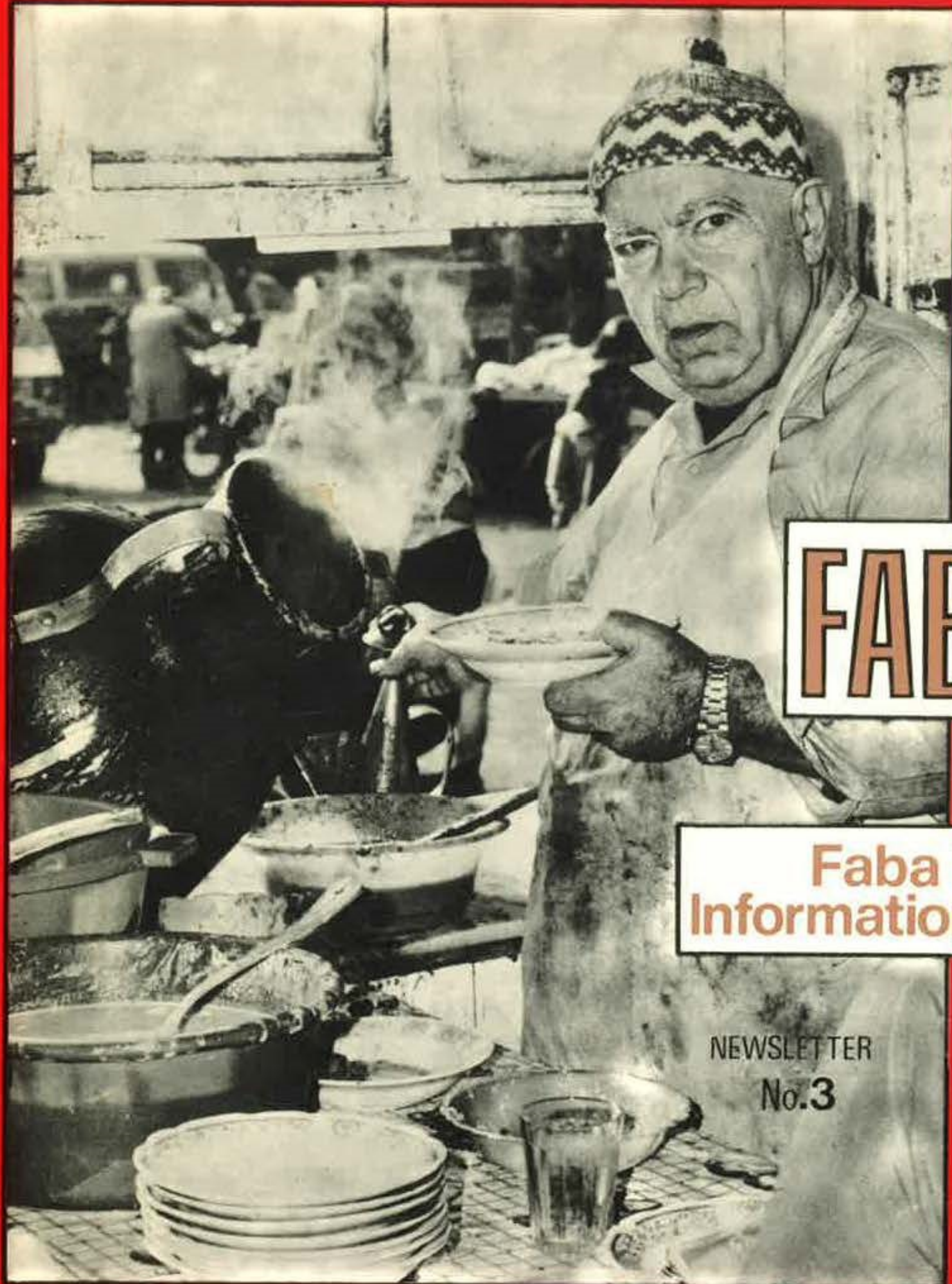


FABIS

Faba Bean Information Service

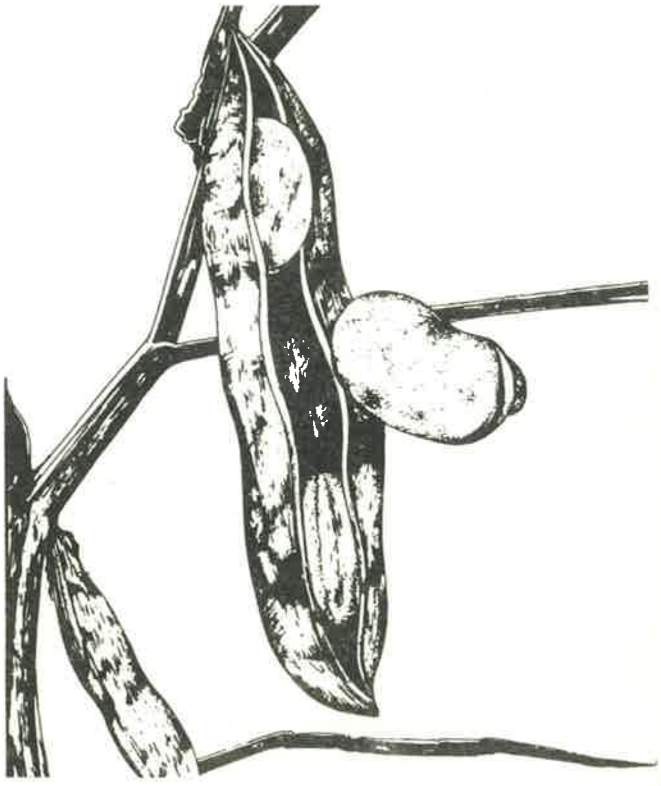
NEWSLETTER

No.3

APRIL 1981

THE INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS
ICARDA

Contents



FABIS

Introduction

This issue of the Newsletter contains the same sections which appeared in Newsletter No. 2, with the exception of 'Institution Reports' and 'Names and Addresses' (see below under 'Directory of Faba Bean Research'). In this issue the 'Letters and Announcements' section highlights the recent International Faba Bean Conference which took place in Cairo, Egypt from March 7th to 11th, 1981.

The General Articles in this issue focus on Seed Quality and Nutrition. In addition, there is a General Article from Sudan on faba bean breeding. This issue also contains a Short Communication on faba bean production and research in China, a country which is featured in FABIS for the first time.

The General Articles in Newsletter No. 4 will feature **faba beans in different cropping and crop/livestock systems** in the different regions of the world. These articles will be prefaced by a General Article surveying world faba bean production and the variability of the different farming systems containing faba beans. If you or any other researcher you know would be willing to write a General Article on the above topic for the country or region in which you are working, please write to :

The Editors,
FABIS,
Training and Communications Program,
ICARDA, P.O. Box 5466, Aleppo, SYRIA

Subscriptions

In order to cover the rapidly increasing mailing costs it has been decided to introduce a subscription charge for the FABIS service for all those listed on the mailing list outside the Near East and North Africa region (the region of primary concern for ICARDA). The subscription charge for the year 1981 has been fixed at **$5.00**. This charge will entitle a mailing list member to:—

- **FABIS Newsletter No. 3**
- **Directory of Faba Bean Research** (scheduled for July 1981)
- List of **Genetic Variation within** *Vicia faba* (scheduled for distribution with Newsletter No. 3)
- **Faba Bean Abstracts** (published as part of the FABIS service by CAB/ICARDA)

Please note that subscription charges do **not** apply to researchers resident in the Near East and North Africa region (ICARDA's mandated region) or to researchers resident in other countries popularly termed 'developing'. Thus the following are liable to subscription charges :

