



**Food  
Legume  
Improvement  
and  
Development**

Proceedings  
of a  
workshop  
held at The  
University  
of Aleppo,  
Syria,  
2-7 May  
1978

Geoffrey C.  
Hawtin  
and  
George J.  
Chancellor,  
Editors

**ARCHIV  
35914**



The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Government of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are in Ottawa, Canada. Regional offices are located in Africa, Asia, Latin America, and the Middle East.

© 1979 International Development Research Centre  
Postal Address: Box 8500, Ottawa, Canada K1G 3H9  
Head Office: 60 Queen Street, Ottawa

Hawtin, G.C.  
Chancellor, G.J.  
International Center for Agricultural Research in the Dry Areas, Aleppo SY  
IDRC-126e

Food legume improvement and development: proceedings of a workshop held at the University of Aleppo, Aleppo, Syria, 2-7 May 1978. Ottawa, Ont., IDRC, 1979. 216 p.:ill.

/IDRC publication/. Compilation of workshop papers on /legume/ /food production/ in the /Middle East/ and /North Africa/ — discusses agro/bio-climatology/ and /cultivation system/s, /nutrition/al value and /food composition/; /plant production/ (particularly of /chickpea/s, /lentil/s, and /faba bean/s), /agricultural research/, /cultivation practice/s for /plant protection/; /plant disease/s, /insect/ /pest/s, /disease resistance/, /weed control/ problems (use of /herbicide/s in /arid zone/s); /plant breeding/ and /genetic improvement/. /IDRC mentioned/, /list of participants/.

UDC: 633.3

ISBN: 0-88936-202-5

Microfiche edition available

## **Food Legume Improvement and Development**

Proceedings of a workshop held at  
the University of Aleppo,  
Aleppo, Syria, 2-7 May 1978

*Editors:* Geoffrey C. Hawtin and George J. Chancellor

*Published by the*  
International Center for Agricultural Research in the Dry Areas  
*and the*  
International Development Research Centre

*The views expressed in this publication are those of the individual author(s) and do not  
necessarily represent the views of ICARDA or IDRC.*

ARCHIV  
633.3  
H 3  
1978

# Contents

Preface .....	4
Foreword .....	5
<b>Section I An Introduction to Food Legumes in the Region</b>	
Some aspects of the agroclimatology of West Asia and North Africa <b>Hazel C. Harris</b> .....	7
Food legume production: the contribution of West Asia and North Africa to the world situation <b>F.M. Hamawi</b> .....	15
Food legumes in the farming system: a case study from Northern Syria <b>David Gibbon and Adrienne Martin</b> .....	23
Nutritional quality and importance of food legumes in the Middle Eastern diet <b>Raja Tannous, Salah Abu-Shakra, and Abdul Hamid Hallab</b> .....	29
<b>Section II The Present Production and Improvement Situation</b>	
Food legumes in Algeria <b>Walid Khayrallah and Lounes Hachemi</b> .....	33
Production and improvement of grain legumes in Egypt <b>Ali A. Ibrahim, Abdullah M. Nassib, and Mohamed El-Sherbeeney</b> .....	39
Food legume production in the Hashemite Kingdom of Jordan <b>M. Abi Antoun and A. Quol</b> .....	47
Food legume production and improvement in Iran <b>M.C. Amirshahi</b> .....	51
Food legumes in Iraq <b>Mahmoud A. Mayouf</b> .....	55
Food legume research and development in the Sudan <b>Farouk A. Salih</b> .....	58
Food legume improvement in Tunisia <b>M. Bouslama and M. Djerbi</b> .....	65
Food legume production and improvement in Lebanon <b>R. Lahoud, M. Mustafa, and M. Shehadeh</b> .....	69
Grain legume production in Turkey <b>D. Eser</b> .....	71
Food legume research and production in Cyprus <b>J. Photiades and G. Alexandrou</b> .....	75
Broad beans ( <i>Vicia faba</i> ) and dry peas ( <i>Pisum sativum</i> ) in Ethiopia <b>Asfaw Telaye</b> .....	80
Food legumes in Syria <b>Sadek El-Matt</b> .....	85
Food legume improvement in the People's Democratic Republic of Yemen <b>Shafiq Mohsin Atta</b> .....	88
Food legume production in Libya <b>Ali Salim</b> .....	90
Status of food legume production in Afghanistan <b>N. Wassimi</b> .....	91
Food legumes in India <b>A.S. Tiwari</b> .....	94
<b>Section III Disease Problems on Legume Crops</b>	
Diseases of major food legume crops in Syria <b>S.B. Hanounik</b> .....	98
Food legume diseases in North Africa <b>M. Djerbi, A. Mlaiki, and M. Bouslama</b> .....	103
Food legume diseases in Ethiopia <b>Alemu Mengistu</b> .....	106
Diseases of broad beans ( <i>Vicia faba</i> ) in the Sudan <b>Mustafa M. Hussein and Sami O. Freigoun</b> .....	109
<b>Section IV Major Pests and Weeds of Food Legumes</b>	
Insect pests of food legumes in the Middle East <b>Nasri S. Kawar</b> .....	112
Insect pests of chick-pea and lentils in the countries of the Eastern Mediterranean: a review <b>G. Hariri</b> .....	120
Some insect pests of leguminous crops in Syria <b>Ara A. Kemkemian</b> .....	124
The biology and control of <i>Orobanche</i> : a review <b>A.R. Saghbir and F. Dastgheib</b> .....	126
Broomrape ( <i>Orobanche crenata</i> ) resistance in broad beans: breeding work in Egypt <b>Abdullah M. Nassib, Ali A. Ibrahim, and Hamdy A. Saber</b> .....	133
Accentuation of weed control problems in the dry areas with relevance to herbicides in food legumes <b>F. Basler</b> .....	136

