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# CURRENT STATUS AND ACHIEVEMENTS OF IDRC SUPPORTED FOOD LEGUME RESEARCH PROJECTS

IN SOME COUNTRIES OF ASIA AND NORTH AFRICA

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*Results of field study conducted between January 24 and March 10 , 1988*

# INTRODUCTION

Soon after its creation by the Parliament of Canada in 1970, the International Development Research Centre (IDRC), has embarked on implementing programs through encouragement and support of scientific research for the development of food legume production in developing countries. These crops which have been identified to play a major role in diets of people in these countries have received practically no attention in the past. Being carriers of appreciable levels of good quality of dietary protein, their development meant relatively inexpensive means for enhancement of nutrition for the peoples of developing countries.

In 1973 IDRC supplied research scientists and financial backing for the Arid Lands Agricultural Development (ALAD) program then based in Lebanon, and supported pulse research through core support of the International Crops Research Institute for the Semi Arid Tropics . The first bilateral project between IDRC and Algeria for developing a research program on grain legumes was also conceived at that time although was not implemented till late in 1976.

When ALAD was transformed to an International Centre for Agricultural Research in the Dry Areas (ICARDA), IDRC was the executing agency responsible for its establishment. IDRC has supported a major part of the core budget of the Food Legume Improvement Program (FLIP) based at Aleppo and cooperative programs between ICARDA and north Africa.

Individual national programmes in the region have equally benefited from IDRC encouragement and financial support. This has helped tremendously in strengthening the individual programs and made them capable of directly interacting with the international centres and use their germplasm and other generated technologies for testing under their own environments as well as to conduct practical research projects of special importance to their agro-ecological conditions.

Support from IDRC took the form of grant funds directed towards reaching specific objectives in a framework of general objectives within a well defined

project that was developed by national scientists with direction and support of IDRC program officers. Frequent visits and follow-up provided by IDRC staff have generally insured proper implementation and management of these projects, and the funds, although limited, have generally brought about considerable success in reaching project objectives.

Project funds have been used to purchase research equipment and supplies,publications,pay for local and international travel to attend scientific meetings, specialized consultants, and most importantly to pay the expenses of training project personnel at technician, university , and postgraduate training.

The primary objective of supporting most of these projects was the strengthening of the national institutional capabilities of the countries concerned.And it has been conceded by all responsible scientists met during this mission that without such support from IDRC the reasonably good present status of the national programs would not have been achieved

As with any new research program, the emphasis in the first phase of these projects was put on identifying and understanding of the major constraints of production, and naturally these became the main output of research support. Nevertheless; with the concurrence of information output from International centres working on these crops, it became obvious that national programmes need to focus more on the particular problems constraining increased productivity at the local level. Thus in subsequent phases emphasis was put on problems and technologies offering the best opportunities for significantly and positively changing the production status of these crops.

IDRC has also supported Universities in the area to work on problems concerned with postharvest technologies on these crops, such as uses and processing, and cooking qualities and storage.

Special projects aimed at controlling the universal parasite of legumes ( Orobanche) has also been supported. Another very important problem , harvesting, has been fully addressed through project work at ICARDA and in Jordan and the

results are beginning to bear fruit.

Cooperative projects between ICARDA and Canadian expertise at the University of Manitoba have also been encouraged and supported. These were projects whose results would have universal application for food legumes every where, such as disease resistance and pollination control systems in faba beans, carriers for chickpea rhizobia, and di-haploid lentil lines for use in breeding.

Realizing how deficient the presence and dissemination of information on food legumes was in all major producing areas of the world IDRC supported information services in national and international programs . As a result of this support a faba bean information service was created at ICARDA (FABIS), expansion of the (LENS) lentil experimental news service of the University of Saskatchewan, was realized in cooperation with ICARDA, and in cooperation with the Commonwealth Agricultural Bureau (CAB) abstract journals on faba beans and lentils are produced.

IDRC has also supported directly the publication of proceedings of regional seminars and workshops on food legumes, and gave personal grants for national scientists to attend scientific meetings and conferences, as well as for university postgraduate training.

***In all for these activities and projects it is conceded that IDRC has followed a unique policy of allowing the scientists to develop a project budget answering to their requirements and within their management capabilities. Additionally a high degree of flexibility in spending of funds was allowed in order to circumvent much of the administrative hurdles often blocking the research process in developing countries. Main emphasis in project follow-up was put in getting the job done expeditiously and according to scientific principles. The above flexibility was and is still greatly appreciated by all scientists concerned.***

Food legume research in the region of Asia and North Africa has also received financial support from other organizations, such as IFAD,FAO, AOAD, ACSAD, and other international agencies.

*The consultant feels without prejudice that such support may have been instigated as a result of IDRC's support that was first.*

It is also worthwhile mentioning that through the support of the individual research programs IDRC has attempted not only to encourage links with international and national programmes of other regions, but to establish good links and relations with other institutes and agencies within the country who were deemed as important for the overall success of the project.

# OBJECTIVES OF THE STUDY

1- To document the history and achievements of national legume research programs in Tunisia, Egypt, Jordan, and Pakistan, and the input of ICARDA towards this process. Particular emphasis would be given to the support provided by IDRC to strengthening research capacity and providing usable research results; and to possible effects beyond the research process.

2- To provide an indication of the current status and priorities of national legume research and requirements for future external support (financial and scientific).

3- To contribute to the overall review of IDRC funding to food legume research in the region.

# COUNTRY REPORTS

# T U N I S I A

# T U N I S I A

1981-1988

## 1. INTRODUCTION

Food legumes in North Africa have been an important part of the crop rotation, and played an important role in the diet of the people. Faba beans and chickpeas are widely used in Tunisian national dishes while lentil are relatively less important. The contribution of these legumes to dietary protein compared to other sources of protein such as meat is less significant.

Their importance in the overall cultivated area however has changed with time since the early seventies. At certain periods, in the mid seventies and sixties Tunisia was a net exporter of food legumes, especially faba beans.

By 1984, the North African countries became a net importer of food legumes. (F.A.O., 1984 Trade Yearbook). In Tunisia food legume production in the eighties has stagnated in chickpeas and faba beans but was very significantly reduced in lentils.The area cultivated in lentils was reduced from 7000 ha in 1972 to 914 ha in 1985

As can be seen from the following table, mean yields from food legume crops have increased slightly over the last 15 years.

Table 1. Evolution of cultivated area and grain yield of food legumes in Tunisia. (INRATstatistics) 1988.

| YEAR | FABA BEANS | | CHICKPEAS | | LENTILS | |
|---|---|---|---|---|---|---|
| | Area | Yield | Area | Yield | Area | Yield |
| | 1000 ha | kg/ha | 1000 ha | kg/ha | 1000 ha | kg/ha |
| 1972 | 30.0 | 600 | 30.0 | 700 | 7.0 | 480 |
| 1973 | 50.0 | 740 | 27.0 | 700 | 6.0 | 670 |
| 1974 | 53.55 | 810 | 19.9 | 880 | 5.1 | 830 |
| 1975 | 57.85 | 930 | 20.55 | 890 | 3.35 | 1060 |
| 1976 | 61.2 | 1090 | 19.88 | 970 | 0.6 | 770 |
| 1977 | 58.5 | 420 | 21.7 | 780 | 1.4 | 540 |
| 1978 | 45.85 | 870 | 25.9 | 730 | 1.1 | 640 |
| 1979 | 54.85 | 850 | 32.5 | 650 | 1.0 | 820 |
| 1980 | 55.41 | 920 | 34.17 | 1100 | 1.42 | 710 |
| 1981 | 49.39 | 830 | 32.85 | 970 | 1.26 | 800 |
| 1982 | 42.21 | 813 | 31.9 | 829 | 0.82 | 739 |
| 1983 | 31.65 | 680 | 37.83 | 730 | 0.48 | 640 |
| 1984 | 38.16 | 950 | 30.0 | 430 | 0.82 | 960 |
| 1985 | 42.31 | 1050 | 32.16 | 782 | 0.91 | 869 |
| 72-85 | 40.0 | 825 | 33.4 | 795 | 2.23 | 752 |
| 82-85 | 38.6 | 873 | 33.0 | 693 | 0.76 | 802 |
| 1987** | 44.0 | | 34.7 | | 0.8 | |
| 1988** | 48.0 | | 36.35 | | 0.85 | |
| 1989** | 52.0 | | 37.9 | | 0.9 | |
| 1990** | 56.0 | | 38.45 | | 0.95 | |
| 1991** | 60.0 | | 39.0 | | 1.0 | |

** Projections based on statistics of the 7th agricultural development plan,sectioncontributed by the D.P.V.

The production of faba beans in Tunisia represent around 8.4% of the region served by ICARDA, is almost double that of Algeria, and around 15.5% of the production in Morocco. The average yield of faba beans in Tunisia (825 kg/ha) is approximately 20% higher than that in Algeria and around 20% lower than in Morocco.

The production area of chickpeas in Tunisia is approximately equal to that in Algeria and only about 21% of that in Morocco, while the average yield is more stable and around 30% and 45% higher than Morocco and Algeria respectively.
Tunisia has a very limited production of lentils compared to Algeria and Morocco although the average grain yield is 25% and 75% higher that Morocco and Algeria respectively.

The price of food legumes in Tunisia is not regulated by the government as that of the cereals. This was cited as being perhaps the major cause of the fluctuation in the areas under production. Although the Direction de Production Vegetal (DPV) plays a major role in planning the acreage of various crops on a yearly basis, they have not been successful so far in attaining their objectives in legumes,due, as they believe, to an open market price policy . The DPV intend to introduce a base price system for food legumes. They believe this will encourage the farmers to adopt their campaign objectives which are basically formulated on attaining self sufficiency.

Such can be seen as recognition of the value of food legumes, and at the present time, can be considered to be a strong commitment towards the development of these crops whose production is consumed locally.

The national objective of the 7th agricultural development plan for food legumes is to increase the area under production gradually from 82,000 ha to 110,00 ha by 1991.

Although the plan seems to place emphasis on increasing the production of agricultural commodities which Tunisia presently imports to meet the national consumption requirements, export crops such as citrus, and vegetable oils, are also to be increased in order to improve the balance of payments. Food legumes are also addressed as possible export crops that can help achieve that objective.

Until 1988, new food legume technologies developed by the research carried in Tunisia has not contributed to the overall production of these legumes. It is believed however that as new released varieties become available to the farmers as early as 1990, that these will directly contribute to attaining the campaign objectives.

## *2. DEVELOPMENT OF FOOD LEGUME RESEARCH UNTIL 1987.*

Food legume research in Tunisia prior to 1981 was not carried out at INRAT. The partial attempts at testing some germplasm introductions was done through the direction d'amelioration des productions of the Office des Cereales, an organisation responsible for extension services in the agricultural sector. But due to insufficient resources and technical manpower the work was restricted and results were fragmented and largely not organized.

A well formulated program was started in a cooperative project ICARDA-Tunisia as part of an IDRC funded project (Food Legumes North Africa-IDRC file 3-P-83-0123). IDRC funds earmarked for the project were $599,300 of which $91,000, $12,500, and $12,500 were for capital items for Tunisia, Algeria, and Morocco, respectively. One hundred and fourty eight thousand dollars were earmarked for casual labour and research expenses, and approx. $50,500 were for travel and training. A sum of $ 399,000 was budgeted to cover the salaries and expenses of the senior scientist and the research associate who were stationed in Tunisia. The Institute National de la Recherche Agronomique de Tunisie (INRAT) was the main cooperating agency in this cooperative project. ICARDA had stationed a legume breeder and an agronomist to start this project, and one year later, Mr. Habib Halila was deputed from Office de Cereales to INRAT to act as the national leader of the project.

When the ICARDA staff in Tunisia left in 1986, a legume breeder-coordinator was posted for North Africa (Dr. M. Solh). ICARDA took this decision after they felt that the Tunisian national programme has advanced to the extent that it could stand on its own feet: Complete adoption of the project had been achieved by INRAT through the programme leader Mr. Halila,in cooperation with the Institute

Nationale Agronomique de Tunisie (INAT), Office de Cereale, and DPV each in their own field of activity.

INRAT management contributed to the success of the program mainly through provision of research facilities and support field staff in addition to moral support.

*The senior staff engaged in the program activities have been awarded achievement medals by the previous president Habib Bourquiba for their national contribution to the development of agriculture within such a relatively short period of time.*

## *3. OUTPUT OF NATIONAL FOOD LEGUME PROGRAM UNTIL 1987.*

The collaborative ICARDA-TUNISIA project supported by IDRC, has addressed two main objectives:

1- Develop improved agronomic practices for the local cultivars.

2- Develop cultivars of improved agronomic characteristics possessing good local adaptation, of acceptable quality to growers and consumers, and most importantly having stable yield.

Other more specific objectives included:

a- strengthening of the overall national research program on food legumes,

b- strengthening the coordination of this program with other national programs in North Africa and the Middle East.

IDRC contributed towards these objectives by supporting the training of young Tunisian scientists, provision of literature and technical information, and supported all efforts to hold workshops and short-term in-country training programs.

### 3.1 *Agronomic Package*

Research results during the project identified a package of agronomic practices combining earlier seeding, optimum plant density in row planting as can be exercised using commercial grain drills,and appropriate manual weed control at 45 and 90 days after sowing.

The traditional cultural practices used by the farmers consist of late planting after the rains, reduced seeding rates without use of seed drills, spring seeding of chickpeas, and minimal hand weeding or no weeding during crop growth. The observations made from limited tests of the agronomic package over a period of 5 seasons between 1982 and 1986, indicated an average increase in yields as seen below:

Table 2. **Percentage grain yield increases resulting from some improved cultural practices. Mean of seasons 82, 83, 84, 85, & 86.**

| CROP | CULTURAL PRACTICE | | | | | | |
|---|---|---|---|---|---|---|---|
| | EARLY SEEDING | | OPTIMUM DENSITY | | HAND WEEDING | | HERBICIDE |
| | Beja | kef | Beja | Kef | Beja | Kef | CONTROL(1) |
| F.BEANS small | 11 | 22 | 49 | 60 | 48 | 69 | 68 |
| F.Beans large | 41 | 55 | 57 | 52 | - | - | - |
| Lentils | 40 | 32 | 48 | 57 | 35 | 60 | 58-66 |
| Chickpeas | 43-77 | 34-74 | 41(2) | 34(2) | 46 | 75 | 55-59 |

Beja= Beja research station: Kef = Kef research station.
(1) = Mean over Beja and Kef
(2) = Spring sown chickpeas.

The advantage of winter sowing of chickpeas is quite clear when no Aschochyta blight is present or when disease resistant lines are used. Results of trials on the use of chemical weed control have not been demonstrated to be economically viable, but the chemicals that are most effective and are tolerated by the crops have been identified in the three crops.

The technical viability of most components of the agronomic package have been verified in limited on-farm trials by staff of "Department d'Amelioration des Production of the Office des Cereales, but economic returns have not been totally established yet.. This department continues to cooperate in a more detailed scheme of on-farm verification and demonstration of technologies with INRAT especially in

the new IDRC-Tunisia food legume project.

This direct IDRC-Tunisia project has allocated $ 361,100 to help the Tunisian national program realise the following objectives:

a- Develop appropriate agronomic practices for the new released varieties of chickpeas and lentils,

b- Evaluate, confirm, and demonstrate on farmers fields the improved agronomic practices developed during the previous 4 years, as well as for the new cultivars.

c- Evaluate and confirm technically and economically farmers response, attitudes and adoption of the new technologies,

d- To further strengthen the research and extension capabilities of the staff of the national food legume program.

## 3.2 *New Varieties*

A selection-testing program researching local and international germplasm has been conducted and is continuing to date. The program tested thousands of lines and segregating populations over the last 5-6 years.

### *3.2.1 Chickpeas*

As a result of this program the project has identified three chickpea lines: two for winter seeding ( ILC 3279, and F83-46C) both of which are tolerant to Aschochyta blight ,ILC 3279 being an ex-ICARDA line, and another line for spring seeding (PL-Se-Be-48) which is a selection from the local Amdoun variety, but is 10-20% more yielding and having resistance to wilt. The latter is recommended for spring planting in wilt infested southwestern arid growing areas. The occurrence of wilt disease in chickpea growing areas in Tunisia seems to be increasing.

***The main objective of the chickpea breeding program is the selection of cultivars combining resistance to both wilt and blight diseases, in order to insure yield stability in the crop.***

Tunisia has the only wilt-sick plot in North Africa . Five hundred and fifteen germplasm accessions and 363 advanced lines from ICARDA were screened in this plot. 36 accessions and 23 breeding lines were identified as resistant. An additional 604 progeny rows were tested for wilt reaction and scored. Several advanced yield trials using winter sowing were tested in several replications and locations. A large number of the tested lines out-yielded the local cultivars. Yields of 3-4 tonnes/ha were not uncommon. Thus with the continuation of the breeding-testing program, identifying high-yielding chickpea varieties will not be difficult. The emphasis is justifiably shifted towards incorporating resistance to Aschochyta rabiei and root rot/wilt complex for winter sown chickpeas in North Africa in General.

### 3.2.2 *Lentils*

Two lentil lines have been selected from the ICARDA ILL collection for release ( ILL 4400, & ILL 4606 ), one is large seeded and the other of intermediate seed size. Expectations are that these will be released in 1988.

The ongoing selection program strives to increase yield levels and stability. Particular emphasis is now directed towards selecting tall erect genotypes with good pod retention to facilitate mechanical harvesting. No mechanisation attempts or trials have been conducted on lentils in Tunisia, mainly due to the lower importance of the crop compared to other legumes, and availability of hand labour for the limited acreage planted.

### 3.2.3 *Faba Beans*

No selections are available in faba beans that are superior to the local cultivars. Work so far concentrated on evaluating exotic advanced lines and selections from exotic crosses. Beginning in 86-87 however, plant selections made from F3 segregating populations of crosses between Tunisian cultivars and other ICARDA lines, crosses that were made by ICARDA (Aleppo), are being selected in a modified pedigree selection method using screen house facilities supplied by the project. The main emphasis in selection is put on resistance to Botrytis Fabae,Ascochyta Fabae, and Orobanche, which are the most important factors

limiting faba bean production in Tunisia. Artificial epiphytotics are created to help in selection.

## 3.3 *Dissemination of Information*

INRAT is presently engaged in the preparation of a pamphlet describing the package of techniques that are recommended for the three crops , and another one describing the new varieties of lentils and chickpeas. This is to be distributed to the extension department of the Office des Cereales and at the time of writing this report this had not been completed.

INRAT has received a large number of reports and publications that are produced by ICARDA, IDRC, ICRISAT, and CAB, and are well kept in their library. They are on the mailing list of the above mentioned centres and continue to receive literature on food legumes. These sources of information are regarded well by the research staff and the scientists who make frequent use of it.

## 3.4 *Training of New Researchers*

Several research personnel from Tunisia, Algeria, and Morocco have benefited from training programs at ICARDA as well as in-country short courses given by ICARDA scientists.

In Tunisia, in 1986, two persons attended a 2-week training course at Lattakia on the subject of food legume epiphytotics. Another person attended a 2-week course at Tal Hadia of ICARDA, Aleppo, on the subject of lentil harvest mechanisation.

Thirteen Tunisian, two Moroccan, and two Algerian food legume staff benefited from a one-week general course on food legume improvement given by the ICARDA training program scientists in Tunisia.

Two Tunisian researchers attended a one month intensive individual non-degree training course at ICARDA on the agronomy of food legumes.