Residents of **Japan, Australia, New Zealand, Canada, U.S.A., Austria, Belgium, Czechoslovakia, Denmark, East Germany, Finland, France, Greece, Holland, Italy, Poland, Portugal, Spain, Sweden, Switzerland, the United Kingdom, West Germany, Yugoslavia**
Researchers in international organisations.

Subscription charges can be paid by filling in the slip of paper at the beginning of the Newsletter, and sending it with a cheque (preferably) or cash to the value of $5.00 (or the equivalent) to the FABIS address. Cheques should be made payable to 'FABIS'.

We have already received a number of cheques to the value of $2.00 following the announcement concerning subscription charges in Newsletter No. 2. We would be grateful if all those who sent $2.00 could now send a further $3.00 to make up the new $5.00 charge.
And please note that **the FABIS mailing list for 1982 will only consist of those people who have paid their subscription for 1981.** If you don't pay this year, you won't get a Newsletter next year. Thank you.

Future Issues

We plan in the future to increase the frequency of the FABIS Newsletter, and in 1982 we aim to bring out two issues. Contributors are requested therefore to send General Articles/Short Communications by December 1st for appearance in the first of the two 1982 Newsletters, but we will be pleased to receive contributions **at any time** thereafter for inclusion in later issues.

List of Genetic Variability

The appearance of Newsletter No. 3 should coincide with that of another FABIS publication entitled 'Genetic Variability within *Vicia faba*'. The latter consists of a list of all the different characters of faba beans so far identified together with their sources and other comments. The list was originally prepared by Dr. G.P. Chapman of Wye College, U.K., who also wrote the introductory notes. The original list was circulated to many members of the FABIS mailing list, whose comments have been incorporated. The list is not intended to be complete, and the many expected additions and modifications should be sent to

'Genetic Variability List'
FABIS,
Training and Communications Program,
ICARDA, P.O. Box, 5466, Aleppo, SYRIA

Directory of Faba Bean Research

The names and addresses of individual faba bean researchers and their institutions which appeared in the last two issues of the Newsletter have been added to, revised and corrected over the past year. We also sent out a questionnaire asking for details of your research interests.

