural grazing lands
- irrigated areas
- other sources (agricultural by-products such as crop residues, stubble, sugar beet pulp).

Emphasis in ICARDA's work is placed on developing complementary systems which can be integrated so that sufficient high quality feeds are avail-

able the whole year round. Scarcity of arable lands and the small farm units underline the need for complementary livestock feed production systems.

Considerable potential for expanding forage production on fallow lands exists in the ICARDA region. This potential can be realised by the introduction of suitable and productive rotation systems which eliminate the fallow phase in the current cropping system.

The characteristic mountainous topography and the dominance of arid and semi-arid conditions throughout the Near East and North African countries mean that substantial areas cannot support regular cropping. Much of this area, however, can seasonally support appreciable amounts of natural vegetation, and thus serve as valuable natural pasture for large numbers of animal flocks and herds. The natural grazing areas include:

- unutilised potentially cultivable land near the main urban areas and towns.
- marginal lands; hilly areas with slopes that are rocky and have shallow soils, and foothill areas that cannot be profitably cropped.
- the Steppe areas, which receive less than 200 mm of rainfall.

Although high priority is placed on the development of forage production systems for rainfed conditions, forage production under irrigation is important in many countries of the region. The Program has initiated research on a very limited basis on this aspect of forage production.

Another Program strategy concerns agricultural by-products. The Program has established adequate quality testing facilities for both *in vitro* and *in vivo* quality assessments of the nutritional value of agro-industrial by-products, and is developing appropriate technology for supplementary feeding and feedlot finishing of livestock. Finishing lambs in feedlots would stimulate the culling of sheep on the rangeland, relieve grazing pressure, enhance rangeland stabilisation and stimulate forage production in the cropping zones.

Important research activities include:

1. the establishment of a broad and comprehensive collection of forage plant germplasm from a wide range of locations.
2. the development of improved forage varieties suited to high levels of production in the various agroclimatic zones of the region.
3. the development of suitable and efficient techniques for the pro-



duction, conservation and utilisation of forage crops, the establishment and effective management of pastures, and the rehabilitation of marginal lands.

4. collaboration with other research efforts in the development of livestock production systems which can be effectively integrated with current and improved systems of crop production.

In addition, the Program is supported and strengthened by the research efforts of other scientists who investigate

- forage plant-Rhizobia relationships.
- soil-plant-animal interrelationships with stocking rates and grazing methods.
- the effects of herbicides on weed control and the consequent effect on seed viability, hardseededness and pasture regeneration.

With the implementation of the strategy outlined above and the development of research activities, the question is how relevant are the Program's goals to the enhancement of collaborative research on crop production in Lebanon?

As a result of past and on-going research work, the Pasture and Forage Improvement Program at ICARDA has tangible commodities to offer. These commodities are germplasm materials, selected lines of adapted forage species and, in the very near future, developed cultivars of forage species. These materials can play a vital role in the revegetation and rehabilitation of marginal lands and in the development of forage production systems suitable for specific situations.

In addition, collaborative and participative research can be fostered and strengthened by the capability at ICARDA to

- diagnose a situation in which pasture and/or forage crops should be encouraged or deemed to have a role.
- monitor and evaluate pasture and forage development programs, specifically in relation to the effectiveness of the technology being used.
- identify constraints and potential and to design appropriate research and advise on education matters in relation to pasture and forage improvement.

The Pasture and Forage Improvement Program at ICARDA can make a contribution to the development of the national forage production efforts, and is prepared to assist in the implementation of participative and collaborative research projects.

## Some agricultural training and communications activities in Lebanon.

Habib Ibrahim

*Food Legume Training Officer, Training and Communications Program, ICARDA, P.O.Box 5466, Aleppo, Syria.*

Agricultural training and communications activities have taken place in Lebanon for many years. This has led to a fair build-up of manpower in this country, as well as in many countries elsewhere in West Asia and North Africa. However, for many reasons a gap has developed in the availability of trained research workers at all levels. It is high time that an effort be launched to fill this gap if Lebanese agricultural research is to be resumed at full speed.

Many institutions can offer training in these areas. These include:

- the Faculty of Agriculture at the American University of Beirut (AUB)
- the Faculty of Agriculture at the Lebanese University
- the Faculty of Agriculture at the Jesuit University, Beqa'a
- ICARDA

This presentation will deal in greater detail with AUB and ICARDA, as both are already extensively involved in training.