In 1985, three Tunisian technical staff attended various training courses at ICARDA. One person attended a 3-month residential course on food legumes. Another person attended a 2-month individual training course on field experimentation and data collection, and a third person attended an individual 3-week training course

on food legume pathology. A forth person attended a general course on food legumes during a period of one week given by the ICARDA training team in Morocco.

The ICARDA legume scientist assigned to the project and resident in Tunisia at the time maintained close working relations with the Tunisian technical staff and thereby contributed to improved skills in the conduct of food legume improvement research in the Tunisian national program. In addition,ICARDA from Aleppo visited with the national program scientists and jointly discussed and evaluated the progress on the field trials during the tenure of this project.
Also the Tunisian program leader, Mr. Habib Halila, participated in the meetings of the Rainfed Agric. Inf. Network Conference in Jordan supported by funds of the project. Similarly the researcher Mr. Hamdi Ben Salah attended the EUCARPIA meeting of 1985 in Spain, and also visited ICARDA in Aleppo.

### 3.5 *Adoption and use of new Technologies*

Research results on agricultural practices have been verified on farmers fields by cooperating staff of the Office des Cereales. Field days had been organised over the last 2 years to show farmers the advantages of the agronomic package over their traditional methods, advantages expressed in terms of an increase in grain and straw yield in the order of 15-20 % and reduced cost of production inputs such as seeding and weeding costs, which could all be translated into increase economic returns per hectare .

According to extension staff of the Office de Cereales, all farmers whose fields have been used for the field demonstrations were convinced of the advantages of the package and were eager to try it on their own when inputs become available.

The small size of the trials, and the fact that they were managed by extension staff and not the farmer has not been conducive to easy adoption and spreading of the technology among farmers without the intervention of extension staff. Seed of the new varieties is however not available in quantities large enough for farmer distribution, and that may be the most limiting factor in technology transfer at present.

The consultant is of the opinion that if a quick and wide impact on adoption of the new technologies is to be achieved, at least three factors must be addressed in an extensive way:

1- Availability of quality seed of the released varieties.

2- Introduction of an interim period during which farmers would be guaranteed purchase of their produce at a fair price, as is the case in cereals,

3- Implementing a wide-spread program for on-farm farmer-managed demonstrations of the new technologies in the food legume producing areas of the country perhaps under supervision of extension personnel.

Food legumes however can easily replace a large acreage of the fallow practice normally used after cereals in the 300 - 800 mm rainfall mid-northern traditionally cereal growing areas. It is possible that if the scheme works large areas normally kept fallow after a cereal crop (more than 100,000 ha) could be planted to food legumes. The extra production could become available for export. This was not however felt to be one of the objectives of developing these crops especially as we see that the target of the agricultural development plan was mainly to satisfy local demand of these crops and relieve the government from the need to import these crops using up much needed foreign currency for other development efforts. Self sufficiency in the three food legumes as determined by DPV could be brought by sustained good production from a total area of 100,000 ha. If that becomes the case then it would be recommended to carry out a market study to identify the possibilities of exportation to eventually avoid any breakdown in the internal pricing system due to excessive supplies. As far as faba beans are concerned over production of the small seeded types may be absorbed by the animal feed industry internally, if the technology of its utilisation is transferred.

The recent and direct IDRC - Tunisia food legume project will successfully address the third factor mentioned above during the next three years. The introduction of a pricing system has been mentioned to the consultant by the representative of DPV,as a real possibility starting 1988. The first requirement however, availability of good quality seed,although will be partially addressed by the present project, needs to be given more emphasis, since the technical capability and set-up to deal with a certified seed production system for food legumes is weak. The testing and certification laboratory has up to date facilities and equipment. The staff need to be trained on specifics of food legumes, and could surely adapt very quickly. This part of the process is not lacking or weak. It is the production system of the various categories of the seed that is now non-existent and needs to be developed.

The two cooperatives, and the private company, if they were to remain interested in producing certified seed, must follow a system such as that proposed by the seed production specialists who have visited Tunisia and gave their recommendations, but should also be allowed to sell the seed at a price higher than that of the grain in order to recuperate the extra costs of producing certified seed.

The subject of food legume seed production has been addressed by FLIP of ICARDA, as mentioned above. A consultant was hired (Dr. P.K. Agrawal, Head, Seed Technology Division, IARI, New Delhi) to study the Tunisian situation in April 1986. The consultant examined the situation and accordingly presented a scientific and methodical seed production program of food legumes for Tunisia.(Progress Report 85-86, Tunisia-ICARDA cooperative program on food legume improvement)

The consultant is unaware whether there has been any follow-up to this study by the Tunisian authorities.

The consultant is of the opinion that a turn-key project, using Canadian technology, adapted to local conditions to produce certified food legume seeds with the government cooperatives or with the private cooperative , perhaps with the assistance of CIDA, could be the most effective way to quickly set-up a working program.

## 4. *NATIONAL and INSTITUTIONAL COMMITMENT to FOOD LEGUME RESEARCH*

The Tunisia-ICARDA collaborative project started out with one Tunisian scientist who became the leader of the project. INRAT has since sent a number of junior staff for short term training courses at ICARDA. One student graduated with an M.Sc in breeding, and now holds the position of legume breeder. Another M.Sc. graduate has recently joined the group to work as an agronomist. The program leader will shortly be going to do a Ph.D degree under the umbrella of the new project. INRAT has committed 10 part-time and full time support staff at 5 research stations to be in charge of the daily activities of the trials.

In an ISNAR study a total of 7 man years of senior research staff on food legumes were recommended. The Director of INRAT Dr. Lasram concedes even this number is modest, and that if budget potential was higher he would recruit more staff. The commitment of Dr. Lasram is strong to the extent that if no outside funding was available he would dig in the purses of other programs to allocate for food legumes.

INRAT also committed field facilities, labour, and increased the internal operating expenses to thirty five thousand U.S dollars/yr.

Many of the field tools and small equipment, vehicles, and laboratory equipment had been provided under the previous project. A special laboratory and office space for program staff had been allocated at INRAT in Tunis.

INRAT has very little budget for purchasing of scientific periodicals, and library materials, but receives a lot without cost from outside institutions as mentioned before.

The Tunisian program continues to receive external support from ICARDA through the ICARDA-NARP.

Dr. M. Solh who is stationed in Morocco and sometimes, FLIP scientists are involved in program planning with the senior national scientists. A program planning meeting is usually held in September in Tunis where previous and current results are discussed and compared. Recommendations are made in the joint meeting, and these become the basis for the program of the following year. Dr. Solh visits Tunisia for follow-up and is usually available for consultation as required.

ICARDA continues to hold In-Country training sessions in special topics of importance to grain legume research. Such a course on crossing techniques was scheduled for this season. FLIP senior scientists may also visit the program from time to time.

ICARDA also continues to provide external support in terms of germplasm, and more importantly special crosses and segregating materials involving locally adapted genotypes.

It was also understood that for 1988 ICARDA will be supporting the operating budget of the Tunisian program in 1988, to the tune of 30,000 U.S dollars.

The leader of the Tunisia food legume program, through moral and material support of both ICARDA and IDRC, encourages linkages with other national programs especially the programs of other Maghreb countries, and has himself visited the Algerian and Moroccan programs earlier. Algerian scientists, and the

Director of the Institute Technologique des Grandes Culture have also visited their colleagues in Tunis. Habib Halilah has also mentioned the possibility of exchange of germplasm and literature with Algeria and Morocco, provided that they are mediated by ICARDA for the time being.

The Tunisian program encourages playing host for the screening of chickpea germplasm from ICARDA and Maghreb countries for resistance to wilt, as they have an excellent wilt-sick plot, and they would like to serve in this capacity as a centre of excellence for North Africa and the Middle East.

The Tunisian program for work on diseases has a basic constraint of inadequate operating budget for purchase of materials, chemicals, glassware and other consumables. The laboratory, at INAT, for the main cooperator Dr. Munsef Harabi has adequate major equipment, a large number of which was made available through IDRC funds.

The disease work is well linked to ICARDA, through provision of short term visits, publications, and germplasm exchange.

The Tunisian team would like however to establish a joint effort in disease work on food legumes with the Maghreb countries, and could seek funding for such a program. This could be a future area where IDRC may contribute some funding, as it helps in the preservation of the integrity of the new varieties and their continuous improvement to satisfy the objective of sustained productivity in the whole North African Refion where IDRC has invested much funds to date to encourage the development of these crops.

## 5. *NATIONALPERCEPTION OF RESEARCH ON FOOD LEGUMES*

Although food legumes in Tunisia do not have a major contribution to the gross agricultural product, they are looked upon as important in the overall crop rotation and diet of the people. In Tunisia Agricultural priorities are: Wheat and other cereals, livestock, vegetables, fruit crops, forages, oil crops, and food legumes in that order.

National research programs on all crops other than food legumes are relatively well established. An organised program of research on food legumes started only some 7 years ago.

The research program entails many facets: a well defined breeding program on faba beans, chickpeas, and lentils, an agronomy-crop management -crop protection program, an on-farm verification demonstration program (the new IDRC program), a verification-extension program implemented the Office des Cereales, and a pathology investigations program in collaboration with INAT.

The breeding program is very well linked to ICARDA FLIP program. While at present most germplasm and segregating materials come from ICARDA, the Tunisian program is gradually moving into having their own crossing blocks. Many nurseries, and yield trials are tested in several locations with emphasis on two locations BEJA and El-Kef, which represent two distinctive agro-ecological zones for food legumes.

There is a well established system for variety release that normally caters to cereals and other crops but has also successfully been used in 1988 to release two lentil and three chickpea varieties.

Seed production in Tunisia is mainly done on contractual basis through the intervention of two cooperatives: CCSPS, and COSEM, which produce seed for the Office des Cereales who in turn sells to the farmers. This system works very well for the cereals.There is also a third private company GRAFOUPAST which produces faba bean, chickpea, and field pea seed and sells them privately at prices that are 20-30% higher than the other cooperative companies without any difficulty.

For food legumes however, the cooperatives do not have any specially trained staff to handle the production of foundation and certified seed. Seed certification can be done at the laboratory of the DPV, as they are now engaged in some seed testing procedures for legumes. This is a well equipped and staffed laboratory which , in my opinion, can respond well to needs of food legume seed testing and certification in Tunisia

It is to be noted then that no scientific seed multiplication and certification system exists for legumes, but that the national scientists are well aware of the requirements and have a commitment to gradually build their capability in such a system if adequate resources and funding are found.

The Tunisian national food legume program has been well linked with ICARDA programs, mainly due to the collaborative project which necessitated a heavy presence of ICARDA staff during the last 6 years.

No apparent direct links were obvious with ICRISAT or with regional institutes. Attempts are now starting for establishing dialogue and exchanges with other Maghreb countries programs, but mostly through using ICARDA as a catalyst. ICARDA is thought to be in a good position to support exchange of scientific visits, and facilitate the travel of scientists among countries with some political sensitivities, especially for attendance of meetings, workshops, or regional training courses.

Although the Tunisian food legume program has advanced in maturity continual help will be needed from ICARDA in the form of some funding, supply of germplasm, training, and technical assistance in the form of consultancies or visits by ICARDA scientists, and execution of special projects of regional importance. Training in special topics not available at ICARDA would be sought by Tunisia as is the case in the projected training courses in the new IDRC_Tunisia project.

The Tunisian national food legume leader supports the idea of using regional centres of experience for testing regional early generation materials in the breeding programs. For example; Tunisia will receive and test in their chickpea Fusarium wilt sick-plot materials from other national programs in the Middle East and North Africa. They would also be of help in testing for Botrytis resistance in faba beans. They in turn can test their faba bean materials for resistance to Orobanchae in Morocco. Both Tunisia and Morocco are thought to be in favour of supporting lentil mechanization research in Algeria. This idea is promoted by Dr. M. Solh of ICARDA.

Such projects of regional importance need to be funded and supported logistically by an intermediary such as ICARDA. The Tunisian program leader also supports linkage with North American & European institutes, but do not presently have any definite plans as to how this could be done.

The Tunisian food legume research program, especially the breeding-testing program has shrunk in size, partly due to severe reduction in budgets after the end of the IDRC supported ICARDA-Tunisia collaborative project, and partly due to reducing the number and scope of the objectives sought after. The operative and capital budgets have been reduced fro 120,000/year during the life of the earlier project to 30,000 presently. The 30,000 are mostly used as operating budget. The breeding program will receive some funding from the new project, but main expenditures are for verification and demonstration-extension purposes.

Considering the relative importance of Phaseolus sp. (1300-3500 ha/yr.) the Tunisian program could use extra funds to develop the technologies for this crop. The Tunisian program leader is encouraged to obtain germplasm and technical support from CIAT.

## SUMMARY

It is evident from this report that the results of the research carried between 1981 and 1987, have not yet had any impact at the farmers level. It has set the stage for such an impact. The new IDRC project in Tunisia is very timely and will speed up the passage of these technologies to the farmer. If good quality seed from the new released varieties becomes available, and some pricing system that guarantees the farmers stable returns, is put in place, the developed package of technology could very conceivably increase the production of the three main food legumes to satisfy the local requirements and perhaps provide some surplus for exportation or for alternative internal use.

# TUNISIA

## PROGRAMME & PEOPLE MET &/OR INTERVIEWED

| MONTH AND DAY | PERSONS MET AND POSITION |
|---|---|
| Jan. 24 | Arrival in Tunis (Afternoon) |
| 25 | Dr. Mahmoud Solh, ICARDA, Legume breeder & coordinator of ICARDA-North Africa food legume program (stationed in Rabat, Morroco.) |
| 26 | Dr. Lasram, INRAT, Director of INRAT.<br>Dr. Ahmed Kamel, ICARDA, Director of ICARDA Tunisian office.<br>Food legume Research Team ( Mr. Habib Halilah (Team Leader), Mr.Hamadi Ben Salah (Legume breeder), & Mr. Taoufik Ouslati Legume Agronomist<br><br>Mr. A. Sellami, Director , Direction de l'Amelioration de la Production of the Office des Cereales.<br>Mr. Ali Haddad, Assistant Director, (same as above), in charge of farm verification trials, and main collaborator with INRAT. |
| Jan. 27 | Field visit to the Oued Beja experimental station and on farm verification trials run by D.A.P, and discussions with research and extension staff on site. |
| Jan. 28 | Mr. Mouldi Ghanmi, Director, Field crops , at the Direction de Production Vegetale DPV.<br>Mrs. Bin Uthman, head of food legumes section, DPV.<br>Mrs. Baghdadi, Assistant director, DPV.<br>Visited laboratory for seed certification.<br>Dr. M. Harrabi, Professor. I.N.A.T, collaborator with INRAT on legume diseases work.<br>In-charge of Office of International cooperation at Ministry of Agriculture. |
| Jan. 29 | Mr. Habib Halilah, Leader, food legume program.INRAT<br>Dr. Lasram, Director, INRAT. |
| ** | Dr. M. Solh of ICARDA, accompanied us on most of the activities and interviews. |

# E G Y P T

*EGYPT*
*1977-1986*

## *1. INTRODUCTION*

Food legumes, especially faba beans assume a relatively high level of importance in daily diet of the Egyptian people. Although they contribute 10-15 % of the vegetable protein consumed and perhaps higher in rural areas, they could be generally regarded as important contributors to the quantity and quality of protein intake in the Egyptian diet.

Faba beans are by far the most important food legume, followed by lentils and then chickpeas.

In 1960 Egypt produced faba beans on some 150,000 ha and had a high level of self sufficiency. This area had decreased to some 120,000 ha in 1985. Productivity per hectare had increased by about 10% . In 1985 Egypt was around 85% self sufficient in faba beans, in spite of the increase of the per capita consumption from 4.8 kg in 1971 to 6.2 kg in 1985.

In 1972 faba bean production areas lost some 40,000 ha to wheat cultivation as a direct response to the increased demand and price of wheat straw. In 1987 Egypt has become self sufficient and may become a net exporter of faba beans in 1988.

Lentils occupied an area of around 34,000 ha in 1960. The total production was around 14,000 tonnes. This area has gradually dwindled to 18,000 ha in 1970, with a total production of some 9270 tonnes. In 1977, the statistics of the Ministry of Agriculture indicated an area of 19,200 ha producing some 6690 tonnes at approximately 320 kg/ha . Sharp decreases in area occurred after 1977 and reached a minimum of 6,000 ha 1980. A gradual small increase in area planted to lentils has occurred until 1985 when it reached 8,800 hectares. The area has been stable since then, but there has been a gradual increase in production mainly due to increases in yields per hectare from 320 to 410 kg/ha.

The most widely accepted reason for the reduction of areas planted to lentils

in Egypt is the one that associates the reduction to the increased pressure from more profitable crops under the new irrigation systems that resulted after the building of the Aswan dam. The productivity and market acceptability of lentils were reduced mainly due to reduced cooking quality of lentils grown under irrigation.

Added to all that, the ceiling price that the government has set and the obligation of the farmer to sell his produce to the government, have also contributed to the decreased cultivation of lentils; however, during the same period the per capita consumption of lentils has decreased from 1.7 kg to 0.8 kg a factor which helped maintain the level of self sufficiency at around 30 % .

## 2. *DEVELOPMENT OF FOOD LEGUME RESEARCH UNTIL 1987.*

Breeding and varietal improvement of food legumes in Egypt has been practised for at least for 4 decades. The research was done at various research facilities of the Ministry of Agriculture. Varieties of faba beans, lentils, and chickpeas were known and cultivated prior to 1975.

The breeding and improvement program however, depended on local materials and did not use international genotypes to improve the diversity and raise the chances of selecting superior materials.

Although the food legume program in Egypt was by far the strongest in the region it has taken a major leap in 1975-76 when germplasm from regional Arid Land Agricultural Development program (ALAD) collections was introduced for evaluation under local conditions, and has rapidly developed with the provision of funding by IDRC towards the end of 1977. Previous work was done by the late Dr. Ali Abdel Aziz Ibrahim and continues to date under the direction of Dr. Abdullah Naseeb at the Crops Research Institute of the Agricultural Research Centre, Giza, Cairo.

A close working relationship between Egyptian and ICARDA scientists had existed at that stage and throughout the life of various IDRC-EGYPT project

phases. Many of the objectives set for the first phase of the project had been. A multidisciplinary team of Egyptian researchers had been recruited to implement the project: 3 agronomists, 2 plant breeders, two plant pathologists, one food scientist and one agricultural economist.

The team collaborated with staff of other institutions in Egypt, primarily the Faculty of Agriculture of the University of Alexandria, and the Experimental Protein Laboratory in Gezira, Cairo, on the aspects of legume quality. Some collaborative work has also been done with the two universities Azhar and Zakazik, for carrying out research on faba bean agronomy, rust diseases, and nutritive quality in the first, and lentil breeding in the second. The research was part of the requirements for postgraduate degrees of students supported by the IDRC-funded project.

The research was carried out at the central research station, Giza, Cairo, and five other stations representing various agro-ecological regions. Four of the stations represent various conditions of the Nile Valley and Delta areas, the oldest farming systems in Egypt.

The research results of the first phase came through with an enhanced package of agricultural practices and new selections that on experimental fields proved to increase productivity of faba beans by as much as 100% .

In July 1979, towards the conclusion of the first phase of the IDRC-Egypt project, ICARDA started a major faba bean development project, The Nile Valley Project (NVP), with funding from IFAD.

The first objective of the NVP project was to " Test recommended cultivars and practices on farmers' fields in order to evaluate both practicality and potential contributions of these recommendations at the farm level and provide feed-back for further research".