## **Section V Food Legume Development**

Genetic resources of grain legumes in the Middle East <b>L.J.G. Van der Maesen</b> .....	140
Strategies for the genetic improvement of lentils, broad beans, and chick-peas, with special emphasis on research at ICARDA <b>Geoffrey C. Hawtin</b> .....	147
Some agronomic and physiological aspects of the important food legume crops in West Asia <b>M.C. Saxena</b> .....	155
The role of symbiotic nitrogen fixation in food legume production <b>Rafiqul Islam</b> .....	166
The ICARISAT chick-pea program with special reference to the Middle East <b>K.B. Singh</b> .....	170
Methods of population improvement in broad bean breeding in Egypt <b>Abdullah M. Nassib, Ali A. Ibrahim, and Shaaban A. Khalil</b> .....	176
Pollinating insects: a review <b>Ara A. Kemkemian</b> .....	179

## **Section VI Cooperative Approaches to Food Legume Improvement at the National Level**

The training and communications program at ICARDA <b>S. Barghouti</b> .....	181
FAO food legume programs in the Middle East and North Africa <b>Hazim A. Al-Jibouri and A. Bozzini</b> .....	185
The food legume improvement and development program of the field crops section at ACSAD <b>L.R. Morsi</b> .....	190
The role of IDRC in food legume improvement research <b>F. Kishk</b> .....	192

## **Section VII Recommendations for Future Research Priorities** .....

<b>Bibliography</b> .....	199
---------------------------	-----

<b>Participants</b> .....	214
---------------------------	-----

## **Methods of Population Improvement in Broad Bean Breeding in Egypt**

Abdullah M. Nassib, Ali A. Ibrahim, and Shaaban A. Khalil

*Food Legume Research Section, Field Crops Institute, Agricultural Research Centre, Giza, Orman,  
Egypt*

The commercial varieties of broad bean currently used in Egypt are the latest in a series of varieties evolved through individual plant selection or hybridization in the cultivated Egyptian landraces, which are mainly of the medium- and small-seeded types. These varieties have a rather extended flowering period and are tolerant to chocolate spot (*Botrytis fabae*) and rust (*Uromyces fabae*), the most common fungal diseases of the country, especially severe in the North Delta of the Nile. As a result, the large-scale distribution and adoption of these improved types has led to a considerable improvement in both the level and stability of seed yield.