An extensive M.Sc. training program is offered at the Faculty of Agriculture, AUB. This lasts for 1-2 years, and degrees are offered in:

- soils, irrigation and mechanisation
- crop science; pathology, agronomy, breeding, weed control, entomology, crop production, horticulture
- food science; food processing, nutrition
- agricultural economics and extension
- animal science; sheep, poultry, cattle

There are also short training courses of 2-4 weeks duration. The training in these course is intensive and specialised e.g. crop protection, breeding methodology etc. Some of these courses are held in collaboration with other institutions. AUB also offers training to research workers for longer periods which can extend to a full semester (3-4 months).

At ICARDA three residential training courses are held in Aleppo each year, lasting for a six-month period from February to July. These courses are offered in forage crop improvement and range management, cereal improvement and food legume improvement. Participants in these

courses receive general field oriented training (ca. 60 per cent) with a theoretical background (ca. 40 per cent). Research fellowships are also offered for periods varying from a few months to one year. These fellowships are intended for young scientists who join ICARDA's team of scientists and conduct collaborative research.

For higher degree training at ICARDA, students usually register at a university, and conduct their thesis work at one of ICARDA's research stations. This, in conjunction with the course work done at the university, can lead to an M.Sc. or Ph.D. degree from the university concerned. This training requires supervision from both institutions. Short training courses are also held at ICARDA. These last for 2-3 weeks, and cover specialised subject matter, such as seed production, germplasm etc.. These are carried out at the Terbol research station or in Aleppo.

Training activities in the future must be planned in order to meet the needs of the research and extension programs in Lebanon. There is a need to co-ordinate training activities at the national as well as the international level.

Much research has been conducted and reported in Lebanon. Reports on research progress are likely to be available at documentation centers in the country. At ICARDA a documentation effort is being launched for the crops and disciplines for which ICARDA has a mandate. There is a need to co-ordinate and link information activities in Lebanon with those at ICARDA, with the aim of linking Lebanese scientists and extension workers with their colleagues at ICARDA and elsewhere in the West Asia and North Africa region. In addition, many workshops and conferences are held in Aleppo and Lebanon. Let us hope that this conference witnesses the start of increased joint co-operation in such meetings.

## ORGANISATION OF SUB-GROUP DISCUSSIONS

Sub-group discussions on seven different subject areas were held in order to recommend to the full Conference concise lists of proposed future collaborative projects.

The seven different subject areas were as follows:

- Farming Systems Research
- On-farm Trials
- Seed Production
- Forage Crops Research
- Cereal Crops Research
- Food Legume Crops Research
- Training and Communications

Each Sub-group Discussion was chaired by one of the Conference participants. Another participant in each Sub-group acted as Secretary to record the collaborative research projects proposed. The Chairmen of the Sub-groups then presented these proposals to the full Conference on the final morning of the Conference.

Sub-groups were requested to indicate the collaborating institutions for each proposed project.

The projects proposed in this way were then discussed by the Conference during its final session. The Conference was thus able to endorse and recommend the research projects and other collaborative work programs listed in full in the following section.

## RECOMMENDATIONS

The following recommendations were accepted by the Conference in its Closing Session:

### Germplasm

Every effort should be made to construct a Genetic Resources Laboratory (Germplasm Bank) at Terbol under the umbrella of ICARDA. Funds should be obtained from traditional as well as new donors. ICARDA and the Lebanese authorities should collaborate generating up to 1 million dollars for that purpose.

### Farming Systems Research

Sub-group Chairman: Heinrich Weltzien

The following projects were identified in order of priority:

#### Project 1.

A survey of the socio-economic situation of Lebanese dryland farmers in the Beqa'a valley. This survey should be representative of rainfed agriculture and may later be extended to other parts of Lebanon. It should cover all crops, livestock and other income sources and should consider agricultural inputs including mechanisation.

All organisations present, including MOA, ARI, CDF, NCSR, AUB, ECWA and ICARDA, expressed interest in such work. The potential contributions to this project from the Department of Statistics and Surveys in the MOA and the CDF are especially mentioned. It was recommended that a committee of representatives from several of these institutions meet to develop a research proposal for such a survey.

#### Project 2.

Experimental work on the constraints identified in Project 1.