The program planning, coordination, and execution of the NVP were the responsibility of national senior scientists in both Egypt and Sudan.

IDRC was the first external funding agency that has helped identify and support the senior national research scientists in Egypt through bilateral projects

prior to the commencement of the NVP. It was these same scientists who had started the practice of on-farm verification and demonstration trials of the developed varieties and cultural practices under the IDRC supported project. The Nile Valley Project has scaled up these tests to gain more information under commercial growing conditions.

The objectives of research on food legumes during the second phase of the IDRC-ARC projects were refined to take into consideration the accomplishments of phase I, and avoid duplication of work on faba beans that was taken up by the NVP. Major emphasis in the second phase was put research in lentils and chickpeas.

## 3. *OUTPUT OF NATIONAL FOOD LEGUME PROGRAM UP TO 1987.*

The output of research on faba beans during the first phase of the IDRC project can be relatively easily identified whereas during the second phase, which coincided with the Nile Valley Project, it is rather more difficult.

### 3.1 *Agronomy and Cultural Practices*

#### 3.1.1 *Faba beans*

Sixteen agronomic trials were conducted in each of the seasons between 1978 and 1980, on population density, sowing dates, Rhizobia inoculation and fertilizer application, and weed control on faba beans.

These trials were conducted in 5 research stations in the Delta, Nile valley, and new lands of the Western desert. The results in general indicated an advantage of increasing the population density from 33.3 plants/$m^2$ to 41.7 plants/$m^2$ and an application of 35-38 kg N/ha and 71-73 kg $P_2O_5$/ha.

The best sowing dates were mid-October for Upper Egypt, Late October for Middle Egypt, and first 15 days of November in Northern Delta.

The best chemical herbicides were found to be Topogard and Igran.

For suppressing damage due to Orobanche, delaying seeding to mid-November was recommended especially on susceptible varieties such as Giza 2.

Two sprays with glyphosate caused an average increase of 24% in seed yield of Giza 2.

The potential impact of the use of this agronomic package is a possible increase in grain yield of not less than 25-30 % with possible higher net returns per hectare. Actually however, the package is not yet widely practised by farmers.

The effect of changing the date of sowing of susceptible varieties of faba beans could be dramatic, as it could mean the success or failure of the crop due to Orobanche attack.

### 3.1.2 *Lentils and Chickpeas*

Around 20 trials on irrigated lentils were conducted to study the effect of: Rhizobia inoculation and foliar fertilizers, irrigation water requirements, herbicidal weed control, and seeding rates and methods, on crop yield.

Broadcast bed seeding was found to be superior to row and ridge seeding. Significant increase in seed yield of experimental plots was achieved by using rates of 115-130 kg/ha. In the provinces of Kana and Asyout it was possible to achieve better yields by seeding in rows at 88 kg/ha.

The use of the herbicide Gesagard against broad leaf weeds at the rate of 4.0 kg/ha proved very effective. The use of the herbicide allows seeding in dry soils, earlier than usual, and irrigating after seeding. The combination of good herbicide control, early seeding and supply of 2-3 irrigations after seeding increased seed yield by more than 30%. Other herbicides have proven effective, but are not registered for use in Egypt yet.

A single application of starter N at 45 kg/ha and $P^2O^5$ at 75 kg/ha are recommended. Lentils have been found to thrive well in non traditional new areas that are calcarious and sandy. This gives more potential for horizontal increase in production which is otherwise not available. Based on results of on-farm trials a comprehensive package of "Recommended Lentil Management Practices in Egypt" is described in a publication prepared by Drs. A. Naseeb and A. Momtaz in 1982 under the same title.

The aforementioned document was published with the help of IDRC funds and was widely circulated to institutes, universities, and most importantly to the extension services of the Ministry of Agriculture.

An agronomic package of cultural practices for chickpeas has also been developed at the research level but has not been fully tested in farmers' fields yet. Work on this aspect is continuing with financial backing from USAID as part of the Egyptian Major Cereal Improvement Project (EMCIP). Most of the 4,500 ha of chickpeas are in southern Egypt. An extensive effort for testing the agronomic package for the new variety Giza 88 will be needed before any increase in cultivated area can be expected.

## 3.2 *New Varieties*

### 3.2.1 *Faba beans*

Many superior faba bean lines have been produced by the breeding-selection program. Crosses leading to selected lines from which the only known Orobanche tolerant variety (Giza 402) has been produced, were started prior to the onset of the IDRC-ARC projects. This work was however intensified after the project and speeded up the release of Giza 402. This particular variety is believed to be the only known source which has heritable tolerance to Orobanche, the most important single factor that threatens faba bean cultivation in many parts of the world. Another cultivar, Giza 2, is equal or superior in yield to 402, but only when grown in Orabanchea free soils.

Another output of the research was the development of a rapid technique, (the detached leaf technique) for screening of breeding materials to chocolate spot, another important disease of faba beans,.

Some lines that are highly tolerant to chocolate spot infestations which are very serious in the North Delta region, have been developed and are now under seed increase. The genetic background these lines have genes from the accession ILB 938. The identification of heritable resistance to Botrytis fabae in ILB 938 is considered a breakthrough for breeding resistance to this disease. Credit for this work goes to Egyptian research scientists.

Several lines having a high degree of tolerance to chocolate spot infestations have been selected and tested under artificial Botrytis infections in a greenhouse

donated by the IDRC-ARC project. Field evaluation continued during the second phase of the project and with additional support from the NVP. The selected superior lines display 50% Botrytis resistance and are 15-25% higher yielding than Giza 3. In 1988 three lines are in the stage of breeder seed increases and will enter through a program of development of cultural practices to suit their particular agronomic characteristics (medium flowering and larger seed size). Some lines are also being selected for aphid resistance for use in southern Egypt.

The variety Giza 2 is recommended for cultivation in the South Delta and Middle Egypt.

### 3.2.2 *Lentils*

The traditional Giza 9 variety is gradually being replaced by the new released variety Giza 370. Giza 370, selected in 1979 and released in 1983, is more tolerant to traditional flood irrigation and is higher yielding by an average of 5-10 % . It is now occupying an area of around 4000 ha which represents 50% of the area cultivated with lentils.

There are also a number of new lines that are characterized by earliness and are of similar yield capability which are in the final stages of evaluation

## 3.3 *Chickpeas*

The variety Giza 88 was released in 1985. It is a variety developed through pure line selection from a group of introduced lines from ICRISAT. Under experimental conditions it has out-yielded the local cultivar Giza 1 by an average of 85 % largely due to its resistance or tolerance to the prevalent diseases which devastate the old cultivated varieties. Under farmers field conditions and management this advantage is reduced to 16.1% . Its main superior characteristics are its resistance to root rot and wilt and tolerance to Ascochyta blight. It has smaller grain, however, (23 g/100), and darker seed coat than Giza 1, but seems to be acceptable to growers and consumers. It has tall plants (56 cm) and few branches, and lends itself readily for mechanization.

## 3.3 *Dissemination of Information*

Generally speaking the dissemination of research information in food legumes among research staff in the Ministry of agriculture is quite good in Egypt. This takes the form of publications in local agricultural journals, seminars at the research institutes, workshops involving Egyptian and regional scientists, and program planning groups. Exchange with ICARDA has been very good during both phases of the IDRC project and especially during the NVP. Research findings are communicated to ICARDA for inclusion in their publications. Progress reports covering the program activities supported by IDRC have been relatively timely except for the final report which is yet to be submitted. Egyptian scientists do not lack motivation for publishing and often times may give this activity precedence over more practical considerations for supporting the dissemination of research results to the end user, the farmer.

The staff interviewed during the mission openly expressed their dissatisfaction with the capability of the extension branch of the Ministry to put their research recommendations into practice. The organizational structure in Egypt does not seem to promote effective interaction between researchers and extensionists. Even in the "Economic Analysis of the 1981-82 Lentil Production Demonstration Program" which was partially supported by IDRC, the involvement of extension staff was limited to the selection of a willing-to-cooperate farmer. All other operations were performed by the farmer and/or research staff of the food legume section of ARC-EMCIP. The on-farm demonstration trials which I have seen during the visit were totally managed by the farmer-researcher. Extension staff were not involved.

Agricultural extension staff in Egypt are either diplomed technicians or B.Sc graduates that are not held in high esteem by staff of the research organizations and are thus not much encouraged to participate in such intermediate transfer of technology programs.

The director of the food legume program however consistently sends technical reports to directors of extension in the Ministry.

## 3.5 *Adoption and Use of Technology*

From the preceding section one can appreciate that the adoption of new technologies by farmers has not been very good, especially as far as the cultural practices are concerned. The more easily transferred technology of new varieties has occurred in various degrees in the three crops.

In faba beans the variety Giza 402 now covers more than 40,000 hectares. It received a major push by the NVP in the areas that are infested with Orobanchea. Due to the emphasis of the NVP project on demonstrations of the technological package on farmers fields, this has stimulated wide acceptance of the variety especially by cooperating farmers, of the Upper Egypt region. It is projected that Giza 402 seed will be available to cover the need of all the areas of upper Egypt within 2-3 years.Observations of research staff, and reports from extension services were reported to indicate that some components of the package dealing with fertilization, date of seeding, and population density are also largely adopted. Aspects of chemical weed control and use of glyphosate for further reducing Orobanche are not yet widely spread. The broad leaf herbicide Topogard is used on 8-12,000 ha of faba beans, and according to Dr. Zahran, if the government makes more of the chemical available, and the extension staff are more active, the area covered could be much larger. In many cases the absence and relatively high cost of the chemical and/or the spraying machines have delayed their use by the farmer.

The use of glyphosate to reduce Orobanche infestations is a technique requiring accuracy in timing and dosage of application which under present farmer capabilities would be hard to administer. The adoption of this technique will then be limited to those farmers having the required capabilities.

Giza 2 variety is dominant in Middle Egypt, while Giza 3 in North Delta occupies 12-16,000 ha.

In lentils, out of some 8,000 cultivated hectares in the delta area, the new cultivar Giza 370 covers around 50 % . The rest are seeded with the old Giza 9.

The use of herbicides for weed control has become quite well adopted according to Dr. Zahran. In 1987, 5 tonnes of Gesagard, which was recommended

in 1985, were used on an area estimated at 1.2 thousand hectares. He signalled also that if more of the chemical was available its use will further increase.

The supply of these chemicals is governed by the general government policy on imports both for the private and public sectors. If this policy could be modified so more of these chemicals will become available for use by the farmer. The use of chemical control of Orobanchea, aphids, and weeds on large scale implies the availability of sprayers.

The availability of sprayers and financial capability of the farmer to purchase them may play a vital role in the adoption of the chemical control techniques mentioned above, not only in faba beans but in the other legumes as well.

## 3.4 *Training of New Researchers*

It should be noticed that the food legume improvement project in Egypt was conducted by a multidisciplinary team of research staff including three agronomists, two plant breeders two pathologists, one food scientist, and one agricultural economist. Other collaborator scientists from University of Alexandria, and the Experimental Protein Laboratory were also involved.

The training of new researchers was not a key element in the project, and may not have played an important role in the Egypt project as it had in other countries which lack research staff in general. The impact of training on the project came through the specialized training of good researchers in particular aspects of food legume research, as well as giving them access to a wide range of experiences through introduction to international scientists in the same field as well as more technical knowledge through attendance of seminars workshops and international meetings on the subject as well as visiting other food legume programs in the region, and organizing workshops such as the one held at the University of Alexandria in 1983.

Nevertheless IDRC supported junior scientists/ senior technicians for short-term (6-month) training at ICARDA and ICRISAT.

Additionally, and as part of the research program, three persons completed postgraduate studies in Egypt and qualified with M.Sc. degrees in faba bean agronomy, faba bean pathology (rust diseases), and lentil breeding. Another person

qualified with a Ph.D degree on faba bean nutritive quality. Two other persons finished M.Sc. studies on seed quality and breeding of faba beans. One was supported towards a Ph.D degree to study heritability of disease resistance in faba beans.

## 4. *COMMITMENT OF NATIONAL INSTITUTIONS TO FOOD LEGUME RESEARCH*

The agricultural research centre at Giza has shown a high degree of commitment to food legume research in Egypt. Through the food legumes section of the Field Crops Research Institute, a comprehensive program involving a multidisciplinary team works towards the improvement of these crops. Many senior and junior research scientists are involved on full time basis at Giza and other research stations throughout the various regions. At Giza there are more than 6 scientists (Ph.D) who work on different legumes in agronomy breeding, and pathology.

At the Sakha research station there are 2 Ph.D's,one Masters, and one B.Sc. At Jumaizah 3 Ph.D's one M.Sc. and 2 B.Sc.'s. At Nubaria 2 M.Sc.'s, at Sids there is one M.Sc. and one B.Sc., and at Shandawil there are 2 M.Sc's. Many of these people had been hired to work especially in the food legume improvement program. The leader of the program indicated that they would also hire more staff in the future.

The Egyptian program had been rather at an advantage due to presence of funding agencies who were supporting such activities. Besides IDRC the NVP has stimulated work and commitment of more staff on faba beans. USAID has also supported activities in the program.Thus it was relatively easy to promote commitment to food legume research from government resources. In view of the above and the continuing support from outside agencies, the Egyptian food legume research program has become well established.

Although one would find a relatively large number of trained staff, more training and specialization is needed in breeding and physiology of lentils under an irrigation conditions which are unique to Egypt. Training is also required in the specific area of genetics of tolerance and resistance to Orobanche and bruchids.

The applied research of on-farm trials is well funded,but more training is needed in the areas of socio-economic studies, farming systems approach, and economic evaluation of on-farm trials. This is especially important because of the uniqueness of the irrigated farming system in Egypt under which the food legumes have to be cultivated as opposed to rainfed systems in other countries and research centres in the region where also active research programs can be found.

The Egyptian program is well linked to ICARDA. This linkage started in the early seventies with ALAD, the predecessor of ICARDA, and continued with the support of IDRC for creating a network of research programs on grain legumes in the region. The Nile Valley Project gave this linkage a further boost, and continues to the present time, and in the future through further support of similar projects on lentils and chickpeas. ICARDA has applied for funding from the EEC, to work on a farming system for boosting the production of lentils, chickpeas and cereals in Egypt, Sudan and Ethiopia. I learned at the time that this funding is coming through this year.

Not much bilateral linkage is however noted between Egypt and other national programs in the region, although Egyptian scientists may have visited other programs and met program scientists and leaders of other countries within the forum of meetings, seminars and workshops, which were mainly organized by ICARDA. Bilateral linkage with Sudan, and Ethiopia within the context of the NVP is however quite good.

## 5. *NATIONAL PERCEPTION OF RESEARCH ON FOOD LEGUMES*

During the early stages the food legume research and development program in Egypt relied heavily on introducing and testing a wide range of germplasm material mainly from ICARDA. The objective was to select adapted genotypes that are superior to local varieties. An appreciable amount of work was directed towards improving quality of faba beans in terms of increasing percentage protein and knowing the factors affecting cooking qualities. The results have not been used in a practical manner in the program, or as recommendations to the farmer, mainly due to their academic nature.

The breeding program on faba beans has been very active and gave commendable results as we have seen before. Lentils and chickpeas have not however enjoyed proportional attention as they merit. It is now that the program is directing attention to selection of lentil lines that are responsive to irrigation.

According to the program leader the breeding program on lentils and chickpeas is now attracting more attention and receiving more priority. The national program has a large germplasm collection and continues to draw upon germplasm from ICARDA. A comprehensive testing program exists involving screening nurseries, preliminary yield trials, and advanced yield trials carried out in several research stations. A number of trials are also carried out as verification and demonstration trials on farmers fields under the complete control of the research staff. For the new promising varieties trials on population density, weed control, water management, and fertilization are carried out.

New released varieties remain under the control of the agricultural research organization. The Field Crops Research Institute maintains the breeders seed, the foundation seed, and is involved in large scale seed production for distribution to farmers. Such seed is produced on lands within the research stations or attached to them.

There does not seem to be a special organization for certified seed production of food legumes in Egypt. While the present situation may assure better

control of seed production and, hypothetically, more dependable seed, it puts a big burden on the land and manpower resources of the research section. The program leader complains of insufficiency of available land, staff, equipment, and operational budgets for producing enough seed to fulfil the national requirements. The potential presently, if utilized to full capacity, can only supply not more than 40% of the requirements.

There is quite a bit of on-farm testing of promising materials and agronomic packages. Outside of the NVP this work is presently somewhat fragmented and lacks and organised plan.It does not involve the extension branch to the extent that their involvement would be considered as on the job training for extension workers. Extension agents are after all charged with responding to farmers needs. The lack of active involvement of extension specialists in this activity allows this missing link to hinder the timely passage of the new technology to the farmer. With the new source of funding from EEC, ICARDA is expected to draw a master plan within which a structured approach will be followed involving research and extension staff in a similar way as it was done for faba beans in the NVP.

The Egyptian national program conducted survey studies on the effect of soil, region, storage conditions and variety on the cooking quality of faba beans during the first phase of the IDRC project. This was subsequently followed by research on chemical and physical constituents affecting cooking quality. Results were inconclusive and could not be used in practical ways to improve this character. Through a separate project with the University of Alexandria, funded by the PPS program of IDRC more work was done to determine ways of enhancing the traditional methods of cooking faba beans. It was observed that even though many technical results and observations were available, the concerned Egyptian staff did not have a clear understanding and practical interpretation which could be used to improve the situation.

The Egyptian national program attempted from the beginning to involve scientists from other institutes from within the Agricultural Research Centre at Giza as evidenced by the constitution of the research team. Cooperative work was also undertaken with the University of Cairo, Alexandria University, Zakazik

University, and Azhar University, as well as with the Experimental Protein Laboratory. Except for the latter however, the cooperation with other universities was mostly in the field of joint supervision of research of students studying for their postgraduate degrees under the project, and cannot be described as true linkage between programs of equally interested institutes. Linkage with ICARDA has been strongest and continual. More on this topic had been said in the previous section.

Research under the IDRC-funded project in its two phases has definitely had results that have affected the farmer. The details of this has been described under the section dealing with the Adoption of Technology.

As noted, most of the effect came from adoption of new varieties developed under the project, such as Giza 402 of faba beans, Giza 370 of lentils, and Giza 88 of chickpeas. The acreage reported is a direct quotation from the scientists interviewed.

How much impact this has created in terms of net improvement of food legume production in Egypt depends on many factors technical and socio-economic which can not be dealt with under the terms of reference of this assignment. Some of these factors such as availability of production inputs (seeds, fertilizers, herbicides etc.), have been mentioned. Control of these inputs lies mainly with government programs that are directed by various government policies.

The persons interviewed for this assignment, have all had extensive awareness of the factors that have limited increased production of food legume crops, and through their familiarity with various general government policies, and technical constraints fro crop production of these crops, have identified the following issues that should be addressed in order to bring about a positive development in food legume crop production:

a- Insufficiency of "good quality" certified seed of the new recommended varieties. It is thought that such may be accomplished through a special program that encourages production by means of direct supervision of research staff or "experienced" extension staff.

b- General insufficiency of fertilizers, pesticides and herbicides or untimely availability, reduces productivity. The reasons sited for such were directly related to the governmental control over the availability of such production inputs, It was felt that government agencies either did not have or did not allocate sufficient foreign currency for the purchase and supply of such inputs that are presently not manufactured locally.

It was also felt that perhaps under the , now prevailing policy of liberal foreign currency exchange, that the private sector may be in a better position to play an active role in the supply of such inputs on a competitive basis.