Thank you to all those of you who replied to this request. As a result, we now have a large collection of information on the people and institutions conducting faba bean research throughout the world. We have put this together in a single FABIS publication called 'Directory of Faba Bean Research'. This will appear later this year, and we hope you find it useful. Please send your comments, corrections and additions to the Directory to

'Directory of Faba Bean Research',
FABIS,
Training and Communications Program,
ICARDA, P.O. Box 5466, Aleppo, SYRIA

Faba Bean Abstracts

By the time this Newsletter appears, you should already have received a copy of the first issue of 'Faba Bean Abstracts', a new abstract journal published by the Commonwealth Agricultural Bureaux (CAB) for ICARDA, as part of the FABIS service. For the first year, this journal is being distributed **free** to all members of the FABIS mailing list. The journal will contain abstracts of articles on faba bean research which have appeared recently in the international literature. It will be published quarterly. CAB is also producing for ICARDA 'Lentil Abstracts', a second new abstract journal, which may be of interest to many of you. The journal will appear annually, and the first issue will be distributed **free** to all members of the LENS mailing lists. If you would like to receive a copy of this journal please write to the Training and Communications Program at ICARDA.

Faba Bean Recipes

The recipes that appear in this Newsletter are reproduced with the author's kind permission from

'The Faba Bean Cook Book' by Lorna Hawtin, ICARDA Internal Document, March 1981.

Faba beans ('foul') in Aleppo market ('souk')

FABIS Co-ordinating Committee Members

EGYPT
Mr. Abdalla Nassib
Food Legume Section,
Field Crops Institute,
Agricultural Research Center,
Giza.

SUDAN
Dr. Farouk A. Salih
Agricultural Research Corporation,
Hudeiba Research Station,
P.O. Box 31,
Ed-Damer.

SYRIA
Dr. Geoff Hawtin
Food Legume Improvement Program,
ICARDA,
P.O. Box 5466,
Aleppo.

JAPAN
Dr. Kiyoshi Kogure
Faculty of Agriculture,
Kagawa University,
2393 Ikenobe,
Miki-tyo,
Kagawa-ken.

CANADA
Dr. Claude Bernier
Department of Plant Science,
University of Manitoba,
Winnipeg,
Manitoba R3T 2N2

BRAZIL
Dr. Homer Aidar
National Center for Research
on Rice and Beans,
BR-153, km. 4 - Goiania/Anapolis,
Caixa Postal 179,
74.000 - Goiania, Goias.

FRANCE
Dr. J. Picard
Station d'Amelioration des Plantes,
INRA,
B.P. 1540,
21034 Dijon Cedex.

ITALY
Dr. Ciro de Pace
Istituto di Miglioramento Genetico
della Plante Agrarie,
Universita di Bari,
Via Amendola 165,
70126 Bari.

SPAIN
Dr. J.I. Cubero
Escuela Technica Superior de
Ingenieros Agronomos,
Departmento di Genetica,
Apartado 246,
Cordoba.

U.K.
Dr. D.A. Bond
Plant Breeding Institute,
Maris Lane,
Trumpington,
Cambridge CB2 2LQ.

Letters and Announcements

Letters to the Editors

Dear Sirs,

I agree with Ir. Heringa (FABIS 2, 14) that seed shape is often a better character with which to classify samples of *V. faba* as *major, equina* or *minor* than 1000 seed weight. Hanelt (Kulturpflanze 20, 75-128 (1972)) summarised the values for the three groups given by six authors for length of seed (mm); Karsai (Agrobotanika **16**, 109-122 (1974)) defined width as well as length, and Kiffman (Z. Acker Pflanzenbau 94, 422-424 (1952)) included thickness as well. Length and thickness are characters which would seem to define the large flat seeds of *major* types most clearly, however, the above authors do not agree precisely on where the lines should be drawn between the three botanical varieties.

Has anyone devised a formula based on two or more of the above four characters (seed weight, length, width and thickness) which is becoming or might become internationally accepted as a means of defining the botanical varieties?

D.A. Bond

Plant Breeding Institute,
Cambridge,
ENGLAND, U.K.

Dear Sirs,

A list of the species in the tribe Vicieae (that is species in the genera *Vicia, Lathyrus, Lens, Pisum, Vavilovia* and *Anatropostylia*) and an index to synonyms are available now as the first products from our Vicieae Data-base Project. I can supply copies of these to any FABIS readers who request them. I imagine that the list and index may be of use to workers interested either in species closely related to *Vicia faba* or in other cultivated *Vicia* species.

We are at present making a computer data-base containing taxonomic, morphological and phytochemical data for the species of the tribe and making a germplasm collection for the wild species. At a later date we hope to provide an experimental taxonomic information service.

Yours sincerely,

Frank Bisby,

Vicieae Data-base Project,
Southampton University,
ENGLAND, U.K.

Dear Sirs,

In the FABIS Newsletter No. 2 there is a table summarising the *Vicia faba* germplasm collection at ICARDA (FABIS 2, 21). For Sweden you have no available data for the area of faba bean grown; this can be summarised as follows :

Year	Area of Production
1977	3,350 ha
1978	4,740 ha

As you see the acreage is not very big, and the faba bean production is all of the *Vicia faba minor* types. The acreage figures given here are from the official Swedish agricultural statistics.