The Sub-group agreed that research on soil fertility and moisture use in dryland cropping systems would be most valuable. Such research should determine the yield potential and produce basic data for economic analysis. Determination of the reasons for the yield gap existing between experimental plots and farmers' fields should be one of the ultimate objectives.

## **On-Farm Trials**

Sub-group Chairman: David Nygaard

It was agreed that it is necessary to start planning an On-farm Trial program that should begin with the 1982 planting season. In the first phase, it should be dedicated to the verification of the data, such as improved materials and practices, that have been obtained on experimental stations.

A committee should be formed that includes representatives of ICARDA and co-operating Lebanese institutes, including ARI, Co-operatives, NCSR, CSO, AUB, MOA. The role of this committee will be to:

- develop appropriate programs of work
- find the necessary finances
- supervise and follow the implementation of the work

## **Seed Production**

Sub-group Chairman: Michel Abi Antoun

As seed production is an integral part of future crop improvement in Lebanon its development should be given top priority. There is a need for substantial improvement to, and expansion in, the current seed production in Lebanon. The following areas are deficient:

- personnel
- seed laws
- the certification agency responsible for
  - i. a seed laboratory
  - ii. seed certification
  - iii. seed processing

A committee should be formed to review the current status of seed production activities as listed above, and to suggest ways and means of implementation.

## **Forage Crop Research**

Sub-group Chairman: Fawak T. Sleiman

The following Projects were recommended:

**Project 1. Germplasm acquisition, appraisal and variety development.**  
**Objective:** to select and develop the most appropriate forage species suited for marginal land development in Lebanon.

**Phases:**

1. Collection of germplasm in Lebanon during the appropriate growing phase.
2. Evaluation of collected germplasm at selected sites.
3. Seed multiplication of promising material.
4. Seed health testing of selected lines.
5. Testing of selected lines on marginal land.

**Duration:** Initially, three years.

**Co-operating Institutions:** NCSR, ICARDA and AUB.

**Project 2. Marginal land rehabilitation.**

**Objective:** to conserve and improve productivity of under-exploited marginal land.

**Phases:**

1. Identifying the location and areas of these lands.
2. Investigating the prevalent climatic conditions.
3. Planting the selected land with certified forage seed, preferably from Project 1.
4. Identifying the most appropriate agronomic practices involved such as fertilization, inoculation, disease and weed control etc.
5. Evaluating the feeding value of the forage.
6. Exploring the most appropriate means of harvesting and preserving the feed if not grazed.

**Duration:** A minimum of three years.

**Cooperating Institutions:** ICARDA, APO, MOA, AUB, NCSR and ECWA.

**Project 3. Utilisation of agricultural by-products**

**Objectives:** By the use of livestock, convert non-edible agricultural by-products into human foods, thereby reducing environmental pollution and reducing feed costs.

**Phases:**

1. Conducting a survey and identifying the available by-products.
2. Determining the nutrient composition of the selected by-products.
3. Determining the acceptability level and the efficiency of utilisation by animals.
4. Recommending the most appropriate rations and feed combinations using least cost programs.

**Duration:** Two to three years.

**Co-operating Institutions:** ICARDA, APO, NCSR, AUB.

## Food Legume Crops Research

Sub-group Chairman: Mahmoud Solh

### Project 1. Crop management

- 1.1 Mechanisation of harvest of lentils, chickpeas and faba beans (dry seeds).

Co-operating Institutions: ARI, AUB, ICARDA

- 1.2 Control of weeds in lentils, chickpeas and faba beans by mechanical and chemical means.

Co-operating Institutions: ARI, AUB, ICARDA

- 1.3 Evaluation of fertilizer nutrient responses on farmers' fields under different agro-ecological conditions based on integrated soil tests. This would include evaluation of response to Rhizobial inoculation and involve a study of the interaction between *Sitona* weevil control and N fertilization.

Co-operating Institutions: ARI, AUB, ICARDA

- 1.4 Study of the economics and productivity of multiple cropping systems incorporating faba beans, lentils and winter chickpeas under different moisture supply situations.

Co-operating Institutions: AUB, ARI

### Project 2. Breeding

- 2.1 Multilocation testing of elite lines under different agro-climatic zones with a view to identifying cultivars for on-farm trials and identifying cultivars for on-farm trials and ultimate release to the farming community.