It was also felt that the existing very slow process in the system for licensing new pesticides and herbicides hinders the timely adoption of new technologies that are dependent on such inputs, and that are recommended the research branch at the farm production level. Thus the persons met have generally recommended that the licensing process be speeded up to respond to actual needs.

c- If the availability of the recommended production inputs was solved and does not remain as a constraint, it was agreed that a simple way for increasing the production of food legumes is the deregulation of their price, which at present was set by the government. This was thought to be the best incentive which would encourage the farmers to increase their areas of cultivation. The consultant concurs with this opinion especially in view of the available evidence from the increased production of faba beans after the deregulation of its price some two years ago.

## 6. *Direction of Research on Food Legumes.*

The national agricultural research program on food legumes in Egypt has come a long way since the mid seventies, It has produced many practical recommendations for increasing the productivity of these crops which if were all put into practice by the farmer would probably bring about a general national increase in production of not less that 20%. If however the objectives of research are to bring about a more extensive and sizable impact to respond to the increased requirements of the nation any research program should stress on solving the most limiting factors of production, the basic agronomical constraints.

While adaptive and practical production constraints have been stressed during the last 12 years, the NARP has now begun to tackle more basic production constraints, as evidenced by the work on disease and insect resistance and continued work on resistance to Orobanchea.

The Egyptian program should, in my opinion, benefit more if it concentrates more on basic research to unravel the basis of resistance and tolerance to Orobanche on faba beans and lentils, physiology of lentils under irrigation and breeding for genotypes responsive to irrigation, resistance to bruchids of food legumes, development of faba beans that are more resistant to Botrytis and rust.

The intricate intensive farming system in Egypt should be revisited in a more detailed fashion for identifying the critical but perhaps simple inputs which can increase the productivity of the whole system.

The scientists could learn to listen more to the farmer, analyze the principles of why he does what he does more objectively, identify the elements of productivity in distinctive systems and structure their research programs accordingly, and stay away as much as possible from conceiving research projects that can bring prestige to the scientist more than the well being of the farmer.

# E G Y P T

## PROGRAMME & PEOPLE MET &/OR INTERVIEWED

| MONTH AND DAY | PERSONS MET AND POSITION |
|---|---|
| Feb. 1 | IDRC group, and travelled to Alexandria |
| Feb. 2 | Attended Seminar at University of Alex.<br>Held discussions with G. Hawtin and Iglal Rashed. |
| Feb 3 | Dr. Shaaban Ali Mohammad Khalil, Head, Food legume research section, ARC, Giza.<br>Dr. B.D. Bhardwaj, Director of adminstration, Nile Valley Project, Cairo office.<br>Dr. M.K. Zahran, retire principal research scientist, Plant Protection Research Institute. Weed Control.<br><br>Dr. Al-Nasr, retired Agronomist. |
| Feb 4 | Dr. Abdullah Nassib, Director, Field Crops Research Institute, ARC, Giza, Cairo.<br><br>Dr. Naja Abu Zaid, Legume Pathologist,EMCIP. Giza,<br><br>Dr. ..... In charge of Aphid Lab, ARC, Giza. |

# J O R D A N

# J O R D A N
1980-1988

## 1. *INTRODUCTION*

The main food legume crops grown in Jordan are Lentils and chickpeas. Faba beans are also grown but mainly as a vegetable for green pod consumption. The dry faba bean grains var. minor are also used in the diet. These are mainly imported.

All field crops in Jordan are mainly grown under rainfed conditions in the East Bank on an area of around 370,000 ha. The predominant crops are cereals (wheat and barley). Lentils, chickpeas, and vetches occupy an area of around 25,000 hectares. Lentils are mainly grown in the northern Muhafazah of Irbid ( around 11,000 ha), but are also grown in Karak and Amman (around 4,000 ha in each). Chickpeas however, which occupy a much smaller area of around 3,800 ha are mainly grown in Mohafazah of Amman. Some 700, and 1000, ha are grown in Irbid and Karak respectively.( all above numbers are estimated averages over a period of 10 years 1969-1978).

The situation changed drastically in 1979 where the lentil production area was reduced by half from the preceding year to 7104 ha. eighties. In 1981, the area in lentils bounced back to more than 10,000 ha, but again reduced by 50% in 1983. In 1984 to the area was 4,900 ha. It is estimated that in 1986 and 1987, for which exact statistics are not available, the area was maintained around 6,000 ha.
Thus after being an exporter of lentils Jordan now imports more than 40 % of the local requirements. See tables 1 and 2.

Table 1. Area (ha), Production (tonnes), and Yield (Kg/ha) of lentils and chickpeas crops grown in Jordan between 1970 and 1984.

| YEAR | Lentils AREA (HA) | Lentils PRODUC'N (tonnes) | Lentils YIELD kg/ha | Chickpeas AREA (ha) | Chickpeas PRODUC'N (tonnes) | Chickpeas YIELD kg/ha |
|---|---|---|---|---|---|---|
| 1970 | 20578 | --- | --- | --- | --- | --- |
| 1971 | 20529 | 20781 | 1012 | -- | -- | -- |
| 1972 | 28411 | 22369 | 787 | 3085 | 1971 | 639 |
| 1974 | 21554 | 31444 | 1459 | 12493 | 9100 | 728 |
| 1975 | 14763 | 5201 | 352 | 1354 | 930 | 687 |
| 1976 | 22935 | 9346 | 408 | 1600 | 335 | 209 |
| 1977 | 13318 | 5560 | 418 | 1347 | 551 | 409 |
| 1978 | 14325 | 8250 | 576 | 1237 | 337 | 272 |
| 1979 | 7104 | 792 | 112 | 2597 | 416 | 160 |
| 1980 | 8580 | 6295 | 734 | 2855 | 1654 | 579 |
| 1981 | 10495 | 7857 | 749 | 1952 | 1430 | 733 |
| 1982 | 10777 | 8074 | 749 | 2006 | 1480 | 737 |
| 1983 | 5864 | 5173 | 882 | 1538 | 678 | 441 |
| 1984 | 4857 | 2470 | 509 | 1321 | 611 | 453 |

Table 2. Jordanian Exports and Imports of Lentils and Chickpeas from 1970 to 1982

| | LENTILS | | | | CHICKPEAS | | | |
|---|---|---|---|---|---|---|---|---|
| | Export | | Import | | Export | | Import | |
| YEAR | VALUE JD (1000) | QTY Tonne | VALUE JD 1000 JD | QTY Tonne | VALUE 1000 JD | QTY Tonne | VALUE 1000 JD | QTY Tonne |
| 1970 | 537.0 | 11373 | 12.6 | 224 | 1.3 | 25 | 156.6 | 2850 |
| 1971 | 335.1 | 7463 | 63.4 | 1460 | 0.9 | 20 | 221.8 | 3683 |
| 1972 | 918.8 | 18697 | 74.5 | 1395 | .06 | 1 | 209.1 | 2251 |
| 1973 | 451.7 | 11000 | 343.9 | 2755 | 1.2 | 11 | 343.9 | 2755 |
| 1974 | 154.5 | 10853 | 552.3 | 4713 | .11 | 3 | 256.7 | 2894 |
| 1975 | 469.0 | 3942 | 80.6 | 643 | --- | --- | 158.3 | 1589 |
| 1976 | 243.6 | 1894 | 206.3 | 1141 | 3.3 | 33 | 91.7 | 890 |
| 1977 | 1373.7 | 12227 | 203.1 | 1516 | --- | --- | 243.9 | 1180 |
| 1978 | 27.8 | 253 | 70.1 | 594 | .06 | 2 | 301.6 | 1146 |
| 1979 | 451.4 | 4352 | 82.6 | 640 | 0.32 | 1 | 1809.8 | 7768 |
| 1980 | --- | --- | 177.4 | 1020 | 2.9 | 11 | 816.8 | 6145 |
| 1981 | 429.1 | 3559 | 279.7 | 1232 | 17.7 | 66 | 882.2 | 6624 |
| 1982 | 90.9 | 856 | 233.6 | 1427 | 7.5 | 60 | 1260.9 | 6962 |

In chickpeas the same trend occurred. Between 1983 and 1987, the area planted with chickpeas varied between 1,300 and 1,500 ha, a reduction of more than 50 %. Jordan now imports more than 8,000 tonnes of chickpeas yearly to satisfy the local demand.

As with other cereals the government has a program to promote the production of these crops, although evidently with a much lower degree of priority. Through the Jordan Cooperative Organization (JCO), local lentils will be bought at a price of 180 J.D /tonne, which is equivalent to $ 650 CDN. The world price is less than half. The same also applies to chickpeas.

Many reasons may account for the reduction in production areas earlier and stagnation in the area at present low levels. The yield levels from traditional varieties are low, but mostly due to non-availability and high cost of labour. Traditional harvesting alone, presently accounts for around 55% of the production inputs. Thus mechanization of production practices is the main limiting factor.

## 2. *DEVELOPMENT OF FOOD LEGUME RESEARCH UNTIL 1988*

Research on food legumes in Jordan prior to 1980 was practically non-existent, except for individual attempts in the late seventies to look at some of the germplasm material that was collected by ALAD-ICARDA, and this through individual efforts.

A well conceived and targeted approach was not in place until 1980, with the onset of the IDRC-Jordan University project. The project was conceived as a direct result of contacts made during the first workshop on food legumes organized by ICARDA in 1978, and later on in 1979.

The IDRC-JU project has evolved through three main phases:

| Phase | Years covered | IDRC Contribution |
|---|---|---|
| I. | 1980-1983 | $266,000 |
| II. | 1984-1987 | $308,100 |
| Bridging | 1987-1988 | $42,390 |
| III. | 1989-1991 | $346,600 |

The first phase of the project embarked on the development of a testing-breeding program utilizing germplasm material from ICARDA and ICRISAT. Also to test and develop further a prototype machine that was produced by Dr. Bassam Snobar at the University of Jordan for mechanical pulling of lentils planted in rows. in order to try to solve the problem of mechanical harvesting of lentils. Whereas tests of that particular prototype indicated its inadequacy as a practical solution, the whole issue of mechanical harvesting was studied along similar lines that were followed by ICARDA and in cooperation with them.

The basic cultural practices of method, dates, and rates of seeding, fertilizer application and rhizobium inoculation, land preparation methods, weed control, and harvesting methods were examined experimentally. Several hundred selections, mostly from ICARDA nurseries were tested in 2-3 locations. Preliminary selections of superior lines were increased, and some on-farm verification of technology was carried out during the second phase of the project and is continuing to the present time.

The research was carried out by the University of Jordan under the leadership of Dr. Nasri Haddad, and Dr. Bassam Snobar. Surveys on existing methods of production and costs of production were carried out in cooperation with other faculty members like Drs. Arabiat and Bqa'een of the faculty of agriculture.

Strong links were developed with the Food Legume Improvement Program (FLIP) at ICARDA, and exchange of information and materials was made with Washington State University and the University of Saskatchewan.

Due to the shortage of research staff trained on work in food legumes in the ministry of agriculture or at the university the project had a strong input for training such staff at the postgraduate and technician level.

Although the food legume program in Jordan has been done by the University of Jordan, rather than by the research branch of the Ministry of Agriculture, it

has thus far been accepted by non-university research staff as the national program on food legumes. This is due mostly to the good contacts and relations that the leader has had with people outside the university for conducting this project.

## *3. OUTPUT OF NATIONAL FOOD LEGUME PROGRAM UNTIL 1988*

### *3.1 Breeding/ Agronomy*

#### *3.1.1 Lentils*

A package of cultural practices most conducive for increase in yield and profitability of producing lentils has been developed for the known varieties, and some improved ones.

- The most adequate date of seeding was between the first week of October and the end of November
- Regular grain drills should be used after adjusting the seeding rate to 80 kg/ha for low rainfall areas (250-300mm), and 120 kg/ha for areas having rainfall in excess of 300 mm/season.
- 20 kg/ha of nitrogen (Ammonium sulphate (21% N) preferred), and 40 kg/ha of phosphorus ( Di-ammonium phosphate preferred), should be applied. The use of nitrogen is designed mainly for the following cereal crop more than for the lentil crop.
- No need for Rhizobium inoculation unless seeding in lands not cultivated with lentils before.
- Land should be prepared similar as in wheat, and use of chisel plough is recommended. Rolling of stony land immediately after seeding is recommended.
- Weed control can be done by hand or preferably for grass weeds by using Pronamide (Kerb) pre-emergence, or Fusilade in a post-emergence application, at 0.5-0.75 l and 1-2 l active ingredient / ha respectively.

  For broad-leaf weeds one of the following herbicides can be used:

  Cyanazine (Bladex) pre-emergence at 0.5-0.75 l a.i/ha.

  Prometryne (Gesagard) pre-emergence at 1.5 kg. a.i/ha

  Metabenzthiozuron (Tribunil) pre-emerg at 1.5-2.5 l a.i/ha

  These can also be mixed with Pronamid (kerb) and sprayed at the same time after seeding and before emergence of the crop.

The breeding program has been very active in developing superior lines of lentils, So far however only one variety has been released under the name UJL 176 (proposed Jordan 1) in 1986. The release of another variety UJL 81 (proposed Jordan 2) is imminent. Several hundred kilograms of UJL 176 have been obtained purely by the efforts of the project and mainly from buying back the seed from the farmers cooperating in the on-farm demonstration trials.

Very little seed of this variety has been made available to other than the cooperating farmers, mainly due to non-availability of adequate amounts. At the time of writing this report the author learned of a UJ-JCO program, in place, whereby JCO undertakes to increase the seed with supervisory help from the JU, and sell it to the farmers.

Several selections that are superior to UJL 176 have been made from the breeding testing program and are presently coming on stream for release within the coming two years. Emphasis in selection was placed on plant height and soil cover, grain yield and straw yield. The value of lentil straw in Jordan is very high and in most cases represents not less than 35 % of the gross profits of the crop. The selections subject for release exceed the local variety in grain yield by not less than 1.5 times on the average under experimental conditions. Experimental yields of up to 2.4 tonnes/ha are not uncommon.

### *3.1.2 Chickpeas*

A number of recommendations for cultural practices have been arrived at and documented in a special bulletin produced by the University of Jordan in 1986.

- Chickpeas can be planted using regular cereal grain drills in rows that are 30-35 cm apart.In spring seeding 90 kg/ha of the local variety or the UJC 107 variety can be used. If late winter-early spring planting is followed the rate can be increased to 130 kg/ha.
- Winter planting of Aschochyta blight resistant genotypes has resulted in doubling yield but when ILC 482, a released variety in Syria, was given to farmers it is claimed that there was not much acceptance due to its small seed size relative to the local varieties.
- Even for winter planting with resistant varieties, it was found that there is no advantage in grain yield for early winter (October) planting over late

winter (January). The advantage of January planting comes from the ability to control the weeds mechanically before seeding and by subjecting the crop to the least period and intensity of disease occurrence.

- Chickpeas respond well to phosphate fertilizers. 40-80 kg of $P_2O_5$ /ha are recommended before seeding. In most cases lentils respond well to fertilization with 20 kg N/ha.
- Leaf minor causes appreciable yield losses in chickpeas in Jordan. The recommendation is for the use of two insecticides with contact and systemic action in the early stages of attack. (Supracid & Roxion ) are examples.
- Pod borers **Heliothis** occurs between 0 and 20%. If epidemic is expected the use of an Organophosphate for control is recommended. Also Carbamates are recommended as an alternative.

The economics of using insecticides for control of leaf minor and pod borers have not been established neither experimentally nor on large scale basis. The research staff in Jordan estimate however that only when epidemic populations can be foreseen to threaten the destruction of the crop, is the use of insecticides perhaps economically feasible. Under normal mild occurrences it would not be economic or even practical.

- Weed control. Cereal volunteers can be controlled by using Fusilade or Pronamide. Broad-leaf weeds can be controlled using the same herbicides as in lentils.
- Chickpeas can be mechanically harvested using traditional combines. Care must be taken to adjust the combine for reduction of seed breakage during threshing. Seed bed preparation and levelling is however important with the local short statured varieties, but does not pause big problems with the tall varieties.
- A description of mechanical methods of harvesting for both lentils and chickpeas is given listing the advantages and disadvantages of each. No clear cut solution is available at this time in Jordan or at ICARDA for mechanical harvesting of lentils and this remains to be an area which requires further work, but mechanical harvesting of chickpeas do not pose any major problems.

The University of Jordan has an active breeding-testing program on

chickpeas. Any where from 5-15 nurseries and yield trials were introduced yearly from ICARDA, and tested in 2-4 locations over the last 7 years. This activity is continuous at the present time although to a reduced extent. Bulk segregating nurseries continue to be the main source of selection of improved genotypes. Over the last 7 years a few hundred germplasm lines has been selected and tested in yield trials . The most promising lines have been advanced and are now subject to final verification, before release, a process which requires large scale testing or verifications within on-farm trials supervised jointly by the research staff and the farmer. A dozen lines or so have been selected that on the average have yielded more than twice the locally cultivated varieties in experimental fields.

On the other hand, earlier in the project, the program has selected a pure line from the well known local chickpea variety which proved to be more uniform, higher yielding, and has good grain qualities accepted by the farmer and the consumer. It was given the name JUC-107. The seed is being increased mainly through the project from on-farm demonstration trials. Some 100 kg had been given to JCO and a similar amount to the National Centre for Agricultural Research and Technology Transfer (NCARTT), for the purpose of seed increase. JU maintains the responsibility for the breeders seed.

In principle, NCARTT, has the responsibility for producing foundation and basic seed of new released varieties, and further increases become the responsibility of JCO. While this has worked reasonably well for cereals, for food legumes a lot remains to be desired.

### *3.2 Adoption and Use of New Technologies*

While the new varieties and package of technology have been tested in a limited way through the help of JCO, and some field days were convened to inform a number of farmers, this has had very limited impact on adoption so far. Farmers involved with the trials were very concerned about the grain losses that were caused by the mechanical harvesting techniques that were demonstrated. They were also quite concerned about the losses in straw, being so important in Jordan. This factor (harvesting) is the one that pre-occupies farmers minds, and tends to

play down the importance of other factors in the package.

Even with farmers who were convinced of the advantages of the new varieties and agronomic practices, the availability of the variety, accessability to seed bed preparation and seed drills, and incomplete satisfaction with harvesting machinery remain stumbling blocks that must be successfully demonstrated to the satisfaction of the farmer in view of his limited capabilities, whether technical or financial. It should be noted that the size of the holding of a typical farmer who cultivates lentils and chickpeas is too small for him to be able to afford owning the machinery, which is the ideal way of insuring timely operations.

Presently,for cereals, most farmers work by buying the service (custom operations) from JCO, or the other limited number of private operators. JCO however represents the main force in this field. In my opinion, as one organization involved in many aspects, JCO has become too big to run a smooth operation. Their services are so much in demand that some degree of corruption has developed in their operations which has affected the setting up of objective working schedules for their clients.

No matter who does the work the Jordanian food legume farmers is very aware of the economics of the enterprise. For the technology to take off it must prove without doubt that it is profitable. In view of the high " subsidized" local price, showing the profitability of the enterprise becomes rather simple. Without such subsidized prices the economic profitability of growing these crops becomes more difficult to establish under the system of small and scattered farms in Jordan.