Sincerely yours,

Gunnar Nilsson

Svalov AB,
268 00 Svalov,
SWEDEN

Dear Sirs,

Referring to your letter dated Oct. 14th, the situation of testing faba bean varieties in our Center is as follows :

A second series of variety testing was carried out from 1974 to 1977. The varieties Herz-Freya and Minden proved to be the best for our area. The varieties Herra, Kristall, Wieselburger and Nixe also appeared suitable.

Faba beans grown for fodder are much needed, but in spite of federal support of 1000 Swiss francs per hectare, the crop is still of minor importance in Switzerland. After the world market prices for high protein fodder returned to normal recently, the cropping area of faba beans decreased from 1300 ha to 650 ha.

With best wishes,

Walter Huber

FAP Zurich-Reckenholz,
Post fach,
CH-8046 Zurich,
SWITZERLAND

ERRATA

The following errors in FABIS Newsletter No. 2 have been drawn to our attention :

p. 25 Bourgeois article

lines 11 and 12 should read '**0.25, 0.50 and 1.0** '

line 14 should read '**0.125, 0.25 and 0.50** '

Similarly in Table 1, all colchicine concentrations should be divided by a factor of 10.

p. 49 Photograph of copulating insects

caption should read '**Stem borer,** ***Lixus*** **sp.**' and not '*Sitona limosus* Rossi'

Names and Addresses

There were a number of corrections to be made to the mailing list. These together with many additions and deletions have been incorporated in a new list which will appear in the 'World Directory of Faba Bean Research' to be published shortly.

GENERAL ARTICLES on
"Faba Beans in different Crop and Crop/Livestock Systems"
are required for FABIS Newsletter No. 4 (1982)
Please send your article or the name of a potential author to :

FABIS,
Training and Communications,
ICARDA, P.O. Box, 5466,
Aleppo, SYRIA

SHORT COMMUNICATIONS on
"Any subject concerned with faba bean research or production"
are required for FABIS Newsletter No. 4 (1982)
Please send your contributions to

FABIS
Training and Communications,
ICARDA, P.O. Box 5466,
Aleppo, SYRIA

All Contributors :
Please see the **Style and Form** guidelines on p. 10

ANNOUNCEMENT

The European Congress on

VEGETABLE PROTEINS FOR HUMAN FOOD

will be held in **NANTES, FRANCE**
from **October 5th to 7th, 1981**

The Congress is organised by the Institut National de la Recherche Agronomique, and the European Vegetable Protein Federation.

The main objectives of the Congress are to review the most recent research, and its applications, in the field of 'European Vegetable Proteins for Human Food'. Crops studied will include rapeseed, sunflower, soya, faba beans (incl. broad beans and horse beans), peas, leaves etc.

The program of the Congress focuses on the following topics :

1. extraction of proteins (concentrations and isolates).
2. composition of raw materials and their variability.
3. extraction and purification technology of intermediate products.
4. nutritional value; organoleptic properties.
5. social and economic aspects, marketing, acceptability, legislation.
6. functional properties; direct applications to food.

The program is designed for participants from administrative organisations, public and private research organisations, raw material or intermediate product producers, food industries and consumers.

The official languages of the Congress will be French and English. There will be simultaneous translation during the plenary sessions.

Anyone wanting to attend the conference should write for a Registration Form to :

The Organisers,
Conference sur les Matieres Proteiques Vegetables,
I.N.R.A.,
Centre Agro-Alimentaire,
Chemin de la Geraudiere,
44072 NANTES Cedex,
FRANCE

Each potential delegate should also supply the following information :

Family Name First Name
Company/Organisation
Address (incl. City, Postal Code and Country)

Thank you.

If you have any
- faba bean news
- announcements of meetings or conferences
- letters to the editors
- comments on articles appearing in Newsletter No. 3
- suggestions
- complaints
- additions to the Genetic Variation within *Vicia faba* list
- changes of address
- new research interests

please send them to

FABIS,
Training and Communications,
ICARDA, P.O. Box 5466,
Aleppo, SYRIA

WANTED

Seed collections of wild species in the genera *Vicia, Lathyrus, Lens, Pisum, Vavilovia* and *Anatropostylia.* Of particular interest would be collections of :

- *Vicia galilaea* (Palestine, Turkey, Syria, Lebanon).
- *Vicia johannis* (Mediterranean from Spain to Turkey, Iran and USSR)
- *Vicia hyaeniscyamus* (Syria and Lebanon)
- *Anatropostylia koeieana* (*Vicia koeieana*) (Turkey, Iran, Iraq)
- *Vavilovia formosa* (Iraq, Iran, Turkey, Lebanon, USSR)
- *Vicia altissima* (West Mediterranean)
- *Vicia subvillosa* (Iran to Afghanistan)
- *Vicia caesarea* (Turkey)
- *Vicia cypria* (Turkey, Cyprus, Lebanon, Palestine)

We could supply seed of other species in exchange.