Co-operating Institutions: ARI, ICARDA

- 2.2. Development of a screening technique for drought tolerance and identification of drought tolerant germplasm sources of lentils and chickpeas and their utilisation in the breeding program.

Co-operating Institutions: ARI, ICARDA

- 2.3 Development of screening techniques and identification of sources of resistance to *Lixus* spp. in faba beans and *Sitona* spp. in lentils.

Co-operating Institutions: AUB, ICARDA

- 2.4 Breeding lentils and chickpeas with tall and erect growth habit facilitating mechanised harvest.

Co-operating Institutions: ARI, AUB, ICARDA



### Project 3. Plant Protection

- 3.1 Etiology race identification and seed health testing for
- faba beans: *Ascochyta*, *Botrytis*, rust, *Fusarium* and root rot complex and viruses
  - chickpeas: *Ascochyta* blight and wilt and root rot complex.
  - lentils: root rot/wilt complex.
- Cooperating Institution: AUB
- 3.2 Biology and prevalence of insect pests and development of economic control.
- faba bean: *Lixus* spp.
  - lentils: *Sitona* spp.
  - chickpeas: *Heliothis* spp.
- Cooperating Institution: AUB
- 3.3 Development of economic control measures for *Orobanche* spp. in faba beans
- Co-operating Institutions: AUB, ICARDA
- 3.4 Survey of diseases and insect pests to identify major diseases and insect pests of economic importance.
- Co-operating Institution: AUB

### Project 4. On-farm Trials

- 4.1 Field verification trials:
- winter vs. spring chickpeas
  - elite lentil lines
- Co-operating Institutions: ARI, AUB, ICARDA
- 4.2 On-farm evaluation of mechanical harvesting of lentils and chickpeas.
- Co-operating Institutions: ARI, AUB, ICARDA

### Project 5. Food legume quality.

- Development of screening techniques for:
- cooking quality in faba beans lentils and chickpeas
  - decortication quality in faba beans and chickpeas
  - anti-nutritional factors in faba beans
- Co-operating Institution: AUB

Source of funds: The projects listed above will require special funding for operational costs and manpower. The NCSR expressed interest in all these projects.

## Cereal Research

Sub-group Chairman: J.P. Srivastava

The following projects are recommended as being the most urgent priorities. However, the sub-group recognises that these projects cannot be adequately fulfilled unless manpower and resources are made available.

**Project 1.** Development of varieties of barley, durum wheat, breadwheat, triticale and agronomic practices for rained and irrigated conditions.

Some work is already underway at both ICARDA and ARI on varietal improvement. Additional research staff are required for further emphasis on dryland research. For the agronomic component, current staff at AUB are inadequate, and it is recommended that one senior scientist and two support staff are needed. Additional field machinery, research supplies, transportation and operating expenses are also needed.

Co-operating institutions: varietal improvement: ICARDA, ARI, (NCSR/FAO)

agronomy: AUB, ICARDA, ARI

**Project 2.** Screening for important cereal diseases and development of genetic stocks with different sources of resistance genes and with multiple disease resistance. Identification of source of resistance to stem sawfly and their incorporation in breeding material.

Research support staff are required, as are improved greenhouse and laboratory facilities, research supplies and operating expenses.

Co-operating Institutions: ICARDA, AUB, ARI

**Project 3.** Improvement of drought and cold tolerance in cereals.

Research support staff are required, as are a suitable high elevation site and associated facilities for cold tolerance screening, scientific equipment, field supplies and operating expenses.

**Project 4.** Testing of breadwheat, durum wheat, triticale and barley for different consumer uses in the region.

## Training and Communications

Sub-group Chairman: Rajah Tannous

- Training: The candidates for training activities were identified as
1. Farmers and field technicians. The objective is greater knowledge, awareness and skills in the handling of new, improved recommended techniques.
  2. Research workers.  
Two types of training are envisaged:
    - high level degrees (M.Sc./Ph.D.). The aim is to train these candidates in the skills of planning, conducting and analysing research.
    - on-the-job training.  
The aim is to improve research performance, for technicians, scientists (with B.Sc., M.Sc. or Ph.D.) and research administrators.

Thesis research projects should be identified, wherever possible, as integral components of research projects recommended by the different discussion groups. Such training should be a collaborative effort between AUB, ICARDA and ARI, aimed at the build up of trained manpower and adding to the capacity for research. Two students should be registered for the first year and two for the second year of two year training periods, allowing for four students at any given time.