While I was in Jordan an agreement was signed between JCO and Agrodev Canada Inc. whereby Agrodev will bring in Jordan a certain amount of machinery destined to demonstrate the mechanization of the full operation of producing a food legume crop. Evidently Agrodev is getting financial backing on this from CIDA. They have a period of two years to demonstrate the success of the operations. If successful the agreement stipulates that JCO will pay for the machinery and buy more of the same from Canada to supply their various stations and commence giving the service to the farmers. The Agrodev project will be conducted with the technical cooperation of Jordan University of Science and Technology (JUST) in

Irbid through the help of the field crops specialist Dr. Abdallah Jaradat, under the supervision of Dr. Fayez Khasawneh (Dean of the Faculty of Agriculture of JUST)

The concept of supplying a complete package of operations to the farmer through an organisation such as JCO was jointly developed by myself and Dr. Khasawneh earlier, as I was thoroughly familiar with mechanisation of lentil cultures. I had the opportunity to discuss this with the president of Agrodev when I was in their employ.

The package proposed by Agrodev, as I have come to understand includes mainly a Canadian manufactured line of equipment for stone picking-secondary tillage-seedbed preparation, coupled with the use of refitted locally available combines for harvesting. I am not aware if flexible tractor-mounted double knife cutter bars, presently considered by ICARDA research results as the most adequate harvesting equipment under conditions similar to Jordan, were to be also demonstrated in this project.

I should like to emphasize however that without the use of the improved varieties that were developed by the project which are expected to come on stream in the near future, the degree of success of the Agrodev project may be very limited and the desired impact may be delayed. This is mainly due to the non-adaptability of the existing varieties to respond well to the elements of the package and do not have the spreading growth habit with the ability to attain sufficient canopy height , attributes that can be found in the newly selected lines, which are very important for moisture conservation, weed competition, and most importantly, successful mechanical harvesting.

Due to my concern that failure of some components of the project would bring about a set-back for the adoption of technologies developed in Jordan during the last 7 years under the IDRC project, and to the fact that neither Agrodev nor JCO have made any efforts to contact the project leader and most knowledgeable person of food legumes in Jordan, Dr.Nasri Haddad, I thought it to be very helpful to try and promote the implementation of this project with the knowledge and cooperation of all parties concerned.

Accordingly I arranged meetings between Dr. Haddad of JU and Drs. Khasawneh and Jaradat of JUST, which I believe may have helped to initiate

discussion and cooperation in the area of food legume research in general and for the implementation of the Agrodev project in particular. The dean of the Faculty of Agriculture at the University of Jordan was informed of the situation during my second visit in March.

## 3.3 Dissemination of Information

As a direct output of the first two phases of the IDRC-JU project two technical bulletins describing the production practices recommended for lentils and chickpeas were published. The bulletins were written in Arabic. The intended reader was the extension agent, or the research-extension agent, and contained enough technical information to be of general use to people who had some training in agriculture. Some 600 copies of each were distributed to research stations of the ministry of agriculture, JCO stations and personnel, government agencies involved in agriculture, students in agriculture, and other universities. It was reported that several inquiries were made to the university as a result of this.

Another publication (bulletin) was published by JU which describes the results of a survey of the production methods and costs of food legumes in three regions of Jordan. The distribution of the latter was limited, and was of more importance academically for the people working in development of food legumes in the country.

Several research papers , annual reports, and M.Sc. theses were also produced as a result of the research work conducted on food legumes during the life of the project.

In 1977 Dr. Haddad organized a workshop on grain legumes at the University of Jordan and invited representatives from JCO, JUST, NCARTT, and Ministry of Agriculture extension people. The results of research up-to-date were presented and discussed.

The University of Jordan maintains a good collection of books, monographs, and periodicals on food legumes from sources like ICARDA, ICRISAT, CAB, and documentation of research papers from other countries in the region. NCARTT also

receives a very limited amount of literature, from similar sources.
The Jordanian scientists, also contribute to the publications Fabis, and Lens, published by ICARDA with direct funding from IDRC.

### 3.4 Training of New Researchers

Dr. Haddad reported that 5 M.Sc. students have graduated under the program by the end of 1987 with direct financial support from the project. Four other M.Sc. students were continuing their studies and research. Two of them finished during the mission: Mr. M. Shatanawi defended his thesis in my presence on the 8th of February 1988. IDRC's financial support and my presence was acknowledged by the chairman of the department. The other, Samir Titi, defended his thesis on 20th February, and will start working with NCARTT on the USAID-Jordan high-land project. Two others will be finishing in 1988, both working on mechanization of food legumes.

One of the graduates of the first batch, Hani Sa'ub, is working with ICARDA, and two are working in the department of crop production at JUST. One graduate is doing his Ph.D in Australia in the same field.

During the first phase of the project two technicians were trained at ICARDA for six months.

*4. NATIONAL & INSTITUTIONAL COMMITMENT TO FOOD LEGUME RESEARCH*

The University of Jordan has a strong commitment to continue the work on food legume research and take pride in the fact that the Dept. of Crop Production, has played a unique and leading role in the subject until now. The Dean of the Faculty of Agriculture emphasized the importance of this commitment as he assured me of the willingness of the faculty to support this activity even in the absence of outside funding, even though this may create a strain on their budget. He indicated that Jordan has come a long way in working on this subject and will begin to see the fruits of their efforts shortly.

The dean of the Faculty of Agriculture of JUST is equally enthusiastic about doing research and development of food legumes in the northern part of the country and openly encourages cooperation with JU if they are willing to share the responsibilities. He travelled to ICARDA and initiated contact with FLIP. They will selectively introduce and test some of ICARDA's nurseries starting 1989. He

supports the idea of having a coordinated program with Dr. N. Haddad, where they will concentrate on the lentil crop due to its importance in the region of Irbid.

The Director of JCO, Mr. Al-Tal, is also enthusiastic about developing the production of food legumes, and according to his way of thinking the Agrodev-JCO agreement is the shortest way to bring about some development. JCO will consider hiring special staff to work on food legume seed production if the project proves successful. JCO has been approached by Dr. Haddad to nominate a young staff member to do a masters degree at UJ in the area of legume seed production, but have not been able to nominate a candidate so far, even though the expenses for this graduate training would be covered by IDRC through the one year extension of the project which expires by the end of 1988.

Discussions with NCARTT personnel indicate that they also are supportive of research on food legumes. They have a B.Sc. graduate who handles whatever limited materials that they receive from ICARDA, under some direction from N.Haddad. It appears though that the work is duplication of what UJ does, and that surely taxes the ability of the NCARTT man to handle the work properly. It would be more advisable if NCARTT activities are directed in full, at this time, to the production and maintenance of foundation and basic seed of the new varieties, with direct supervision from the breeder.

When NCARTT was asked whether it had any plans to develop staff and a research program on food legumes the answer was negative. Therefore it seems necessary and advantageous to maintain the work with JU and promote more cooperation and coordination with JUST as the commitment is certainly there.

For that purpose, and to avoid any duplication in work done on all aspects of food legumes, it is perhaps necessary to set-up a coordination committee including representation from JU, JUST, NCARTT, and JCO.

### *5. NATIONAL PERCEPTION OF RESEARCH ON FOOD LEGUMES.*

Lentils and chickpeas in Jordan are not major contributors to the gross agricultural product, but in the highlands are conceived as a desirable part of the crop rotation. They play an undeniable role in the traditional diets of the people and their production can exceed that of meeting the local requirements, if they can successfully replace the fallow part of the cereal-fallow rotation on the rainfed highland areas. On rainfed areas they are presently a distant second in importance after cereals. They can also conceivably become an export commodity. If the package of improved-economic technologies are applied, the costs of production will be reduced thus forcing a normalisation of the market price. The most important hurdle in such a development would be the demonstration of a successful mechanised system for cultivation, especially for lentils.

In the ministry of agriculture there is a reasonably well developed research-extension program that is heavily supported by a joint project between USAID and Jordan (the highland project). The director of the project indicated that they do not have any definite plans to include food legumes in the program but

that they were open to suggestions and for that purpose they maintain some contact with JU on this issue.

The research program supported by IDRC from 1980 till present is based on sound footing. It is lead by a very capable scientist, who has so far maintained a very active lead role in bringing the program to its present status in spite of inadequate number of support staff. The program entails a continuing breeding-testing activity in the two crops, which depend heavily on FLIP materials, but has recently moved in the direction of creating own segregating materials for further selection. A number of trials (Jordan trials) are formed from advanced materials and tested over several locations for wide adaptability. Personal good connections with staff of the ministry of agriculture and JCO have helped in conducting this research on sites not belonging to JU and using equipment and labour that are not under the jurisdiction of JU. This is very commendable.

There is a system for release of new crop varieties. It depends on a committed with representatives from the Ministry of Agriculture NCARTT, JU,and JCO. A seed production and inspection system also is operational for cereals, but has not been used for food legumes yet. The JU will be operating a well equipped, seed testing- and conservation laboratory, which can be used if and when a certified seed production program is adopted. Although the adoption of such a system with cereals was described as within the works, no clear plans were shown for food legumes.

No real scientific system exists for production of good quality seed (certified seed production) although it is maintained that the present system works well.

The food legume research and development program is very well linked to ICARDA, and maintains contact with similar programs at the Washington State University and the University of Saskatchewan. No apparent direct links were identified with other national programs, although the program leader Dr. N. Haddad is very supportive of the concept.

The program in Jordan has reached a good stage of maturity, but without continued support and presence of graduate students or more support staff the JU alone will have difficulties bringing the previous efforts to fruition. With the involvement of JUST, and a Canadian agricultural consulting company (AGRODEV), the situation is unfolding to a very interesting situation. I believe that IDRC can and should be implemental in further supporting the Jordanian program taking into consideration the new players in the game, all of which share the same goal of bringing actual impact at the farmer's level by transferring the developed technology to him in a form he can deal with.

# J O R D A N

## PROGRAMME & PEOPLE MET &/OR INTERVIEWED

| MONTH AND DAY | PERSON MET AND POSITION |
|---|---|
| Feb 5 | Dr. F. I. Khasawneh, Dean, Faculty of Agriculture, Jordan University of Science and Technology. |
| Feb 6 | Dr. Nasri Haddad, Leader, Food Legume project, University of Jordan<br>Dr. Bassam Snobar, Chairman, Dept. of Crop Production<br>Dr. A. Baqa'en, Associate Professor, Extension.<br>Faculty of Agriculture, Univ. of Jordan.<br>Mr. Hussein Hawamdeh, Research Assistant, Food Legume Project,<br>University of Jordan. |
| Feb 7 | Mr. Ghazi Kanaan, Assistant Director, Technical, Jordan Cooperative Organization, Amman.<br>Mr. Mreiwed Al Tal, Director, Jordan Cooperative Organization.<br>Visit Mshagar area to examine some on-farm trials. |
| Feb 8 | Mr. Nabil Katkhuda, Assistant Director, National Centre for Agricultural Research & Technology Transfer. Baq'aa , Amman.<br><br>Dr. James D. Maguire, Chief of Party/Jordan Highlands Agricultural Development Project, NCARTT-USAID. |
| Feb 9 | Attendance of M.Sc. thesis defence of Mr. M.Shatanawi.<br>Continued discussion with N.Haddad, Visited research trials on food legumes.<br>Visited JCO station. |
| Feb 10 | Dr. F.I. Khasawneh, Dean of Agri. JUST<br>Dr. Abdallah Jaradat, Acting chairman, Dept. of Crop production, JUST, Irbid.<br>Dr. Rawajifa, Assistant professor, soils, Faculty of Agriculture, JUST. |
| March 5, | Dr. F. Khasawneh and Dr. Jaradat, JUST, Irbid |
| 6 | JCO station, Ramtha, Irbid<br>Industrial City, Irbid. |
| 7 | Dr. Mahmoud Duwayri, Dean Faculty of Agr. Univ. of Jordan.<br>Dr. Nasri Haddad, and Dr. A. Baqa'en. |
| 8 | Departure to Vienna, to meet Dr. M. Saxena. |

# P A K I S T A N

# P A K I S T A N
# 1978–1987

## 1. INTRODUCTION

In spite of their importance in the diet of the population and as animal feed concentrates food legume crops in Pakistan have usually been associated with poor soils, poor people, and rainfed agriculture. Emphasis has been placed on cereals, cotton, and rice in all aspects of agricultural development during the period of the green revolution. It was not until a crisis of production was experienced in 1980-1982 where the failure of chickpea crops due to attack by Ascochyta blight which forced the government to import more than 40% of the national requirement, that development of pulses was taken seriously.

Until 1980 the country produced an average of around 575 thousand metric tonnes of chickpeas from an area of around 1 million hectares. This represented around 73 % of the area cultivated with pulses. In lentils the production ranged between 21 thousand to 39 thousand tonnes from an area of 61 - 100 thousand hectares, while in mungbean the production averaged around 30 thousand tonnes from 65 thousand hectares. In black gram *mashbean* the production averaged around 25,000 tonnes from an area of around 46,000 hectares. Table 1 below shows the areas, production and yield of these legumes between 1980 and 1985, during the life of the two phases of the IDRC project under consideration, which is ongoing to date.

The devastating effect of Ascochyta blight on chickpea yield and production can be seen in the data for 1980 and 1982 with a milder effect in 1981. The area of production of lentils was reduced by an average of 40% in the years 84 and 85, but the yields have increased sufficiently to almost offset the reduction area, maintaining the production around 25,000 tonnes. In mungbeans the area has increased by about 25% during these 5 years but yields have been stable. In mashbean an increase in area of around 25 % is accompanied by an increase in yield of around 10%.

Table 1.Area(1000 ha),Production(000 tonnes) and Yield (kg/ha) of the the four main pulse crops in Pakistan between 1980 and 1985.

| Year | | Chickpeas | Lentils | Mungbeans | Black gram |
|---|---|---|---|---|---|
| | Area(A) | 1128 | 86 | 69 | 64 |
| 1980 | Prod(P) | 313 | 36 | 33 | 33 |
| | Yield(Y) | 277 | 422 | 474 | 519 |
| | A | 843 | 73 | 67 | 68 |
| 1981 | P | 337 | 30 | 32 | 34 |
| | Y | 400 | 407 | 474 | 497 |
| | A | 901 | 74 | 65 | 66 |
| 1982 | P | 294 | 31 | 31 | 33 |
| | Y | 325 | 424 | 482 | 492 |
| | A | 892 | 82 | 79 | 74 |
| 1983 | P | 491 | 30 | 40 | 36 |
| | Y | 549 | 363 | 501 | 492 |
| | A | 919 | 49 | 94 | 84 |
| 1984 | P | 522 | 22 | 45 | 47 |
| | Y | 568 | 445 | 476 | 564 |
| | A | 1013 | 49 | 94 | 84 |
| 1985 | P | 524 | 26 | 45 | 47 |
| | Y | 517 | 531 | 476 | 564 |

It is highly visible that chickpeas hold the major importance occupying an area of more than one million hectares or 71 % of the total food legumes. The second largest crop is Lathyrus which is grown on an average of 141,000 ha. (10 %), followed by mungbeans (7 %), mash (6 %), and lentils (4 %). Other legumes are also cultivated like pigeon peas, cowpeas, an Phaseolus beans. The total area covered by all food legumes in 1986 is around 1.62 million hectares, with an average production of 725,000 tonnes annually. Pakistan remains a net importer of pulses, and the size of the imports although not large vary from one year to another depending on the performance of the local crops.

The imports in 1988 may be large due to the fact that the rainfed areas of the country this year had been plagued by a drought which persisted until at least the 20$^{th}$ of February.

Chickpeas are cultivated under two systems, grown on residual moisture of a rice

crop, mainly in the Sind province, and in rotation with fallow in the Thal desert area of Punjab and the sandy soils of NWFP provinces. Mungbeans, mash and lentils are cultivated mainly under rainfed conditions but also irrigated in some areas.

Compared to the world (700 kg/ha) and Asian (658 kg/ha) average yields, the yield of food legumes in Pakistan are depressed (519 kg/ha). There are also large fluctuations from year to year. The most serious factor responsible is the occurrence of Ascochyta blight on chickpeas, for which until 1983 no tolerant varieties were cultivated in Pakistan.

Crop research in Pakistan is carried out by federal and provincial institutes. Federally the Pakistan Agricultural Research Council conducts research on food legumes at the National Agricultural Research Centre (NARC) at Islamabad, and at the Nuclear Institute for Agriculture and Biology which undertakes mutation breeding as means for developing new varieties. At the provincial level Punjab is the most active province in food legume research. Ayub Agricultural Research Institute (AARI) has a comprehensive program. Some work is done at the University of Agriculture at Faisalabad also and at provincial research stations.In the Sind province the Rice Research Institute (RRI), at Dokri undertakes work on food legumes, whereas in NWFP province the work is done at the Gram Research Station at Ahmad Wala. In Baluchistan limited work is done at the Agricultural Research Institute at Sariab, Quetta.

There are a number of factors that are limiting increased productivity in food legumes: inadequate supply of quality seed of improved varieties, lack of fertilizer, and susceptibility of cultivated varieties to diseases and pests, are some.

***DEVELOPMENT OF FOOD LEGUME RESEARCH UNTIL 1987***

Food legume research in Pakistan started in 1956 under the scheme sanctioned by the Punjab provincial government and the Agricultural Research Council for a period of five years at the end of which it was dropped. Later on in 1977 limited research work started by the cereals section in the Punjab Agricultural Research Institute and at the Agricultural University at Lyallpur, now known as Faisalabad. Some work was also conducted in cereal sections in Sind,

NWFP, and Baluchistan.

A systematic national program was not created until the pulse crisis caused by the failure of the chickpea crop in 1980. The Pakistan Agricultural Research Council formulated a Cooperative Research Program for pulses improvement in Pakistan with provincial coordination in July 1980 with the general objectives of:

a- serving as a national program for improvement of genetic potential for grain yield and nutritional quality of major pulses, and

b- assisting provincial research programs through cooperation and support by sponsoring training, operational funds, equipment, literature, workshops/ conferences etc..

This coordinated program has been supported by the first phase of the IDRC project and is continuing at present. This national program seems to be the strongest one in the region. Through the strength of the appointed coordinator, the provincial research units have received constant support from provincial and federal resources in addition to those from IDRC. A strong team of research staff has been assembled and provided with practical training to reinforce their academic training.

The program utilizes 9 research/testing stations in the various provinces. Four research institutes also act as units of this program in addition to one agricultural university.

An annual planning meeting is held at NARC to study the results of the year and chart out the work program for the coming year. A travelling seminar involving key scientists in the program is also convened annually and travels to all important food legume producing areas to gain first hand information about the problems of production and select promising materials from various trials and nurseries. These activities are funded by the IDRC project.

Many of the program staff have been trained at ICARDA,ICRISAT, & IRRI. The team working in the program is a multidisciplinary team of well qualified researchers that show a high degree of dedication to their work. A high degree of amicability has been noted between staff that were seen on this mission.

Within the context of a national chickpea improvement project the Asian Development bank has supported the Pakistani program in cooperation with ICRISAT since 1984. Emphasis in this project is placed on developing chickpea varieties resistant to the prevailing diseases of economic importance mainly Ascochyta. This project has also been extended another three years starting 1988 and has helped release IDRC funding for use on other pulse crops. The ICRISAT scientist plays a role of advisor to the chickpea development section at PARC, and maintains intimate interaction with the other staff working on other pulses.

## 3. *OUTPUT OF NATIONAL COORDINATED PROGRAM UNTIL 1987.*

The output from project phases I and phase II to the present will be combined.