Selection from this rather narrow genetic base has, however, tended to result in varieties with very similar branching, flowering, and fruiting characteristics, and it seems that most of the original genotypic variation available from natural sources within the country has been exploited. As a consequence, little further progress is expected from the traditional improvement scheme involving selection from local land varieties. Despite this, studies of selected strains collected from different parts of the country have revealed differences in agronomic characters that could be used for further improvement and so this method still continues to be a part of the overall Egyptian breeding program.

In addition to the selection program, improvement efforts have also focused extensively on biparental crosses involving selections of landraces or landraces and introductions and aimed at improving disease resistance and adaptability. However, to date, only 1 cross out of 66, NA 29 (Holland)  $\times$  Giza 1 (Commercial variety) has proved highly successful. This cross has resulted in the production of two varieties, namely Giza 3 and Giza 4, through the pedigree method. Giza 3 is tolerant to fungal diseases and has an average seed yield 11% greater than its parent Giza 1; it is well adapted to production in the North Nile Delta region. In contrast, Giza 4 is much more widely adaptable, yielding 5% more than Giza 3 in the South Delta and Middle Egypt regions and 6% more than the local variety Revaia 40 in Upper Egypt.

### **Population Improvement**

In spite of the advances achieved by past breeding efforts it appears that line breeding based on recombinations from biparental crosses does not permit rapid progress in broad bean improvement. New approaches are thus needed to achieve the improvements in yield level and stability that seem possible.

Broad bean stands midway between a completely self-fertilized and a completely cross-fertilized crop, having on average one-third outcrossing and two-thirds selfing. In Egypt, considerable variation was found in the percentage of cross pollination, and this could be attributed to the varying climatic conditions affecting the prevalence of insect pollinators. However, unlike most self-fertile crops, broad beans require the action of an insect alighting on the flower to cause the dehiscing anthers to come in contact with the stigma (a process known as tripping). So, despite being only 33% cross pollinated, broad

beans may be considerably reliant upon insects, specifically wild bees, to give adequate fertilization and hence good pod set. This is one of the reasons why seed yields tend to vary greatly between years and locations, depending to a large extent on the wild bee population.

In England, studies on the possibility of producing a completely autofertile broad bean crop have revealed the presence of many of the necessary characters in available lines but, in general, in association with low levels of seed yield and adaptation. The total number of pods per plant has been found to be a good selection index for improving seed yield in broad beans; however, a negative correlation between seed weight and pods/plant tends to limit the improvements that are possible by using this criterion.

It thus appears that there is considerable scope for improvement of this crop by methods aimed at breaking the association between low yield and high autofertility levels on the one hand and low number of pods per plant and high seed weight on the other. Even in the absence of linkages between characters, frequent hybridization is necessary to release variability, which is the prerequisite for selection. Therefore, a population improvement program that involves continual crossing designed to give the maximum opportunity for the rearrangement of genes in linkage groups and designed to provide a wide range of genetic backgrounds against which the genes and gene arrangements can be expressed seems to be the best method of tackling this problem. In addition, continuous selection will be essential so that the improvements generated by each series of crosses are accumulated and concentrated in the population. A system of recurrent selection, under which pressure is applied to a freely intercrossing population and the selected material is again intercrossed and subjected to selection, so that a series of crossing and selection cycles result in continuous genetic improvement, appears to be the breeding method best suited to satisfying both these criteria. This method, by which the population itself is improved from generation to generation, steadily increases the chance of identifying individuals with the required combinations of characters. These individuals are then propagated as pure lines and form the new variety for multiplication.

### **Establishing Populations**

Recognizing the potential of this breeding method, the broad bean improvement program in Egypt has been focusing on recurrent selection since 1974. Nine composite populations aimed at achieving varieties with higher adaptability, disease resistance, and good protein quality have been established in the intervening 4 years. Entries included in these composites are characterized by genetic diversity and desirable agronomic characters. They include cultivated landraces, hybrid derivative lines selected from yield trials, commercial varieties, and introductions. Each entry is represented by 5–10 seeds in each composite, which is grown in a 1 or 2 Saran screen compartment (mesh=20×20 mm) of 7.20 m × 3.60 m × 1.80 m in size.