The collaborating institutions must keep each other informed of details of training activities so that co-ordination of activities could be worked out. This will help clarification of logistics and financial arrangements.

The following areas are identified from which the ARI can state training requirements:

- M.Sc. programs
- Short training courses
- Individual training programs

It is recommended that AUB, ICARDA and ARI nominate one representative each who will meet together and work out details of training nominations and logistics for collaborative research projects and taking into consideration financial resources available.

### **Communications**

Field days should be held periodically at Terbol, AUB Tel Amara research stations, to include on-farm trials.

Workshops, informal seminars and exchange of visitors should be arranged periodically, initially three times a year, and to include all institutions collaborating on the research projects.

Scientific staff in the different institutions should have free access to information held by each others documentation units. Information specialists at the different institutions should create awareness of the services available at the respective institutions. There should be a project to collect information material available in Lebanon on the areas of collaborative research identified by this Conference.

This information should be processed and made available to scientists in the different institutions.

## CLOSING SESSION

The Conference agreed that, in order to ensure the implementation of the above Recommendations and the projects proposed therein, a Conference 'Follow-up' Committee should be formed, to include representatives of the following three bodies :-

The Agricultural Research Institute  
The American University of Beirut, and  
The National Council for Scientific Research

It was also agreed that this Committee be convened by the Agricultural Research Institute, and that nominations for membership of this Committee should be sent to Dr. Joseph Haraoui (ARI) not later than the first week of January, 1982, and that the Committee should meet not later than the second week of January.

## CLOSING STATEMENT

Dr. Mohamed Nour  
*Director - General, ICARDA*

Ladies and Gentlemen:

My intervention is going to be brief, simply because most of the important and valuable material has already been covered. I will just try to bring a few points to the forefront.

The first point on which great consensus has been shown is that there has been a great deal of hard work put into this Conference. I would like to congratulate members of this Conference for their dedication and devotion. In my judgement it was well worthwhile. It has been a magnificent conference. This is an expression I have heard from various people at various levels. I have heard it from the Minister downwards. Though he did not attend all the sessions, nevertheless he had the feeling that we were on the right track from the start, and he wants to express his gratitude to each and every one of you for the time you have devoted to this important exercise. I would like to extend this expression of thanks on behalf of the Minister, to include my thanks on behalf of ICARDA. ICARDA has been the initiator of this idea, and we have found immediate responses from all the various parties concerned - in fact we have not only had a positive response from those we have invited; but also we have had urgent requests from those we have inadvertently not invited. And this in itself is

an indication of the keenness that has been generated by the very idea that we wanted to hold such a Conference. The Conference has evidently been timely. It was needed and will hopefully produce results. I would like to congratulate the organisers of this Conference who have worked behind the scenes and have put a great deal of thought into the occasion - many of them outside ICARDA, and some of them inside ICARDA. They deserve our thanks, for without their contribution we would not have had those positive results.

My second point - again a point of substance - is that I am very happy indeed to see that a co-ordinative mechanism has already been established through the formation of your 'follow-up' committee, the 'national' committee, which has the support of ICARDA. We from ICARDA will do our best to contribute in realistic terms to the success of the research projects that will emerge. We wish them well. I may appear as if I am throwing the ball back onto the 'national' court, but this is naturally necessary in order to keep the ball-game going. It is the National Program that we, ICARDA, are here to stimulate and support; but we are certainly not here to lead.

On the part of the international institutions, and I think I can talk on their behalf as well as ICARDA, we are sincerely glad to have had the experience of this gathering and we will sincerely continue to support national programs in general through our participation and through our mandates.

On ICARDA's part, we have a principal research station in Lebanon, and we have a moral responsibility to do research work in Lebanon for the sake of Lebanon, as well as for the sake of the region with the accompanying global implications.

My third point, Mr. Chairman, is the time scale. Some Sub-groups have indicated a time scale of three to four years for the research projects they have proposed; some two to three years; and some Sub-groups did not indicate a time scale at all. I assume that your 'follow-up' committee will look into the time scale of the proposed projects as well as their priorities. I hope your committee will give due justice to the important work that has been put into granting priorities to the proposed projects. They all reflect to me a very mature approach, a very realistic approach, and I sincerely hope that donors and institutions that will support these projects will realise that these have not been thought out in a shallow way, in an immature way or in casual way. The time scale is important, the

priorities are important. The realism inherent in the projects should be borne in mind. And I think that the Committee should take these recommendations very seriously, and press on towards their implementation. There is no doubt about it that the work that has been put in here richly deserves it.