### *3.1 Breeding/Agronomy*

Some information was obtained during phase one of the project on seeding dates, inoculation, herbicidal control of weeds, and row spacing in chickpeas, lentils, and mungbeans. More research and on-farm trials have been conducted in phase II to complement the previous information. In 1988 the program scientists feel that they have enough information to put together an agronomic package of practices for the improvement of productivity in these crops. As new varieties are being produced at this stage of the program this package need to be fine tuned to the requirements of such varieties. The program staff are well aware of this and have continually carried research on these aspects. It must be noted however that the agronomy work is not given much importance at this time since the program is pre-occupied with breeding for resistance against the various diseases which pose a consistent threat to the production of these legumes, as well as breeding varieties with superior adaptation and yield stability in the various cropping systems in the various provinces of the country.

### 3.1.1 Chickpeas

In chickpeas two varieties were released in 1982-83; CM 72, and C-44, which were resistant to Ascochyta blight. CM-72 was developed at NIAB through mutation breeding. Today it is observed that CM-72 is susceptible to another race of Ascochyta. Thus work is being done to develop lines with multiple race resistance to this devastating disease. Screening is conducted under researcher enhanced natural epidemics supplemented by artificial application of the fungus at NARC, AARI, and NIAB. Several thousand germ lines have been screened in this fashion, and now the screening is done on the breeding mate rials on early generations to increase the efficiency of selecting resistant material with good agronomic characteristics. In several multi-location preliminary yield trials, 4 lines were selected for high yield and resistance to Ascochyta. In nine National Uniform Trials of advanced lines over nine locations one variety DC-I out-yielded all other entries yielding an average of 1.6 tonnes/ha, although it is not known to be a resistant variety to blight. Segregating material from ICARDA, and ICRISAt screened at NARC has indicated the presence of some 19 F2 single plant selections out of 116 lines that displayed various degrees of resistance to the disease. From 1134 F4 single plant progenies only 4 were found to be resistant. This seems to be a good source of resistant genotypes for further study and release.

Screening for resistance to Heliothis armigera has not brought any positive selections so far, but use of chemical or bacterial (Bactospeine) insecticides was thought to be more effective if applied during the larval stages of the borer. A natural parasite for this insect (Campoletis chlorideae) has been studied but eventhough it showed 32 % parasitism in November and December, was not active during the peak of activity of the borer in March and April.

The program is also actively involved in selection for resistance to chickpea wilt, another devastating disease in the Thal area, a major chickpea producing area. AARI has developed an excellent wilt sick plot which is used to screen all breeding materials against this disease. The national coordinator supports the use of such areas to test all the national material. The main objective in chickpea breeding in Pakistan now is the production of varieties resistant to the existing races of Ascochyta blight and Fusarium wilt. Some such lines have been identified and are

now advanced for verification in various yield trials. They are also being used as parents for crosses with other diverse genotypes in the breeding program.

The National Chickpea Improvement Project, funded by the ADB, has adopted all the chickpea work done under the IDRC-funded project, and now assumes full responsibility for the study and development of disease resistance in chickpeas.

### *3.1.2 Mungbeans*

The characters of earliness, uniform maturity, resistance to mungbean yellow mosaic virus and Cercospora leaf spot, and high yield are most important in this crop.

NIAB does mutation breeding on this crop and have developed some varieties with general interest to the conventional breeding program that are used in crosses with other material.

Over one thousand single plant selections from segregating materials have been screened for the various characters. Forty selections were advanced to preliminary yield trials. In advanced yield trials of other materials 16 selections were made showing superior qualities. In national uniform yield trials including the most advanced materials 5 selections were superior and gave yields of around 1.5 tonnes/ha.

Thirteen selections out of 32 were found to have tolerance to MBYMV. Two selections, E-321 and NCM-68 showed resistance to MBYMV and Cercospora leaf spot at the same time. Cercospora can cause severe yield losses of more than 60%.

Adequate reduction of MBYMV was achieved through increasing plant density, which reduced the population levels of the whitefly, the principle transmitter of the virus.

Adequate control of grass and broadleaf weeds in mungbean was achieved through the use of a combination of Fusilade and Flex.

In 1986, five new mungbean varieties released by NIAB and tested through the project will reach the farmers within 2-3 years.

The project obtained several germplasm lines from AVRDC in Taiwan. The results of screening these indicated the selection of 13 lines which are resistant to MBYMV and 12 that are resistant to Cercospora leaf spot. One of these selections is subject to release soon.

### 3.1.3 Black gram (urdbean or mash).

A collection of over 1000 lines was screened for various attributes. Four thousand plants were selected on the basis of early maturity and high yield potential. Seven hundred and fifty of these were retained for further evaluation in 1988. Some lines were very early (60 days), a sought after character.

The project released one variety which is a high yielder and has resistance to YMV, M-133.

Trials on population density and spacing indicated the best combination for high yield was around 22 kg/ha in rows spaced 20 cm apart. The achieved yield was 680 kg/ha.

### 3.1.4 Lentils

The most desirable characters for lentils in Pakistan are, earliness, yield potential, and resistance to Ascochyta lentis,Botrytis, and stem rot.

Hundreds of germplasm lines from ICARDA have been screened and selections of several lines made. From preliminary yield trials 4 lines that yielded 800 kg/ha or more were selected for further evaluation. Other selections from major yield trials have yielded around 900 kg/ha. Varieties selected at AARI have yielded in excess of 1000 kg/ha in national trials. AARIL-334 yielded 1099 kg and AARIL-502 yielded 1016 kg/ha when tested over 12 locations.

From disease screening nurseries 4 selections have been made which show a good degree of tolerance to stem rot. In national Uniform yield trials three lines were tolerant to Ascochyta blight; LP-1, LP-2, and Precoz. Precoz was resistant to the blight and is resistant to rust and is a *macrosperma* whereas all other pakistani varieties are *microsperma*. Additionally, due to its earliness the variety also fits perfectly for cultivation before peanuts as it matures in March and allows the seeding of Peanuts in April, thus allowing double cropping within one year.

Precoz is an introduced variety which will be released for use within that cropping system soon.

A new lentil variety Massor-85 was released in 1985 by AARI. It is now in seed increase stages and will be released to farmers by 1989.

Four other selections from National Uniform yield trials are expected to be released in the future. They are high yielding and show high degree of tolerance to blight.

## 3.3 Dissemination of Information

The results of research under the IDRC-funded project have been very well documented. Yearly progress reports have been timely and very well written.

Additionally, the staff have published several papers every year in Pakistani and Asian Journals as well as FAO, ICARDA, and ICRISAT publications. Seventeen papers were published during Phase I, and 8 papers during the first 2 years of Phase II.

A list of such papers can be found in the appendix. Also many papers were presented in scientific conferences held in Thailand, Indonesia, India and elsewhere. Some publications included recommendations for farmers on the cultivation of pulse crops.

The Consultant has not seen any special technical publications aimed at helping the extension community to understand these crops better and transfer the new recommended findings to the farmers.

Some program staff have recently been interviewed on radio to talk about pulses.

The national program receives documentation through subscriptions to various international Agricultural journals, ICRISAT, ICARDA, and CAB publications and monographs, and distributes copies to the various food legume research units in the country.

Almost all program staff have taken part in tours to learn first hand about the problems in the field and contact cooperating farmers in the program of on-farm trials. The travelling seminar of research staff which is conducted every year has helped the direct interchange of ideas and technical opinions among research staff and made them more informed of the global issue being researched.

### *3.4 Trainingof Research Staff in Food Legumes*

During phase I of the IDRC-funded project ( whose total funding was $ 376,000 for 3 years ), six research staff from the provinces of Punjab, Sind, and NWFP, attended six-month training courses at ICARDA, ICRISAT,and the Asian Vegetable Research & Development Centre (AVRDC), on the improvement of lentils, chickpeas, and mungbeans respectively. Two M.Sc. and one Ph.D students were supported during their tenure at the University of Agriculture, Faisalabad.

Twenty three food legume breeders pathologists and research staff in Pakistan took part in a training course funded by IDRC and given by a reputable legume pathology scientist from the University of Manitoba, Dr. C. Bernier. The course was held at NARC. The trainees received assistance in defining control programs for Ascochyta rabiei and MBYMV.

Project funds were also used to train some 25 support research staff from different provinces, attached to the cooperative research program units were given a formal one week training course at NARC in Islamabad in the areas of pulse research and production.

Phase II of the project established a fund of $ 335,600 to be spent in a period of three years starting May 1986. One M.Sc and 1 Ph.D candidates were supported in the area of breeding. Eight short-term (4-6 months) trainees were also supported. Four of them at the International Rice Research Institute (IRRI)in cropping systems, 2 at ICARDA in lentil improvement, and 2 at ICRISAT in chickpea improvement. One pulse scientist received a six-month training period in Canada in 1987. One attended a Mungbean symposium in Thailand, and another a Lathyrus symposium. Other training activities were undertaken by the staff which were not directly funded by IDRC:

In 1986 the pulse program entomologist at NARC attended a training course on "Integrated Pest Management of Food Legumes and Coarse Grains" for 40 days in Indonesia and presented a paper titled studies on insects in Pakistan. The senior Pulses Pathologist at NARC, presently the acting program coordinator attended a 3-week training course on " International Legume Pathology" in January 1987, at ICRISAT, India. Mr. M. Riaz Malik, program scientific officer at NARC also attended a course on "cropping systems" given at IRRI, Philippines during a period of 5 months. The program coordinator Mr. Bashir Malik

was supported towards his Ph.D. He is presently finishing his research and writing his thesis at ICARDA. He will return to Pakistan early November of 1988. U n d e r support from the world bank two scientists are presently studying for Ph.D in legume research in the United States. Mr. Mohammed Bashir the program's pathologist has also obtained support to do his Ph.D in the States starting the fall of 1988.

***3.5 Adoption and Use of New Technologies***

The most striking example of adoption is in the area of new varieties. When the chickpea variety CM-72 was released in 1982, and due to the severe crop losses caused by Ascochyta blight, it only took two years for the variety to cover more than 60 % of the areas subject to disease attack. The other areas are covered by another released good variety C-44. It was learned however that demand for seed from the new varieties is larger than the supply. Seed production is the responsibility of the Punjab Seed Corporation. This corporation does not give priority to seed production of food legumes. They produce this seed on available lands under their control after satisfying their program for cereals,rice, cotton, maize and others. The corporation does not have technically trained staff in food legume seed production and, according to food legume staff interviewed during this mission, are not enthused about doing that.

Availability of good quality seed of food legumes is presently, surmised in the Consultant's opinion, to be the most important factor hindering increase of productivity and total production. The Consultant suggests that further funding from IDRC could be used to identify the main constraints of "quality seed" production, and devise a scheme that could encourage this activity in a more structured manner.

A very limited number of farmers, usually those directly associated with the on-farm demonstration trials have begun to seed in rows, and apply fertilizers, otherwise the agronomic package developed have found limited use in the farming community. This can be partially explained on the basis of cost or non-availability of the production inputs which are required by the new package.

With concentrated extension or research-extension efforts however, the use of grain drills for seeding, which was identified as a very important factor, and herbicides for weed control can easily be adopted by farmers, because the equipment used is available and used by farmers on cereals and other crops.

It is my opinion that to bring the research results to fruition in Pakistan, a special project should be designed with three main objectives:

a- Make the seed of the new improved varieties available to the farmers of a targeted priority region;

b- Introduce the practice of using the cereal grain drills for seeding the food legumes;and

c- Introduce the use of herbicides for weed control.

Upon completion of the second phase of the IDRC project a number of yet better varieties would be available for specific regions and farming systems. A new project conceived around achieving the above mentioned technologies in pilot areas could be considered by IDRC for completion during a period of 3-4 years. If it is estimated that a lot of capital equipment is needed then perhaps CIDA could be involved for further funding.

## *4. NATIONAL AND INSTITUTIONAL COMMITMENT & PERCEPTION OF FOOD LEGUME RESEARCH*

The cooperative pulse research program in Pakistan is very well developed and coordinated between the federal and provincial research institutes. It employs a relatively complete team of research scientists and support staff most of which have received some form of training in food legumes. Most personnel met and interviewed seem to be well pleased with the advances made so far and encourage the leadership of the project to continue the work. PARC has so far supported this work through the facilities that are extended to the program in terms of staffing, training, and provision of recurrent and supplementary budgets for operational expenditures. Work on food legumes at present is done under three umbrellas: a Cooperative Research Program on Pulses which is government financed , the IDRC food legume improvement project which will end in 1989, and a national chickpea improvement project which ends in 1990 and is supported by ADB.

The leadership of the program have developed a 12 year plan for work on improvement of food legumes. The plan emphasizes the strength of approach to use a National multidisciplinary pulse research team through federal-provincial coordination. The team would work on the most limiting and practical aspects of the crops. Emphasis would also be put in strengthening the various units so they could undertake projects adapted to their specific agro-climatic condition. The following are some goals that clarify the perception of research on food legumes as was indicated by the program leadership.

- Utilization of all scientific disciplines necessary for the development of the new technologies in order to remove or alleviate all production problems associate with each pulse crop according to its national priority and importance to the farmer.

- Basic research on inheritance of desirable characters in major crops is foreseen as a very important factor in insuring the success of the breeding program.
- Studies for identification of various races of Ascochyta rabiei and for establishment of a set of differential cultivars for future use.

- Epidemiology of chickpea blight, lentil rust, and yellow mosaic virus.

- Development of more efficient techniques for creating artificial epiphytotic conditions for diseases of economic importance.( chickpea blight, MYMV, Cercospora leaf spot) to speed up the screening process.

- Development of a vigorous hybridization program for varietal improvement focusing on high yield, wide adaptation, drought tolerance, disease and pest resistance, and uniform pod maturity.

- Enlarge and intensify the program of on-farm research trials in a farming system program.

- Development of integrated control measures for major diseases.

- Development of appropriate production technology suitable for different cropping systems (rainfed, rice based, and irrigated).
- Manpower training and further strengthening of provincial food legume research units.
- Develop national and international linkages in research on sound lines

The resources needed to undertake such a program are listed as:

- More trained scientists and support staff in breeding, pathology, physiology, agronomy, entomology, and quality.
- Adequate funding
- Equipment and greenhouse facilities especially for disease screening work.

## *LIST OF PUBLICATIONS DURING, 1986 - 1987*

A. ***Journal Articles:***

1. Malik,B.A., Tahir,M., Hussain,S.A. and Chaudhary,A.H., 1986. Identification of physiologically efficient genotypes in mungbean. Pakistan J.Agri.Res. 7(1): 41-43.

2. Malik,B.A., Khan,I.A. and Chaudhary,A.H. 1987. Heterosis in chickpea. Pak. J.Sci.Ind.Res. 30(5): 396-398.

3. Khan,I.A., Malik,B.A. and Tahir,M. 1987. Phenotypic stability for yield in chickpea. Pak.J.Sci.Ind.Res. 30(6): 455-456.

4. Malik,B.A., Malik,M.R. and Khan,I.A. 1987. Correlation and path analysis of yield and its components in pigeonpea. Pak.J.Sci.Ind.Res. 30(6): 452-454.

5. Zubair,M. and Srinives,P. 1986. Path Coefficient analysis in mungbean. (Vigna radiata (Linn) Wilczek.) Thai J.Agric.Sci. 19: 181-188.

6. Malik,B.A. and Tufail,M. 1986. Progress on varietal improvement and evaluation of pulses in rice based cropping system in Pakistan. Report of the upland crops varietal improvement monitoring tour. May-26 June 4, 1986. Asian Rice Farming System Network. IRRI, Philippines.

7. Bashir, M., Alam,S.S. and Malik, B.A. 1986, In vitro evaluation of fungicides against Ascochyta lentis LENS Newsletter Vol. 13(1): 26-27.

8. Bashir,M., Alam,S.S. and Qureshi,S.H. 1986. Collar rot of chickpea caused by Sclerotium rolfsii. FAO Plant Protection Bull 34(1) 163.

B. ***Papers presented in conferences:***

1. Malik,B.A. 1986. Food Legumes cultivars released to improve farming system in Pakistan. Contributed paper. This paper was presented at ACIAR workshop on "Food Legumes Improvement for Asian Farming System" Khon Kaen, Thailand, 1-5 September, 1986.

2. Ahmed,K., Khalique,F., and Malik,B.A. 1986. Studies on insects in Pakistan. Proceedings of the Training course on Integrated Pest Management of Food Legumes and Coarse Grain. FAO/Biotrap, Bogor, Indonesia, July 15 - August 20, 1986.

3. Khalique, F., Malik,B.A., and Ahmed K. 1986. Protection of stored pulses by edible oils against attack of bruchid beetle. Proceedings of the Training course on Integrated Pest Management of Food Legumes and Coarse Grains FAO/Biotrop Bogor, Indonesia July 15 - August 20, 1986.

4. Ahmed,K., Malik,B.A., Khan,I.A., Bashir,M., Rahman,M.S. and Malik,M.R. 1987. Research on chickpea improvement in Pakistan. The paper was presented in chickpea Scientist Meet 9-11 Feb., 1987 held at ICRISAT, India.

*LISTING OF PUBLICATIONS DURING 1987 - 1988*


1. Afzal,M. Ahmed,K. Tahir,M., Malik,B.A. and Khalique,F. 1988. Some genetic parameters of resistance to Callosobruchus maculatus in chickpea. Sabrao Journal, Malaysia (In Press).

2. Ahmed,K., Khalique,F., Afzal,M., and Malik,B.A. 1988. Efficacy of vegetable oil for protection of green gram from the attack of Callosobruchus maculatus. 1988. Pak. J.Agric.Res. (In Press).

3. Ahmed,K., Khalique,F., and Malik,B.A., 1987. Prospects for biological control of chickpea pod borer. Progressive Farming. 7(4): 41-42.

4. Bashir,M., Khan,I.A., Iqbal,S. and Rahman,M.S., 1987. A new chickpea disorder observed in Pakistan. International Chickpea Newsletter. 17:30-31.

5. Bashir,M. and Malik,B.A., 1988. Diseases of major pulse crops in Pakistan - A review. Tropical Pest Management. 34(3): 309-314.

6. Bashir,M., Khan,I.A., Iqbal,S. 1988. Chickpea blight resistant lines developed in Pakistan. 1988. FAO Newsletter on Food Legumes and Coarse Grains. 3:20.

7. Ghafoor,A., Qubair,M. Iqbal,S., Bashir,M., 1988. Evaluation, classification and usefulness of germplasm of mash. Pak.J.Agric.Res. (In Press).

8. Khalique,F., Khalique,A., Afzal,M., Malik,B.A., and Malik,M.R. 1988. Protection of stored chickpea from attach of Callosobruchus chinensis 1988. Tropical Pest Management (In Press).

9. Khan,I.A., Malik,B.A., 1988. A study of heterosis in chickpea. Biologia, 34(1); (In Press).

10. Khan,I.A., Malik,B.A., and Zubair,M., 1988. Effect of various seed rates on yield and yield components in mash. Pak.J.Agric.Res. 9(2): 165-167.

11. Khan,I.A. and Malik,B.A.,1988. Genetic variability and correlation studies in desi chickpea. Cicer arietinum L. Pak.J.Agric.Res. 9(3): (In Press).

12. Khan,I.A., Malik,B.A., and Zubair,M., 1988. Selection criteria in chickpea. Biologia. 34(2): (In Press).

13. Khan,I.A. and Malik,B.A., 1988. A study of harvest index and associated characters in chickpea Cicer arietinum L.) J.Agric.Res. (In Press).