Please send/write to :

Dr. F.A. Bisby,
Vicieae Data-base Project,
Southampton University,
ENGLAND, U.K.

ORIGINALS/PHOTOCOPIES OF ARTICLES WANTED

We are trying to make a collection of articles on faba bean research and production at ICARDA. We want to make these articles available to all members of the FABIS mailing list. If you have written any articles on research or production of faba beans, or if you have access to a large collection of articles on the crop, could you please send copies (originals preferred, but photocopies will be very welcome) to :

FABIS,
Training and Communications Program,
ICARDA, P.O. Box 5466,
Aleppo, SYRIA

BIBLIOGRAPHIES/REFERENCES WANTED

We are also trying to compile a complete list of references of all articles written on faba beans. Even if you do not have original copies or photocopies of articles to send to ICARDA, we would be grateful if you could send us copies of bibliographies or references of those articles which you think may not have found their way into the international literature. We intend to set up a comprehensive information service for faba beans through FABIS - and the provision of bibliography lists, abstracts and reprints would form part of that service.

Please send any information you have to :

FABIS,
Training and Communications Program,
ICARDA, P.O. Box 5466,
Aleppo, SYRIA

A list of species in the tribe *Vicieae*

(i.e. *Vicia, Lathyrus, Lens, Pisum, Vavilovia, Anatroposttylia*)

plus index to synonyms is NOW AVAILABLE from

Frank Bisby,
Vicieae Data-Base Project,
Southampton University,
ENGLAND, U.K.

(see 'Letters to the Editors')

NAMES AND ADDRESSES

If you know of any one who has recently begun research on *Vicia faba* could you please send his/her names and address to FABIS, so that we can contact him/her with subscription details. Thank you.

Vicia faba

REPORT ON THE

CAIRO FABA BEAN CONFERENCE

An international conference on faba beans was held in Cairo, Egypt, from 7th to 11th March, 1981. The conference was sponsored by ICARDA and the International Fund for Agricultural Development (IFAD) as part of their Nile Valley Project, in cooperation with the Government of Egypt.

The main objective of the conference was to present and discuss papers reviewing aspects of worldwide faba bean research, and to focus on the problems of irrigated faba beans in the Nile Valley in Egypt and northern Sudan.

The conference was attended by 136 participants from 16 countries around the world. Organisations represented include the Egyptian and Sudanese national programs, IFAD, ICARDA, The Ford Foundation, GTZ, IDRC, the United Nations University, USAID and the World Bank.

The organising committee of the conference consisted of representatives of ICARDA, GTZ, the Agricultural Research Council (ARC) of Sudan, the Agricultural Research Council (ARC) of Egypt, and Cairo University and the National Research Center (NRC) in Egypt.

The opening session of the conference included short statements by Dr. H.S. Darling (ICARDA Director General), Dr. M.A. Nour (ICARDA Deputy Director General) and H.E. the Minister of Agriculture, Sudan, and an address by H.E. Dr. M.M. Dawood, Minister of Agriculture, Egypt. Most of the papers presented at the conference are included in a book which is being edited and prepared at ICARDA, and which will be printed and published by Martinus-Nijhoff (Publishers) Ltd. in The Hague, The Netherlands. It is expected that the book will be available by the end of 1981.

Closing remarks on the conference were made by Dr. D.A. Bond (PBI, Cambridge, U.K.). These remarks and the full list of recommendations will appear in a separate publication of the proceedings of the conference.

PAPERS PRESENTED

The following papers were presented at the conference :

Title	Author	Organisation
Overview of the Egyptian National Program	A.A. Ibrahim	ARC, Egypt
Overview of the Sudanese National Program	I. Babiker	ARC, Sudan
Nile Valley Project in Egypt : farm-level constraints to higher yields.	A. Nassib, A.A. Ibrahim, H.M. Farrag and F.M. El-Rogers	ARC, Egypt
Nile Valley Project in Sudan : on-farm trials	G.E. Mohamed	ARC, Sudan
How Yield Stability Can Influence Farmers' Adoption Decisions : the case of faba bean production in Egypt	D. Nygaard and A-M M. Basheer	ICARDA and ARC, Egypt
Genetic Resources of Faba beans	J. Witcombe	IBPGR
An Overview of Breeding Methods for Faba Bean Improvement	G. Hawtin	ICARDA
Population Improvement in Faba Beans	A. Nassib and S.A. Khalil	ARC, Egypt
Development and Performance of Synthetic Varieties of *Vicia faba* L.	D.A. Bond	PBI, U.K.
Male Sterility and Future Prospects for Hybrid Varieties in *Vicia faba*	J. Picard, P. Berthelem G. Duc and J. Le Guen	INRA, France
Pollination Studies on Faba Beans.	L.M. Monti and L. Frusciant	Univ. da Napoli, Italy
Mutation Breeding in Faba beans	M.M.F. Abdalla	Cairo Univ., Egypt
Interspecific Hybridization in *Vicia*	J.I. Cubero	ETSIA, Spain
Need and Concept of Wider Adaptability Including Breeding Methods	E. Von Kittlitz	Univ. of Hohenheim, Germany
The Utilization of Faba Beans and their Role in Diets in Egypt	G. Gabrial	ARC, Egypt
The Utilization of Faba Beans and their Role in Diets in Sudan	A. El Mubarak Ali, G. El Amin Ahmed, El Hardallow	ARC, Sudan
Protein Quantity and Quality in *Vicia faba*	S. Sjodin	Seed Association, Sweden
Anti-nutritional Factors in Faba Beans	L.A. Hussein	NRC, Egypt
Favism	R. Marquardt	Univ. of Manitoba, Canada