My fourth point is that those that have participated in this meeting, but who may not be members of the Committee or who may not be instrumental in policy decisions, should be encouraged to realise that their contributions here were not only extremely valuable but also that they should be sustained. Their contributions should be borne in mind; they are members of this community of agricultural researchers and they have every right to keep communicating with the Agricultural Research Institute and with the conference follow-up committee to find out how far their proposed projects have been implemented. In other words one would like to feel that the consensus that has been generated here does not get lost out of sight and that conferences of this nature should be held from time to time. However, I do urge that a meeting of this nature is an important landmark, and since we have made a beginning I would like to put before you the proposal that future conferences of this nature, as well as the workshops and seminars that have been suggested, are needed, but that they should be timed in such a way as not to be repetitive nor to appear that we are holding a conference for a conference's sake; but that we have a conference in order to a) evaluate the ground that has been covered, and b) to look into new grounds and new propositions.

My fifth point is that there is one small gap in the Conference which I ought to try to fill. This is not a gap due to any omission but simply due to the fact that there has been no spokesman for the subject concerned, which is the Germplasm Unit which we hope will be created in Lebanon. This is an important factor which ICARDA has been working on, and ICARDA, the Agricultural Research Institute and the National Council for Scientific Research, all are interested in the development of such a unit in Lebanon, to serve Lebanon, to serve the region and to be a global gene-bank. I am bringing this issue to your attention now, so that this Conference doesn't feel that the 'follow-up' committee will have transgressed the totality of the Conference recommendations if this matter is included in future recommendations. Unless I hear any strong objections, I will take it that this Conference also endorses the possibility of pursuing this exercise. (Agreed)

These are the main points from my notes on what has taken place here. I would like to point out to the Conference that there are certain formalities which we need to complete. One of these is to send a message to His Excellency the President Mr. Elias Sarkis from the Conference, thanking him for his patronage. I have prepared such a message, which will be sent in Arabic. I have already shown this to a random sample of people in this room representing national institutions and other bodies. The spirit of the message is to thank him, to inform him of the representation at this Conference, of the serious manner in which it has conducted itself, of its hopes that its results will be effectively implemented, and that his patronage will continue to support agricultural research and development. I would like to have the agreement of the Conference that this telegram should be sent. (Agreed)

Another message will be sent to His Excellency the Minister of Agriculture, Dr. Moustafa Dernaika to thank him for his attendance at the Conference and for his support. I would be grateful if the Conference could agree to my sending this message on behalf of the Conference. (Agreed)

This brings me to the end of my presentation. Thank you.

## CLOSING REMARKS

Dr. Tannous (AUB):

Excuse me, Dr. Nour, but I would not like to let this opportunity slip by without our having a chance to thank you. I would like to say that, on behalf of the AUB group here who attended the Conference, we thank ICARDA first for the enthusiasm with which they have indicated their willingness to co-operate with the national institutions in this country. I would also like to thank ICARDA for the very interesting Conference they have provided (- I don't think I have before stayed 50 hours in one building without going outside at any time, but in a way I wish it was perhaps longer).

But, seriously, we thank you, ICARDA, very much for inviting us to participate here and for your hospitality, and in particular we thank you, Dr. Nour.

Thank you very much.



Dr. Nour:

Well it is very nice that the Conference ends with a glowing feeling. I appreciate your good words, Dr. Tannous. All I can say is that what we have done, stems from our sincere belief that Lebanon is a country that has institutions that are extremely worthy of support. That is what we are paid for, and we are glad to be here with you.

I want to thank every one of you for your participation.

Now the Conference is closed.

## CONFERENCE PARTICIPANTS

His Excellency,  
The Minister of Agriculture,  
**Dr. Mustapha Dernaika**  
The Ministry of Agriculture,  
Beirut,  
Lebanon.

**Mustapha Zeidan**  
Director-General,  
Ministry of Agriculture,  
Beirut,  
Lebanon.

**Samir Abu Jawdeh**  
Director, Mountain Development  
Project,  
Ministry of Agriculture,  
Green Plan,  
Beirut,  
Lebanon.