14. Khan,I.A., Malik,B.A., and Malik,M.R. 1987. Variability correlation and path coefficient analysis in chickpea Cicer arietinum L. J.Agric.Res. 25(1): 17-22.

15. Malik,B.A., Tahir,M., Khan,I.A., and Zubair,M., 1988. Cenetic variability, character correlation and path coefficient analysis of yield components in mungbean Vigna radiata L.) Pak.J.Bot. 19(1): 89-97.

# P A K I S T A N

## PROGRAMME & PEOPLE MET &/OR INTERVIEWED

| MONTH AND DAY | PERSON MET AND POSITION |
|---|---|
| Feb 11 | Mohammad Bashir , Acting Coordinator of National Food Legume Improvement Program, NARC, Islamabad. |
| Feb 12 | Dr. Muhammad Akmal Khan, Deputy Director General, NARC. (quality assessment laboratory) |
| | Mr. Khalique Ahmed, Entomologist, Pulses, NARC.<br>Mr. Ahmed Barmsh, Lentil Breeder, NARC<br>Mr. M. Zubair, Mungbean Breeder, NARC<br>Mr. Abdul Ghafoor, Mash breeder, NARC<br>Mr. M. Iqbal, Plant pathologist, NARC<br>Mr. Habib-UR-Rehman, Agronomist, NARC<br>Mrs. F. Khalique, Entomologist, Pulses, NARC |
| Feb 13, 14, 15 | Dr. M.A.R Bhatti, Professor/Chairman, Dept. of Plant Pathology, University of Agriculture, Faisalabad. |
| | Dr.M. Bashir Ilyas, Associate Professor, Dept. of Plant Pathology, University of Agriculture, Faisalabad. |
| | Mr. Tariq Ahmed, scientific officer, M.Sc. Student (IDRC project). Univ. of Agr. Faisalabad. |
| | Mr. M. Sadiq, Senior Scientific Officer, Chickpeas, NIAB, Faisalabad. |
| | Mr. Mahmood Ahmed, Scientific Officer, Chickpeas, NIAB, Faisalabad. |
| | Dr. Muhammad Tufail, Director, Pulses, Ayub Agr. Research Institute (AARI), Faisalabad. |
| | Dr. Akhtar Ali, Senior Scientific Officer, Chickpeas, AARI, Faisalabad. |
| Feb 16 | Dr. M.S. Rahman, Chickpea Resident Scientist, ICRISAT, ADB project, NARC, Islamabad. |
| | Mr. Imtiaz Ahmed Khan, Chickpea Breeder, NARC. |

I C A R D A

# THE ROLE OF ICARDA

## IN THE DEVELOPMENT OF FOOD LEGUME RESEARCH IN WEST ASIA AND NORTH AFRICA

## INTRODUCTION

IDRC was the executing agency responsible for the establishment of ICARDA. IDRC has supported a major part of the core budget of the Food Legume Improvement Program (FLIP) at Aleppo as well as cooperative projects between ICARDA and North African National Programs as well as projects with the University of Manitoba in Canada. IDRC has co-sponsored seminars and workshops held by ICARDA on food legumes, and has supported individual projects for dissemination of information on food legumes undertaken by ICARDA. IDRC has also supported individual National programs directly, which made them more capable of positively interacting with the ICARDA regional programs. For details on IDRC funding to ICARDA FLIP program , see table below.

Table 1 : IDRC funding of ICARDA FLIP Program since 1977.

| PROJECT TITLE | MAIN EMPHASIS | YEARS | TOTAL ($ Can) |
|---|---|---|---|
| Food legumes | core support for FLIP with focus on WANA | 1977-83 | 2,942,850 |
| Orobanche | control through chemicals | 1974-81 | 192,012 |
| Food Legumes in N. Africa | support core + partial programs in Tunisia, Algeria and Morocco on faba bean lentils, & chickpeas | 1984-87 | 599,300 |
| Lentil mechanization | Lentil mechanical harvesting systems | 1985-1988 | 226,900 |
| Faba bean Info services | support for FABIS information services and documentation | 1981-1986 | 486,150 |
| Lentil News and information | Publication of LENS & documentation | 1981-1986 | 97,000 |

Prior to the establishment of ICARDA, a food legume research and development program was started by the Arid Land Agricultural Development program (ALAD) in 1973, using funds provided by IDRC. The main points of emphasis of the program were on collecting and distributing germplasm, training of scientists of the region, and breeding and agronomy research.

Germplasm collections of lentils and faba beans were made in Lebanon, Syria, Iraq, Jordan in 1973, and Afghanistan in 1974. With ICRISAT, major collections of mainly chickpeas were made in Afghanistan in 1975, also under IDRC funding ($ 595,800).

The ALAD/IDRC program started a regional nursery program in 1974, and 14 national programs in the region received elite germplasm lines in 1974. In 1975 a total of 43 nurseries were sent to 11 national programs, and in 1976 the regional nursery network was expanded to 46 nurseries and 15 different locations. The participating national programs at that time included Algeria, Tunisia, Egypt, Sudan, Ethiopia, Yemen, Jordan, Lebanon, Syria, Cyprus, Turkey, Iraq, Iran, Afghanistan, and Pakistan.

Following the identification of desired characteristics through screening in Lebanon and Egypt, hybridization work started in 1975 and over a thousand crosses have been made in the three crops.

Through the ALAD/IDRC program many national agricultural research programs in the region were motivated to recognize the value of research on these neglected crops.
The ALAD/IDRC program, realizing the need for trained junior scientists and senior technicians, conducted in 1974 and 1975 training courses of five and six months duration and successfully trained a total of 26 members from 10 countries in the region.

With the establishment of ICARDA the food legume program started by ALAD under IDRC funding was given a new boost. ICARDA continued the mandate started by ALAD using all facilities, germplasm, and human contacts developed earlier. The

ICARDA FLIP program further expanded and improved the research and devlopment work on Faba beans, Chickpeas, and Lentils, with major funding from IDRC

IDRC may therefore claim an important part of the credit for the achievements of ICARDA's FLIP program in West Asia and North Africa (WANA).

ICARDA's role in the development of food legumes in WANA during the last 10 years was evident in the following major areas:

*1- RESEARCH IN CROP IMPROVEMENT, AND TRANSFER OF TECHNOLOGY*

*2- COLLECTION, MAINTENANCE AND PROVISION OF FOOD LEGUME GERMPLASM IN THE WANA REGION*

*3- DEVELOPMENT OF AN INTERNATIONAL FOOD LEGUME TESTING PROGRAM*

*4- JOINT RESEARCH WITH NATIONAL AND INTERNATIONAL INSTITUTIONS*

*5- TRAINING*

*6- ENHANCEMENT OF REGIONAL AND SUB-REGIONAL RESEARCH NETWORKS*

*7- CREATION &/OR ENHANCEMENT OF FOOD LEGUME INFORMATION DISSEMINATION AND EXCHANGE PROGRAMS IN THE REGION*

## 1. *RESEARCH IN CROP IMPROVEMENT & TRANSFER OF TECHNOLOGY*

**The major portion of crop improvement research on food legumes undertaken by ICARDA during the last 10 years was on purification of land races the development of genetic variability, as well as selection of plant idiotypes that presented a higher potential for increasing stable yields in the three crops.**

Many lines from base collections or developed by the FLIP breeding program and tested by NARP's have been selected for release or are at pre-release stages:

Table 2 below lists all such lines which have been released by national programs or which are in the last stages of confirmation experiments or seed increase for eventual release.

Table 2. ICARDA germplasm lines released or to be released by NARP's.

| COUNTRY | CULTIVAR & ICARDA ORIGIN | STATUS |
|---|---|---|
| Tunisia | ILC 3279 chickpea (CP) | released 1986 |
| | FLIP 83-46c chickpea | released 1986 |
| | FLIP 83-89 Faba bean (FB) | final national testing |
| | 84s 43238 Faba bean | final national testing |
| | ILL 4400 Lentils | to release in 1988 |
| | ILL 4606 Lentils | to release in 1988 |
| Morocco | ILC 195 CP | released 1987 |
| | ILC 482 CP | released 1987 |
| | FLIP 82-30 FB | seed increase for |
| | FLIP 84-127 FB | verification trials |
| | FLIP 84-128 FB | same |
| | 74TA22, 80S 44027 | same |
| | ILB 1269 | same |
| Syria | FLIP 84-139 FB | On-farm trials |
| | Ghab 1 (ILC 482) CP | released 1986 |
| | Ghab 2 (ILC 3279) CP | released 1986 |
| Jordan | FLIP 86-146 FB | On-farm trials |
| | FLIP 87-136 FB | same |
| | FLIP 87-138 FB | same |
| Egypt | ILB 1270FB | Pre-release multiplication |
| Cyprus | Yialousa (ILC 3279) CP | released 1984 |
| | kyrenia (ILC 464) CP | released 1987 |
| Lebanon | FLIP 87-26 FB | On-farm trials |
| Iran | ILB 1269 FB | Released 1986 |
| Spain | Fardan (ILC 195) CP | released 1985 |
| | Zegri (ILC 200) CP | same |
| | Almena (ILC 2548) CP | same |
| | Alcazaba (ILC 2555) CP | same |

FB = Faba beans, CP = Chickpeas,

## 1.1 *Faba Beans*

In faba beans much emphasis was placed on pathology work and developing resistance to major diseases and pests, as well as faba bean pollination and development of plant types to control vegetative growth and flower and pod drop. One of the objectives of pathology research was to develop lines with uniform resistance to ascochyta blight, chocolate spot, rust, aphids, and orobanche, and combine multiple resistance in agronomically adapted backgrounds that can be distributed to various countries in the region, for use in their breeding programs or for direct use as improved lines. During the last 3-4 years determinant plant types, high auto-fertility, independent vascular system, and closed flower trait to enhance self pollination have been studied with the objective of introducing them into adaptable genetic backgrounds.

Improved screening techniques for disease resistance were developed in collaboration with the University of Manitoba which also received funding ($ 281,512) to work on the main faba bean diseases in the WANA region. Field manuals and guides on the main faba bean diseases were published by ICARDA with the participation of scientists from Manitoba, Sudan, and Egypt.

Rhizobium research on faba bean was carried mainly for defining the need for inoculation in various areas, and selection of superior strains for areas where needed. New simple techniques have been devised and are being used by cooperating countries.

As a result of genetic improvement work and the use of genetic materials developed at ICARDA by national programs, to date one improved faba bean line was released in Iran (ILB 1269) for green pod production. Another line (ILB 1270) is being increased for release in Egypt.

Chile has requested permission to commercially produce seed of 4 ICARDA lines, and Jordan has 3 lines in on-farm trials. Morocco is increasing seed from 5 ICARDA lines for verification trials, and Tunisia has two lines in final national testing trials.

Request for ICARDA international diseases resistance screening nurseries has increased steadily between 1982 and 1987. The faba bean international chocolate spot nursery (FBICSN), the ascochyta blight nursery (FBIABN), and rust nursery (FBIRN),are tested in 51 different locations around the world.

One line from FBICSN, (BPL 1179) was rated resistant over all locations including the most virulent isolate, B-29, found in Manitoba. BPL 710 and BPL 1179 were resistant across all locations but susceptible to isolate B-29. Other sources of resistance were found in all other disease nurseries. These sources of resistance would continue to be used effectively to suppress major faba bean diseases in various countries.

## 1.2 *Kabuli Chickpeas*

In chickpeas, the main emphasis was put on introducing resistance to ascochyta blight and wilt disease, and selection of cold tolerance for winter sowing. Work has been undertaken to screen for resistance to major insect pests such as leaf miner and the cyst nematode and is still continuing. No source of resistance has been found although two lines were described as tolerant (5 on a scale of 1-9). Hundreds of lines were screened for multiple tolerance to stresses, but only different dual tolerances were found in 12 lines so far. Combination of genes for resistance to 2 or more stresses has already been started by ICARDA in 1987-88.

The major achievements in Kabuli chickpea improvement so far has been in the areas of finding resistance to ascochyta blight and in winter sowing.

Trials on winter sowing, which had been started as early as 1975, under the ALAD/IDRC program indicated the possibility of doubling chickpea grain yields .

By 1978 it was evident that winter sowing of chickpeas increased experimental yields from 40 to 60 %, if the blight disease was not present. Winter sown traditional chickpea varieties were extremely susceptible to Ascochyta blight attack. Thus major emphasis was put on finding resistance and transferring it to adaptable genetic backgrounds. Today, with the presence of lines developed by ICARDA that are resistant to the main Ascochyta blight isolates and tolerant to

cold, the potential for increasing grain yields by as much as 100% is attainable in most countries of the WANA region. Winter sowing of chickpeas was seen by the consultant during the mission in three farmers fields in Syria. It was also seen in cooperating farmers fields in Jordan.

The practice seems to have begun to be adopted by farmers of the region but still in a limited way . One of the major limitations associated with winter sowing for farmers is the increased amount of weeds and hence weeding cost. In Tunisia, and Jordan the recommended date of winter sowing for highest experimental yields is being delayed 2-3 weeks to allow for mechanical weed control. This apparently does not reduce yields or reduce them significantly. Although ICARDA and other national programs have given recommendations for chemical control of weeds in winter sown chickpeas, this method has not had consistently positive results, and requires timely mechanized intervention from farmers who either cannot afford the cost or can't readily find the chemical or the sprayer for timely intervention.

It is my opinion that if the desired impact from winter sowing of chickpeas is to be realized, the aspect of weed control should be addressed by ICARDA in an integrated cultural practices-chemical weed control approach. Only this approach may have wide acceptability by the majority of farmers in the region. Well equipped farmers that may be currently using late cultivation and chemical weed control may not consider this as a draw back since economically the increase in yield covers all the extra costs of chemical weed control and leaves an appreciable margin of profit. Additionally winter sowing is conducive to stabilize chickpea production from one year to the other, since the crop has a higher chance of getting good establishment and growth with the more dependable winter rains as opposed to the non-dependable spring rains which are used as basis for spring sowing.

Recognizing that kabuli chickpeas are grown under supplemental irrigation in the Nile valley, south Asia, parts of west Asia, and in Central America, ICARDA has during the last 3 years conducted research to screen for lines that respond to irrigation. A few lines showed more response and doubled their yields under supplemental irrigation. ICARDA plans to incorporate the genes from these lines into high yielding lines for distribution to the above mentioned regions.

## 1.3 *Lentils*

Emphasis in lentils improvement was put on increasing genetic variability in plant height, plant biomass, lodging, pod dehiscence, resistance to rust, cold, and ascochyta blight and wilt, and for improved general plant idiotypes. Hundreds of crosses were and continue to be made every year, 5 % of which are with wild species. Thousands of germplasm lines have been distributed to interested national programs, which have in most cases undertaken to select adapted types for their reg ions. Some six lentil cultivars have been released so far in countries like Ecuador, Ethiopia, Syria, Tunisia, and Turkey, and more releases are imminently expected.

A major part of IDRC funding for lentil improvement at ICARDA has been in the area of systems for mechanical harvesting in collaboration with national programs of Jordan,Syria, and Turkey.($ 226,000 for 3 years). The national programs of the above three countries have been directly funded by IDRC to work on these same problems.

ICARDA has also concentrated on developing germplasm which is adapted for mechanical harvesting. A lentil harvest mechanization course is also offered jointly with the Faculty of Agriculture of Jordan University. Much information has been gathered on evaluating the various prototype machines used for lentil harvesting. Advantages and disadvantages of each system have been well documented after several trials were carried on farmers fields . A seminar on this subject was held at ICARDA as part of the meeting of the International Association on Mechanization of Field Experiments held at ICARDA between May 23rd and 27th, 1987 with 3-4 participants from each interested country.

Of the several equipment tested it seems that the most successful and economically feasible system was the use of a modified double-knife side mounted cutter bar. This involves an investment which can be afforded by the average lentil grower in the countries of direct interest. It does not seem to require major intervention on the part of the average farmer in land preparation and seeding methodology compare to other methods. The seminar concluded that depending on the particular situation of lentil cultivation in each country variations of this

system or adoption of other tested systems like direct combining using 3-4 m combine table widths fitted with air blower for pushing cut plants, may be feasible and economical. The economics and power requirements for all tested machines have been identified with reasonable certainty.

One of the specific objectives of the IDRC_ICARDA project was to identify and interest potential manufacturers of selected implements, ICARDA attempted to interest manufacturers like BUSATIS , " WINTER STEIGE", "HEGE" , and other companies in the development of mechanical technology for harvesting of lentils. "BUSATIS" are manufacturers of the double knife reciprocating cutter bars. It was indicated that some manufacturers are still pursuing the development of lentil harvesters.

The consultant is of the opinion that ample information has been produced on this subject which is useable directly or with some modification to fit special requirements. It now remains the responsibility of national programs to fine-tune the findings and recommendations to best suit their needs. No more research on this aspect should be warranted. The task of sensibilizing local industries to undertake the production or modification of available equipment like the double knife reciprocal cutter bar, remains, in may opinion, to be the major hurdle in wide adoption of the identified techniques. I do agree that unless adoption of mechanical harvesting techniques spreads, the area under cultivation, especially in Syria, Lebanon, and Jordan, will continue to shrink.

Agronomic practices such as sowing rates under different moisture conditions, sowing methods, chemical weed control, and inoculation with nitrogen-fixing bacteria have been investigated under 2-3 agro-ecological conditions in Syria, and in cooperation with other NARP.

In most areas the elements of the agronomic package to realize the genetic potential of each crop have become available. NARP's have in most cases investigated the various elements of the package under their own conditions, and by and large, found that most elements were conducive to increased productivity.

Many of the recommendations arrived at by ICARDA could be transferred to different national programs without much variation.

Agro-economic studies were conducted in association with the Farm Research Management Program, to study cost-benefit ratios for winter sowing of chickpeas, advancement of sowing date of lentils, and mechanisation of lentil harvest.

## 1.4 *Orobanche Studies*

ICARDA was involved in studies to control Orobanche sp. on food legumes since its early days in 1976-77 as a continuation of the work started at the University of Sussex. The synthetic germination stimulants produced at Sussex needed refinement and rigorous testing under field conditions. IDRC simultaneously supported projects at the University of Sussex ($ 88,600 for 2 years), ICARDA ($106,000 for 3 years.), and University of Alexandria ( $45,000 for 3 years).

Inconclusive results were arrived at from limited testing of these compounds under various soil conditions and different Orobanche species and populations. The un-availability of these compounds in larger quantities due to disinterest of manufacturing companies, did not allow more rigorous testing to reach more conclusive evidence of their effectiveness as an economic method of control.

ICARDA has during the last 3-4 years embarked on research to develop an integrated control method through the use of cultural practices and chemical herbicides: It was found that the most promising elements appear to be: solarization, use of tolerant cultivars, and herbicidal sprays. The later part of studies on Orobanche were conducted in close collaboration with the University of Hohenheim with special funding from GTZ, Federal Republic of Germany.

The most practical method found so far has been the use of two herbicides, Glyphosate ( Lancer), and Imazaquin (Scepter), which were in general able to control up to 98 % of the parasitic weed in fababeans and up to 100 % in lentils using two sprays spaced 15 days apart commencing at the tubercle stage of Orobanche growth.

Scepter seemed more effective than Lancer and at lower doses (5-15 grams a.i./ha). The two compounds, although could knock out 40-60% of the weed on fababeans in coastal areas, the remaining population of the parasitic plant grow profusely due to most favourable conditions of moisture and temperature in coastal areas and will usually cause an almost complete crop failure. The successful use of these herbicides to reduce infestation of Orobanche crenata on faba beans in farmers fields in non-coastal regions of Egypt was demonstrated by ICARDA within the context of the Nile Valley Project. The use of the variety Giza 402 developed during the IDRC funded project in Egypt can equally reduce the effect of the parasite in moderately infested farms.