Title	Author	Organisation
Cooking Quality and its Relationship to Agronomic Factors and Chemical Composition	A.M.E. Shehata	Univ. of Alexandria, Egypt
Hard Seeds in Faba Bean	F.A. Salih	Shambat Research Sta., Sudan
Some Physiological Aspects of Adaptation	M.C. Saxena	ICARDA
Alternative Plant Models	G. Chapman	Wye College, U.K.
The Effects of Water Stress on the Growth, Development and Yield of *Vicia faba* L.	P. Hebblethwaite	Univ. of Nottingham, U.K.
Flower Drop	M.M. El Fouly	ARC, Egypt
Tolerance to Salinity	K. Caesar	Inst. of Crop Science, Germany
Aspects of Faba Bean Agronomy in Egypt	A.A. Ibrahim, A.M. Kassib M. El-Sherbeeny	ARC, Egypt
Aspects of Faba Bean Agronomy in the Sudan	O.A.A. Ageeb	ARC, Sudan
Symbiotic Nitrogen Fixation in Faba beans in Egypt	Y.A. Hamdi	ARC, Egypt
Symbiotic Nitrogen Fixation in Faba beans in Sudan	M.M. Musa	ARC, Sudan
Weed and *Orobanche* Control	M.K. Zahran	ARC, Egypt
Breeding for Resistance to *Orobanche*	A. Nassib, A.A. Ibrahim and S.A. Khalil	ARC, Egypt
Characteristics of a Local Collection of Faba Beans and its Reaction to *Orobanche*	M.M.F. Abdalla	Cairo Univ, Egypt
Major Disease Problems of Faba beans in Egypt	H.A. Mohamed	ARC, Egypt
Major Disease Problems of Faba beans (*Vicia faba* L) in the Sudan	M.M. Hussein	ARC,Sudan
Virus Diseases of *Vicia faba*	L. Bos	IPO, The Netherlands
Breeding for Resistance to *Botrytis fabae*	S. Hanounik and G.C. Hawtin	ICARDA
Breeding for Resistance to Rust	C. Bernier and R. Conner	Univ. of Manitoba, Canada
Factors Affecting Resistance to Root Rot and Wilt Diseases	G.A. Salt	Rothamsted, U.K.
Faba Bean Pests in Egypt	A.H. Kamal	ARC, Egypt
Major Pest Problems of Faba Beans in Sudan	S.A. Siddig	ARC, Sudan
Breeding for Resistance to Aphids	F. Klingauf	Bonn, Germany

RECOMMENDATIONS

The recommendations of the conference were as follows :

Breeding

1. That increased international cooperation between all faba bean breeders is required.
2. That breeding objectives should stress increased yield potential and resistance or tolerance to pests, diseases and adverse environmental conditions.
3. That there is a need for an institution to be identified as the main center for faba bean germplasm. ICARDA would be ideal for this purpose.
4. That seed of all variants be sent to ICARDA for maintenance, and distributed, on request, to all interested scientists.
5. As variability within *V. faba* is wide and, to a great extent, under-exploited, it is recommended that all new variability and linkage relationships should be communicated through FABIS. The list of variation drawn up by Dr. Chapman, should be updated periodically.
6. That efforts should be made to collect landraces, especially *paucijuga* and *minor* types, which are under-represented in existing germplasm collections.
7. There is a need for development of descriptor lists for germplasm.
8. There is a need for greater involvement by scientists from different disciplines to work together in multi-disciplinary teams, on the improvement of faba beans.
9. *Ascochyta*, *Botrytis* and *Uromyces* have special significance in being of wide occurrence and importance. By inter-relating the work at several centers, it would be possible to test systematically a range of resistant lines against a number of pathotypes. The breeder would then have available resistances of known status for incorporation. It is therefore recommended

that ICARDA help towards this end.

10. That in view of the importance of off-season and techniques for rapid generation turnover, these should receive greater attention by breeders.
11. That work should be encouraged on faba bean cytogenetics of relevance to plant breeding.
12. It was expressed that genetic engineering and regeneration techniques were advancing very fast, and should be available for use by faba bean breeders in the not-to-distant future.