**Malek Najjar**  
Horticulturalist,  
Dept. of Agriculture in Beqa'a,  
Ministry of Agriculture,  
Zahle,  
Lebanon.

**George Malouf**  
Extension Supervisor,  
Dept. of Agriculture in the Beqa'a,  
Ministry of Agriculture,  
Zahle,  
Lebanon.  
(also ICARDA, Terbol, Lebanon).

**Salim Makarem**  
Director, Joint Technical Affairs  
Service,  
Ministry of Agriculture,  
Beirut,  
Lebanon.

**Dr. Samir Khair El Din**  
Head of Agronomy Department,  
Ministry of Agriculture,  
Zahle,  
Lebanon.

**Rachid Edriss**  
Director-General,  
Animal Production Office,  
P.O.Box 11-7521,  
Beirut,  
Lebanon.

**Ghattas Akl**  
Head of Forage and Animal  
Department,  
Animal Production Office,  
Beirut,  
Lebanon.

**Khaled Hajjar**  
Technical Consultant in Dairy  
Products,  
Animal Production Office,  
Beirut,  
Lebanon.

**Dr. Masri Hatem**  
Veterinary Scientist,  
Animal Production Office,  
Tripoli,  
Lebanon.

**Mr. Raji Bissat**  
Chief, Department of Agric.  
Engineering,  
Cereals and Sugarbeet Office,  
Ministry of Economy and Trade,  
Artrois St.,  
Beirut,  
Lebanon.

**Charles Issa**  
Regional Officer,  
Animal Production Office,  
P.O.Box 70,  
Zahle,  
Lebanon.

**Mounir Serhal**  
Assistant Agricultural Engineer,  
Animal Production Office,  
P.O.Box 70,  
Zahle,  
Lebanon.

**Antoine Chamoun**  
Director-General,  
General Directorate of  
Cooperatives,  
Ministry of Housing and  
Cooperatives,  
Achrafieh,  
Beirut,  
Lebanon.

**Mr. Khalil Haider**  
Chairman, Board of Trustees,  
Agricultural Research Institute,  
Fanar,  
Jdeidet al Metr,  
Lebanon.

**Joseph Haraoui**  
Director-General,  
Agricultural Research Institute,  
Fanar, Jdeidet el Metn,  
Lebanon.

**Michel Abi Antoun**  
Research Scientist,  
Agricultural Research Institute,  
Tel-Amara,  
Rayak,  
Lebanon.  
(also: Faculty of Agriculture, AUB)

**Adnan Alameddine**  
Head, Plant Breeding Department,  
Agricultural Research Institute,  
Tel-Amara,  
Lebanon.

**Abdallah Shammas**  
Science Advisor for Agricultural  
Research,  
National Council for Scientific  
Research,  
P.O.Box 8281,  
Beirut,  
Lebanon.

**Sultan Haidar**  
Science Advisor for  
Medical Science,  
National Council for Scientific  
Research,  
P.O.Box 8281,  
Beirut,  
Lebanon.

**Dr. Mustapha Soufi**  
Secretary-General,  
National Council for Scientific  
Research,  
P.O.Box 8281,  
Beirut,  
Lebanon.

**Dr. Mohammed A. Chouman**  
Research Scientist,  
Plant Improvement and Genetics  
Dept.,  
National Council for Scientific  
Research,  
Tel-Amara, Beqa'a Valley,  
Lebanon.

**Dr. Khaled Makkouk**  
Associate Professor,  
Faculty of Agricultural and Food  
Sciences,  
American University of Beirut,  
Beirut,  
Lebanon.  
(also: National Council for Scientific  
Research, Beirut, Lebanon.)

**Raja Tannous**  
Acting Dean,  
Faculty of Agricultural and Food  
Sciences,  
American University of Beirut,  
Beirut,  
Lebanon.

**Dr. Fawwak T. Sleiman**  
Director, AREC,  
Faculty of Agricultural and Food  
Sciences,  
American University of Beirut,  
Beirut,  
Lebanon.

**Mahmoud Solh**  
Asst. Prof. of Agronomy and Plant  
Breeding,  
Faculty of Agricultural and Food  
Sciences,  
American University of Beirut,  
Beirut,  
Lebanon.

**Nuhad J. Daghir**  
Professor and Chairman of Animal  
Science Dept.,  
Faculty of Agricultural and Food  
Sciences,  
American University of Beirut,  
Beirut,  
Lebanon.