Solarization for 40 days before planting was effective in reducing the number of Orobanche plants as well as plant parasitic nematodes, but also greatly reduced the Rhizobia population in the soil. The degree of reduction seems to have been dependant on the ambient temperature and number of hours of sunlight during the mulching period. The results are very encouraging but need confirmation. Accordingly, more research is being carried out to establish the efficiency of this method, and to test the persistence of the effect over the seasons. The practicality , considering the inputs needed and the costs, may limit wide acceptance of this method on large scale.

## 1.5 *Research Support To FLIP*

ICARDA's scientists are actively involved in research to identify, characterize, and find practical solutions to other factors affecting food legume production in the WANA region.

Entomologists have studied and continue to study the effect of various insect pests of economic importance on the crops. Storage pests whether univoltine or multivoltine have been studied. Practical recommendations for controlling multivoltine pests through fumigation have been given.

The most important non-storage insects in the Middle East, are aphids on faba beans, leaf miner on chickpeas, and Sitona weevil on lentils. These pests can individually cause up to 30 % yield losses. The work at ICARDA is mainly

concentrated on finding genetic sources of resistance for these pests, but alternative control measures including biological control (in the case of leaf miner and aphids ) are also projects of special interest to ICARDA scientists. Sitona weevil control was demonstrated to be possible by the use of the chemical compound Carbofuran, but the economics of its use are not well established for a dependable recommendation.

## 1.6 *LEGUMES IN THE FARM RESOURCES MANAGEMENT PROGRAM*

During a meeting with the Deputy Director General (research) of ICARDA, he has explained the importance of food legumes in the development of the farming output in the area by saying that " ICARDA considers that improving the cereal-legume rotation as the backbone for developing a stable food production system in the area."

Guided by this same strategy ICARDA has since the early days of its establishment, studied the relevant farming system in Syria to identify the basic elements. Since then many short and long term research projects have been undertaken. The main activities concentrated on the effect of soil tillage and cereal stubble management, soil moisture, method of seeding, weed control, fertilizer application ,etc.. on grain and straw yields. Improved techniques of cultural practices were tested in multi-location on-farm trials in Syria, and in other countries who expressed interest in the program. Much information was learned concerning most aspects of crop management in the cereal-legume system. The economics of various technical interventions which resulted in increased productivity were studied and analyzed for use by the farmer.

Recently, in April, ICARDA, has helped the Algerian NARP's conduct a survey study to identify the main pathological-entomological-weed constraints of food legumes, to study their role in the farming system.

In very general terms, the Farm Resources Management Program has established the degree of applicability of experimental findings at farm level, and contributed practical-feedback to the research program. Some main findings are:

a- Weed control in food legumes contributes to around 25 % increase in grain and straw yield of cereals

b- Early seeding of food legumes using grain drills produces more straw yield, and depending on other circumstances will also increase grain yield.

c- Farmers generally delay seeding of legumes mainly due to the excessive weed competition that can result from earlier seeding.

d- Deep tillage, as often practised by farmers of the area, is of little use in enhancing soil fertility for the cereal-legume rotation. Yields are not significantly affected except after fallow.

## 2. *GERMPLASM COLLECTIONS, DEVELOPMENT, & MAINTENANCE*

During the last 10 years ICARDA has dedicated a lot of funds and resources on collecting, purifying, selecting, and dissemination of germplasm lines of the three food legume crops from inside and outside the WANA region.

In faba beans a collection of 3305 open-pollinated lines has been assembled and 5009 pure line accessions derived. Eight hundred and forty pure line accessions having 43 descriptors is being published in a special catalogue to be distributed to all interested personnel and institutions. The germplasm accessions are generally widely distributed separately in response to individual requests or as part of the international nurseries to NARP's for use in their breeding programs.

In lentils 6758 germplasm accessions have been assembled. A lentil germplasm catalogue has been published including passport data on 5424 accessions. Four thousand five hundred and fifty accessions included evaluation data on 19 morphological and stress characters.

Genetic variability for lodging and pod dehiscence has been found and is being utilized. Also resistance to cold, ascochyta blight, rust and wilt has been identified.

In chickpeas 6509 accessions have been assembled at ICARDA. A Kabuli chickpea germplasm catalogue having 3400 accessions described for 29 characters has been published and distributed.

The activity of germplasm development will be reduced in scale as more responsibility for production of breeding material is now being assumed by the NARP's. ICARDA has therefore recently been putting more stress developing screening and breeding methodologies to improve the efficiency of crop improvement.

## 3. *INTERNATIONAL TESTING PROGRAM*

The majority of germplasm collected and developed by ICARDA has been distributed to NARP's via a system of international nurseries and trials.
These included nurseries with advanced or early generation breeding materials, sources for resistance/tolerance to various stresses, crossing blocks, and materials for agronomy-management trials. These nurseries and trials have by and large been designed as per needs of NARP's as conceived early in 1977 and during the continuous interaction between ICARDA and national programs. These have in most cases really served as the backbone of most of the NARP's programs.

In 1979 ICARDA distributed 6 international nurseries to some 15 countries in a limited number of sets. This activity has grown considerably over the years such that in 1987, forty two different nurseries were supplied to 55 countries to the tune of around 1400 sets. As the development of breeding materials with specific agro-ecological adaptation and specific characteristics increased these nurseries have become very specific and for targeted areas. Whereas the bulk of materials included in nurseries in the early eighties consisted of direct accessions from collections, they are now mainly originating from targeted hybridization work.

## 4. *JOINT RESEARCH*

On some food legume problems ICARDA undertook joint research projects with other NARP's, Universities, and other institutions.

For example ICARDA helped the Egyptian NARP to establish an aphid screening laboratory in Giza. Joint screening programs for lentil diseases in Ethiopia and Pakistan and cold tolerance in turkey were conducted. Screening against wilt diseases in chickpeas is jointly conducted in Tunisia and Spain, and for cold tolerance in Turkey and the university of Perugia, Italy.

ICARDA collaborated with Jordan University in developing the system for mechanical harvesting of lentils, within the context of the IDRC supported project with Jordan University. Research collaboration with the American University of Beirut for work on legume quality and other aspects continued since IDRC first supported research projects at A.U.B., and joint research is carried with the University of Aleppo especially as special projects for postgraduate students.
ICARDA collaborated with international institutions , in North America and Europe in the fields of basic research on legumes. A total of 20 institutions involving some 35 collaborators was sited. Among these is the University of Manitoba in Canada where collaborative projects were directly financed by IDRC in the area of fababean pathology lentil haploids and Rhizobia inoculum carriers.

Joint research with NARP's through the use of ICARDA-NARP's coordination committees is already a practice that is followed and is being developed further by ICARDA. The annual coordination meetings to study the results of the research and plan the yearly program serve as a good forum where national scientists voice their views on the critical problems concerning them and reach consensus as to the parts of the research which they will undertake and parts where ICARDA will have input.

In general therefore ICARDA has demonstrated an active role in promoting joint projects with national programs and Universities in areas which are complementary to ICARDA's expertise.

The consultant does not have ample information to comment on the specific advantages, disadvantages, and effectiveness of such joint research projects in reaching the objectives sought after.

## 5. *TRAINING*

**The function of training in food legume research is a major contributor for development of capabilities of the NARP's on one hand and is implemental in strengthening the links between ICARDA and the national programs as well as among national programs.**

ICARDA has helped in the training of some 600 persons involved in scientific work on food legumes from 15 different national program in the WANA region during the last 10 years. Training started initially as resident courses at ICARDA,and has developed during the past few years to include more specialized courses in legume pathology and entomology, biological nitrogen fixation,lentil harvest mechanization, on-farm trial methodology, and crossing techniques.

ICARDA has also embarked on accepting visiting scientists from various national programs to undertake special research projects at ICARDA.
Several in-country training courses were held during the past few years on different aspects. For the last 2-3 held in North Africa research staff from neighbouring countries were invited to take part in these 4-7 days training courses, and participation was rather encouraging.

**The structure & content of the training program is being adapted to the needs of the NARP's, and as these become more developed the needs become more specific. It is planned that starting 1989 a specialized training course for research associates in very specific areas requested by NARP's will be given. Candidates for these courses are selected by joint coordination committees involving scientists from ICARDA and the NARP's.**

A graduate research training program was created recently and received a number of applicants where students were registered in postgraduate programs at Universities in the region (A.U.B, Jordan University, University of Alexandria,

University of Aleppo), and do their research at ICARDA. This has helped to strengthen the links between ICARDA and NARP's. Recently however, **Areas of special interest have been identified in Microbiology, advanced breeding methods, and cropping systems.**

As the training activities become more specialized, ICARDA is upgrading the level and quality of their training manuals, and developing special audio-visual modules. The scientist responsible for training in the FLIP program is also proposing the use of International experts from developed countries to participate in specialized training work shops for different countries in the region.

In the area of reporting on results of international nurseries, training of young researchers in the NARPs has been quoted as the main reason for improving the status of reporting research results of ICARDA nurseries from 20 to 60 % during the last 4 years.

ICARDA scientists have made individual visits to various NARPs to advise on various aspects of food legume research and to learn about the performance of their materials and trials. While this type of contact was good, it was mentioned by national scientists and ICARDA scientists that more impact was achieved by "Travelling Workshops" and in-country training courses, because they have alerted all scientists concerned of the problems involved, have resulted in quicker feed-back and exchange of information. This has also helped in responding to the needs of NARP's more quickly, and facilitated the process of adoption of new superior germplasm lines, varieties, and techniques. This approach has been very successful even internally within the NARP's as evidenced in Pakistan. FLIP scientists should, in my opinion, enhance this activity even further.

In 1987 ICARDA conducted 4 training courses for candidates from 13 countries in the region: summary is given in the table below. This serves as an indication of ICARDA's ongoing activities.

Table 3. Summary of training courses given by FLIP in 1987. *

| Type of Course | Topics | NO. OF participants | NO. of countries Represented |
|---|---|---|---|
| Training at Aleppo | Crop Improvement, Biological Nitrogen fixation, Lentil harvest Mechanization | 32 | 13 |
| In-Country | Crop Improvement, Crossing techniques | 99 | 03 |
| Individual no-degree training | Breeding, Pathology Microbiology, Agronomy Data Processing Quality Entomology crossing techniques Computer data analysis Training methodologies | 28 | 08 |
| Individual degree training | Agronomy, Breeding Physiology, Lentil harvest Mechanization | 3 M.Sc's & 8 Ph.D's | 06 |

* Source: Annual report of FLIP, 1987.

The countries represented in these training programs were Algeria, China, Egypt, Ethiopia, Iraq, Jordan, Morocco, Sudan, Syria, Tunisia, Turkey, N.Yemen,and South Yemen.

## 6. *Regional and Sub-Regional Research Networks*

A sub-regional network has been developed in the Nile Valley covering the NARP of Egypt, Sudan, and Ethiopia for work on fababeans. The linkage among the NARP's including ICARDA is multilateral in this subregion. Food legume scientists have been posted permanently in Morocco and in Ethiopia to strengthen the NARP's of North African countries and Ethiopia.

The North Africa sub-region covering the Maghreb countries has also received special importance.

As a result of a general evaluation of ICARDA's activities by the committee representing the donor group, a recommendation was made to move the activities of faba bean research from Aleppo to a sub-regional centre in North Africa where faba beans are most important in the WANA region. Morocco was chosen to be the headquarters for this sub-regional program since it is the major producer of faba beans in WANA. It is hoped that the development of joint research programs in this crop with centres of expertise in the North African national programs and with Spain would take place, in all research and development activities especially however in the area of disease and Orobanche resistance.

ICARDA, with major funding from IDRC, has demonstrated the ability to establish successful sub-regional research programs in the work done in Tunisia, where a first rate program is now in place where there was none some 7 years ago. The same capability can be clearly demonstrated in ICARDA's role and contribution to the success of the Nile Valley Project.

IDRC's support of national food legume research programs prior and during ICARDA's mandate has been very important in strengthening the links between ICARDA and NARP's of North Africa and West Asia. The strength of national programs in the region brought about by direct IDRC support ensured that results and materials developed by ICARDA and NARP scientists were effectively utilized at the national level. The ICARDA FLIP program was the focus of this network, and has provided the NARP's with germplasm, elite lines and other genetic materials, technical back-up through exchange visits, publications, training, and the development of appropriate research methodology that was useful for the national programs.

The many seminars, workshops and international meetings held at ICARDA so far, and attended by many scientists from various countries in WANA, and around the world has made possible the development of personal contacts between scientists, and facilitated bilateral exchange between NARP's. Nevertheless exchange of information and germ plasm and technology among NARP's continue to be strongest by using ICARDA as an intermediate partner. The international testing nurseries program of FLIP and special publications like FABIS, and LENS has been a very useful vehicles for this exchange.

The consultant is of the opinion that until all National Programs reach a certain stage of maturity where each will have something to offer to the others for mutual benefit the role of ICARDA as an intermediate partner must be maintained and encouraged

## 7. *INFORMATION DISSEMINATION*

Before the creation of ICARDA, a very limited amount of literature dealing with food legumes could be found worldwide, scattered in various journals, monographs etc.. When ICARDA got the mandate to develop research of these crops, the first function was information gathering and consolidation. This was successfully done through the convening of seminars and workshops involving scientists from all parts of the world. Proceedings of these were published through the help of agencies like IDRC and served an important primary function of generating interest in research and publishing on these crops. Since then ICARDA, has played the role of the assembly house for information generation on food legumes. And through aid from IDRC and other donor agencies have developed this activity to serve the NARP's and any interested scientist in the world.

The number of reports, newsletters, abstracts, monographs, field guides, germplasm catalogues, proceedings, bibliographies, etc.. that have been produced during the last 10 years is quite impressive. Most of this is available for distribution worldwide whereas some are targeted to the main cooperating countries in the WANA region. IDRC, in its role as promoter of exchange of information maintains most of the publications in microfiche archives and encourages people working on these crops to use them.

There are now five main periodicals for publishing information on these legumes. FABIS, Faba Bean Abstracts, and Faba bean in AGRIS, all of which have worldwide distribution, and LENS, and Lentil Abstracts. The demand for reprints for faba bean literature has increased from 85 in 1987 to 1000 in 1988. That for lentils is around 200.

## 8. *COMMENTARY*

Hypothetically if ICARDA was not given a mandate to work on food legume development, and some or most of the CGIAR and other funding was directed for individual national programs instead, what would have been different today? Only aspects related to the contribution of ICARDA will be touched on by the Consultant in attempting to highlight this contribution.

1- There would not have been a comprehensive germplasm collection, maintained and used to the benefit of all countries concerned.

2- Work on problems of global importance such as disease resistance, Orobanche tolerance and control, mechanization of harvesting in lentils, and requirement for inoculation and development of efficient Rhizobia strains, would have been fragmented and with reduced general applicability and impact of research results.

3- There would not have been an international testing program to benefit the various countries, but rather limited development of fragmented germplasm collected by each country.

4- The capacity of the individual national programs reflected by lack of or insufficient availability of trained scientists to work on food legumes, could have, in most countries, caused inefficient use of funds, in improperly streamlined or well conceived projects,as no specialized facility for training of young national scientists specifically in the area of food legumes such as the one created at ICARDA would have been available for training of young national scientists and thus enhancing the commitment of individual countries to continue their work on these crops.

5- The publication of research efforts and results may have been fragmented and scattered and not easily accessible to all scientists and interested institutions in the area or the world.

6- Due to political differences and other constraints , cooperation among scientists of the various national programs would have been minimal or non-existent, and thus the idea of a creating a research network, an idea strongly promoted by IDRC, would have not been developed in reality.

7- There would have been duplication of research work, and research projects would have most probably been targeted at simple problems of practical nature, leaving the basic problems with very little attention.

8- More funds may have been directed by national programs for carrying practical research and demonstration of partially successful technologies arrived at under local situations. While this may have brought about a positive impact in the short term, in the long term the results may not have been very beneficial.

It is the consultant's opinion that the support of IDRC and other funding agencies for ICARDA's FLIP program with all the resulting output, together with direct financial and moral support of the individual national programs has been the most efficient way of stimulating national, regional, and international interest in the development of food legumes.

The FLIP scientists have since 1977 established good personal and professional contacts with national scientists. These relationships have been very implemental in bringing about cooperation in the area of food legume research.

***National food legume scientists have helped FLIP tremendously through personal meetings, seminars, and workshops, with invaluable local information regarding their needs and aspirations which was used by FLIP to set the objectives and develop methodology for undertaking research and development work on food legumes for the WANA region as a whole.***

Between 1978 and 1985, the FLIP program has contributed germplasm, information and practical concepts and methodology to cooperating national programs. Subsequently and with the maturing of these national programs there is more and more feedback and contribution to the betterment of FLIP program. It was evident to me that the role of the research objectives and methodologies used by FLIP and national programs are clear in the minds of both, national program scientists and FLIP scientists, with a clear indication of growing participation on equal basis . Each comprehend their role with more certainty.
This, in my opinion will bring about a more fruitful cooperation effort for improving output from food legume research in the area.

*ICARDA's ROLE DURING THE NEXT 10 YEARS*

The consultant has visited and learned about the food legume programs of four countries that have been directly supported by IDRC funding. Each of these national programs was important in its own special way, as described in the introduction of the report. Each program has worked in various degrees of cooperation with ICARDA's FLIP. Each program has had its own priority problems, although many problems are common to all. The degree of development in the national programs was a function of two main factors: the national commitment, and the intensity of cooperation with FLIP. All national programs have come a long way compared with the way they started. They have all matured in the areas of capability to conduct commodity oriented practical research. Their capability in conducting basic research on the problems plaguing these crops is variable but generally limited. While some countries may not lack trained scientists, this factor plus lack of funding, modern facilities, and well conceived coordinated targeted approaches, may, in most instances inhibit the individual national program from undertaking such required basic research.

The Consultant is encouraged by the fact that the FLIP scientists met during the mission have a very clear view of their changing role viz a viz the role of the national programs. Their approach to improving food legumes has been slowly shifting towards gaining more basic information about the factors limiting further improvement and researching novel methods for dealing with these factors,

particularly as the National Programs now have increasing responsibility in developing new cultivars. The breeding program has well identified sub-programs targeted at various regions.

More basic research is being conducted on diseases, pests, and methods of their control, the results of which can be applicable over the whole area. The FLIP program recognizes the need to help national programs in building or fine-tuning their seed production systems, an activity which so far has been considered as a total responsibility of NARP's. The consultant is of the opinion that ICARDA should step up its technical aid to NARP's to speed up the process of putting in place scientific seed production systems, as this continues to be a major limiting factor in the adoption of food legume production technologies.

While still trying to increase genetic variability for agronomic characters, FLIP is embarking on projects to identify the physiological constraints for grain yield and hence researching methods for improving the crops physiological response under different environments to impart high stable yields.

The development of the research techniques and methodologies for studying the various constrains can also be sited as one issue to which FLIP may give priority in the coming few years, as this will directly bear on the accuracy and speed at which dependable results will be achieved.

ICARDA's Deputy Director General (Research) explained FLIP's evolving role and indicated that FLIP will give due emphasis on researching the stress environment under which food legumes are grown, and will conduct basic and back-stopping research with the major aim of allowing food legumes to efficiently replace fallow in the traditional crop rotations in WANA.