Agronomy

1. That agronomists and physiologists should get together in the field on the same trials. This would enable more predictive data to be collected, and yield response could then be explained and related to growth and development.
2. That environmental conditions should be measured and related to field trials, e.g. accumulated temperature, water and light use. Such measurements are fairly easy and cheap. Again, such information should give a greater predictive basis for response.
3. That experiments on agronomic areas such as sowing date, plant populations, irrigations etc. should continue, but there is a strong need for present data to be utilized and analysed in a more predictive manner e.g. the use of Holiday's population model, or to related water use and yield. This would enable future trials to be designed with greater precision and efficiency.
4. That greater emphasis should be placed on understanding in detail the effects of simple measurements. Multifactorial trials, while they may have a role if adequate resources are available, are often expensive and difficult to interpret.
5. That work on nitrogen fixation should be increased. Trials are particularly needed on the residual effects of faba beans on the crops which follow them.
6. That future work on fertilizer use should always account for the residual soil fertility, either on a historical or directly measured basis. Without such background data, fertilizer experiments are almost worthless. Such measurements should be utilized when response data are presented.
7. That further work should be undertaken on emergence and establishment, and should include quantification of soil physical conditions and the role of seed quality.
8. That work should be increased on water conservation, i.e. the potential of growing faba beans in marginal areas where irrigation is not available or limited.
9. That information be obtained on the limiting moisture deficits of soils in different areas.
10. That on-farm trials should continue and, if possible, be extended, and that research findings should be rapidly disseminated to the extension service. On-farm trials should be simple and realistic so that they can be easily understood by farmers.
11. That research findings should be related to economics and on-farm trials should contain economic alternatives. Consequently there is a need to define economic responses and not only optimum responses for yield.
12. That work be undertaken in relation to the rotational aspects of faba bean.
13. That work should be done on short term water stress at particular growth stages. Water stress and its interaction with cultivars is needed particularly as there seems to be differences in water extraction depth between cultivars. With such an increased potential for greater exploration of soil volume, selection of these cultivars for stress regions should be made. This work should include measurements on water extraction depths in relation to water stress; the effects of short term stress cycles, and measurements of plant water potentials.
14. That under flood irrigation, information is needed on the effects of excess water.
15. That detailed work on saline water and its effects on growth and yield of faba beans should be intensified.
16. That work be increased on aspects of seed quality etc.

Weed Control

1. That the screening of varieties for resistance against *Orobanche* should be continued and intensified and the mechanisms of resistance studied.
2. That the screening of herbicides and other chemicals for *Orobanche* control should be continued. Successful herbicide application (glyphosphate, pronamide etc.) as well as other control methods, should be evaluated under field conditions in different countries. Residues should be studied on all edible parts of faba beans, as well as in the ecosystem as a whole.
3. That work on the use of synthetic germination stimulants of *Orobanche* seed should be continued.
4. That the screening of chemicals for selective and wide spectrum weed control should be continued.
5. That methods should be developed for surveying *Orobanche* and other weeds of faba beans. Surveys should be conducted in different countries, and economic threshholds established.
6. That integrated programs for the control of *Orobanche* and other weeds should be initiated.
7. That ICARDA should encourage workshops and specialized meetings on *Orobanche* and other weeds.

Plant Pathology

1. That closer cooperation between plant pathologists and plant breeders is encouraged.
2. That ICARDA should ensure knowledge of the risks involved in the distribution of germplasm.
3. That in view of the clear lack of research on biology and epidemology of key pathogens, these areas should receive more emphasis.

4. That ICARDA should strive to standardise disease assessment methods, prepare leaf diagrams for estimating the percentage of disease on leaves, and provide instructions about how leaves can be assessed during different growth stages. Similar methods for assessing root diseases should be developed.
5. That international testing of lines found resistant to *Ascochyta* blight, chocolate spot and/or rust should be organised by ICARDA. This would ensure the testing of lines resistant to a range of different pathotypes.
6. That in future on-farm trials, more attention should be given to monitoring the incidence of pests and diseases. Demonstration trials for the chemical control of pests and foliage diseases should be set up.
7. That ICARDA should coordinate the publication of a "field guide" on faba bean diseases. Rating scales for key diseases might also be included.

Pest Control

1. That further evaluation of the main pests of faba beans, both in the field during storage, is required throughout the region.
2. That there should be an analysis of field data and reports for confirmation of the pest status of different insects which attack faba beans. Although certain species occur in high numbers, the damage which they cause may be of less importance, e.g. relatively low damage by *Aphis pisum* compared with that of *A. fabae* or *A. craccivora.*
3. That maps be prepared showing the geographic distribution of patterns of the pests throughout the dry region (distribution maps).
4. That maps of the main infestation areas of important pests be prepared (infestation maps).
5. That a simple guide be prepared to describe the main pests and provide indicators for differentiation between similar species.
6. That a plant protection manual be produced for the main pests. Attention should be given to establishing economic threshholds to avoid unnecessary control measures, and should be incorporated in the manual.
7. That studies of the population dynamics of the important pests of faba beans be made in order to develop adequate strategies for pest control and plant breeding. For example, earliness, which may be an effective way of escaping late infesting pests, is probably easier to achieve that resistance or tolerance.
8. That an evaluation of the host spectrum of faba bean pests may be valuable in identifying resistant *Vicia* species, which may be used as a source of resistant genes for faba beans when techniques for interspecific hybridization have been developed.
9. That a description of the many beneficial insects be prepared. Pherenome traps may be useful in reducing the losses by bean pests in stores, and research is needed on the control of faba bean pests by insect pathogens, whether in the store or in the field.