**Nasri S. Kawar**  
Professor,  
Faculty of Agricultural and Food  
Sciences,  
American University of Beirut,  
Beirut,  
Lebanon.

**William J. Russell**  
Extension Agronomist,  
Faculty of Agricultural and Food  
Sciences,  
American University of Beirut,  
Beirut,  
Lebanon.

**Hovaguim M. Kizirian**  
Asst. to Agricultural Attache,  
American Embassy,  
P.O.Box 110-301,  
Beirut,  
Lebanon.

**Marcel V. Gunst**  
Second Secretary,  
Belgian Embassy,  
P.O.Box 5400,  
Beirut,  
Lebanon.

**Mr. George K. Dagher**  
Senior Commercial Officer,  
British Embassy,  
Avenue de Paris,  
Beirut,  
Lebanon.

**G.A. Pirie**  
Commercial Secretary,  
British Embassy,  
Avenue de Paris,  
Beirut,  
Lebanon.

**Per Skovgaard Andersen**  
Commercial Counsellor,  
Danish Embassy,  
P.O.Box 5191,  
Beirut,  
Lebanon.

**R. Ternus**  
Commercial Attache,  
Embassy of the Federal  
Republic of Germany,  
Beirut,  
Lebanon.

## ICARDA Participants

**Dr. Mohamed A. Nour**  
Director-General,  
ICARDA,  
P.O.Box 5466,  
Aleppo,  
Syria.

**Dr. David Nygaard**  
Program Leader.

**Dr. Euan Thomson**  
Livestock Scientist.

**Farming Systems Research Program**  
ICARDA,  
P.O.Box 5466,  
Aleppo,  
Syria.

**Dr. J.P. Srivastava**  
Program Leader.

**Dr. Walter Anderson**  
Agronomist.

**Dr. Ahmed Kamel**  
Pathologist.

**Dr. Mohamed Mekni**  
Barley Breeder.

**Dr. Miloudi Nachit**  
Triticale Breeder.

**Dr. Walter Nelson**  
Wheat Breeder.

**Dr. Omar Mamlouk**  
Section Leader.

**Dr. Rafiqul Islam**  
Microbiologist.

**Ms. Oreib Tahhan**  
Entomologist.

**Mr. Sobhi Dozom**  
Research Associate.

**Specialist Support Section**  
ICARDA,  
P.O.Box 5466,  
Aleppo,  
Syria.

**Dr. Habib Ibrahim**  
Training Officer.

**Dr. Richard Stewart**  
Science Writer.

**Dr. Samir Ahmed**  
Training Officer.

**Mr. Kamal Hindawi**  
Research Assistant.

**Training and Communications**  
**Program**  
ICARDA,  
P.O.Box 5466,  
Aleppo,  
Syria.

**Cereals Improvement Program**  
ICARDA,  
P.O.Box 5466,  
Aleppo,  
Syria.

**Dr. Mohan Saxena**  
Program Leader.

**Dr. Farouk El Sayed**  
Faba Bean Breeder.

**Dr. William Erskine**  
Lentil Breeder.

**Dr. M.V. Reddy**  
Chickpea Pathologist.

**Dr. K.B. Singh**  
Chickpea Breeder.

**Food Legume Improvement Program**  
ICARDA,  
P.O.Box 5466,  
Aleppo,  
Syria.

**Dr. Bhal Somaroo**  
Program Leader.

**Dr. Salvatore Ceccarelli**  
Plant Breeder.

**Dr. Ahmed Osman**  
Plant Breeder.

**Forage Improvement Program**  
ICARDA,  
P.O.Box 5466,  
Aleppo,  
Syria.

**Dr. Jurgen Diekmann**  
Farm Manager.

**Farm Operations**  
ICARDA,  
P.O.Box 5466,  
Aleppo,  
Syria.

**Mr. Munir Sughayyar**  
Station Operations Engineer.

**Mr. Nicolas Rebeiz**  
Senior Research Technician  
Cereals.

**Mr. Pierre Kiwan**  
Senior Research Technician FLIP.

**Ms. Aida Naimch**  
Research Technician FLIP.

**Mr. Adel Nassar**  
Research Technician Forage.

**ICARDA**  
Terbol Research Station,  
Terbol,  
Beqa'a,  
Lebanon.