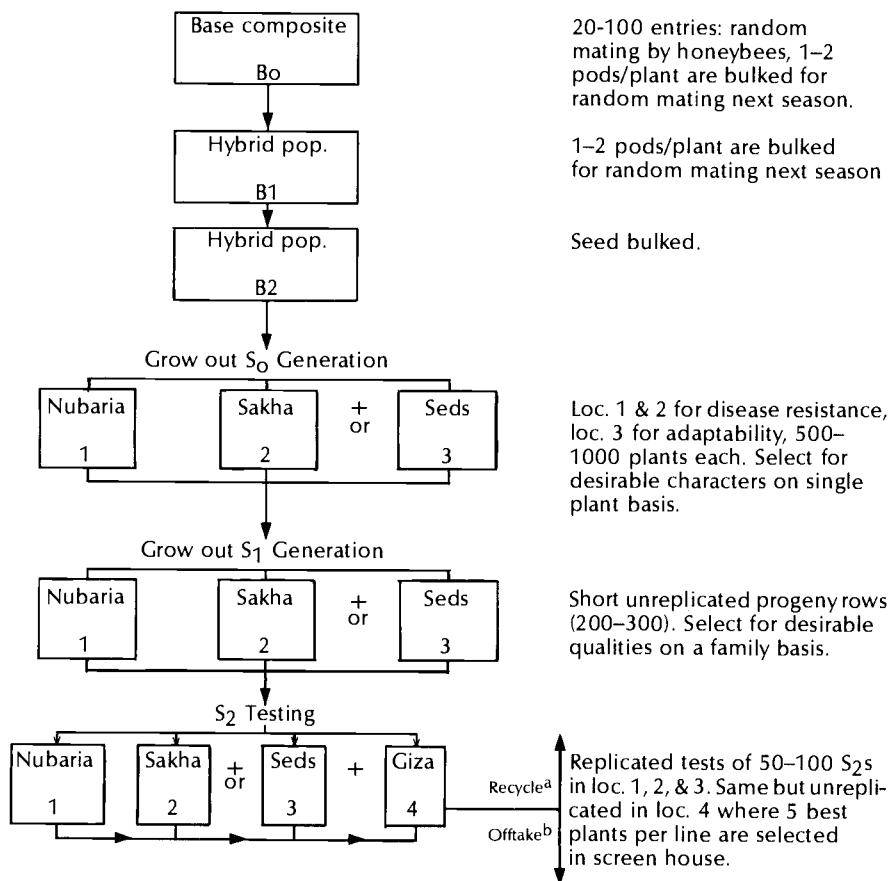
### **Increasing Random Mating by using Honeybees**

To increase both cross-pollination and seed set, a small framed nucleolus beehive (60 × 45 cm) is placed in each Saran compartment immediately following flower initiation. The hive is supplemented with a new brood of honeybees every 10–15 days during the flowering season, which usually extends for up to 60 days. Studies using a genetic marker have indicated that, under these conditions, cross pollination can be as high as 79.9%. It thus appears that this technique is very useful as a breeding method to ensure a freely intercrossing population.

### **Recurrent Selection**

Random mating, using the honeybees, is continued in the composite for three seasons, the composite in the second and third seasons being composed of the seed bulk from one or two pods sampled from each plant grown in the previous season. The remnant seed bulk can be handled as a hybrid bulk population on which the pedigree or improved bulk breeding method is applied to identify lines with the desirable characteristics.

After three seasons of recombination, the populations are then grown out for selection. Composites destined for selection with regard to disease resistance are grown at the Nubaria and Sakha research stations, and while those to be selected for adaptability, protein content, and other characters are grown at Seds. Replicated tests for yield determination are carried out in the  $S_2$  generation at these three locations in addition to Giza, where the best selected lines from all the locations are grown for selection and recycling (Fig. 1).



<sup>a</sup>Only the five selections in each of the 10% best performing lines over locations are recycled.

<sup>b</sup>Offtake for pedigree, selection, or bulk population improvement can be done at all stages.

Fig. 1. Recombination and selection procedure for population improvement in broad beans (*Vicia faba* L.).

With this program it is hoped that selection from continuously improving populations will result in the continuous generation of improved high-yielding disease-resistant and adaptable varieties suitable for production in Egypt.