Nutrition :

1. That dietary surveys on faba bean consumption among population groups, including urban and rural populations, be conducted.
2. That surveys on faba bean utilization should be conducted in countries other than Egypt and Sudan.
3. That an assessment be made on the prevalence of favism in the different countries where faba beans are consumed, with special reference to age groups, sex, etc.
4. That the mechanisms by which these antinutritional factors react with and affect faba bean utilization by people and animals, should be investigated.
5. That the breeding programs should develop cultivars that have low levels of antinutritional factors, including vicine and convicine.
6. That selected new varieties should not be below the nutritional quality of current varieties, and not inferior in their cooking quality and acceptablity.
7. That studies should be encouraged on the determination of the nutritional quality of faba beans, as incorporated into the diet.
8. That special attention should be given to the development of techniques for the measurement of physical, chemical and organoleptic properties of faba beans, related to cooking and processing.
9. That an assessment be made of faba bean losses during storage at the village level, and develop suitable methods for reducing these losses, using locally available materials at the village level.
10. It is highly recommended that, where possible, the maximum use of national institutes be used in meeting the objectives for research training of necessary personnel and dissemination of information.

'Foul medames', Aleppo

STYLE AND FORM FOR FABIS CONTRIBUTIONS

All contributions should be submitted if possible before December 1st, 1981.
Please remember the following guidelines:

Short Communications

☆ must not be more than 600 words and may in addition include one Diagram/ Figure/Photograph.

☆ should contain a single theme, even if this means more than one article is submitted by the same author.

General Articles

☆ must not be more than 1500 words

edited articles will be returned to authors for approval if the originals were submitted before December 1st.

☆ contributions should **not** consist of outlines of research programs carried out at institutions.

☆ all references cited should be directly relevant to the content of the article. Additional references will be welcomed but not included in the newsletter (they may be published in future bibliographies).

☆ contributions must be typed double-spaced.

☆ the species should be referred to as *Vicia faba* or faba beans.

☆ sub-classes should be referred to as *Vicia faba minor, Vicia faba major* etc.

☆ numbers in the text less than 10 (except for measurements) should be written one, two, three, etc. unless they form part of a series containing numbers greater than 10 or appear at the beginning of a sentence.

☆ yields should be expressed in t/ha or kg/ha.

☆ If these Style and Form conditions are not met, the Editors reserve the right to shorten or otherwise alter the text so that it meets the requirements of FABIS. Thank you

Please Note :

While FABIS articles are not refereed as in other journals, we do reserve the right to refer individual articles back to an author in such cases where there are technical inconsistencies. This may mean that an article submitted to FABIS does not appear in the next published issue of the Newsletter. This, however, should not result in a long delay in publication, as we intend to increase the frequency of the Newsletter over the next two years. Thank you.

The views expressed in FABIS articles are those of the individual authors, and do not necessarily represent the views of ICARDA. Likewise the results presented in FABIS articles are the responsibility of the individual authors. Thank you.

The faba bean as a novel protein food.

D.A. Jonas
Food Science Division, Ministry of Agriculture, Fisheries and Food (MAFF), London, SW1P 2AE, U.K.

Introduction

The faba bean produced in Western Europe is potentially a valuable source of novel protein food. In the UK yields in excess of 3700 kg/ha are possible though average yields are around 3100 kg/ha (Anon, 1978a). Perhaps because of wide seasonal variations this crop is not widely grown at present in the UK: some 42000 ha were grown in England and Wales in 1979 with an average yield of 3040 kg/ha. Nevertheless if the problem of yield variability can be overcome, which seems likely given the worldwide research interest in this crop, the faba bean has two significant advantages over other potential sources of novel vegetable protein food for U.K. production. Not being an oil seed, returns to the producer are likely to be largely independant of fluctuations in the market for vegetable oils. Faba beans have long been grown for human consumption so novel protein products obtained from them offer no hazard to human health (Anon, 1978b) provided that processing introduces no such hazards. This paper summarises the requirements for a novel protein food for the U.K. and some of the technological problems in exploiting faba beans in this way.

In the U.K. there is no overall shortage of protein in the diet and some 60 per cent of the protein intake is of animal origin. However, for social and economic reasons there is a growing market for novel vegetable protein products, currently based largely on soya. These novel vegetable protein products find two distinct applications. Firstly, they may be produced in texured form intended to extend or replace expensive animal products such as meat and fish in meat and fish products or in dehydrated snack foods. Whilst defatted soya flour forms the basis of many of these foods; the more highly refined concentrates (from which the soluble carbohydrates have been removed) and isolates (containing more than 90 per cent protein) are being increasingly used as their advantages in terms of flavour and functionality outweigh the increased cost of production. Secondly, novel vegetable protein products are being increasingly used as functional (i.e. non-textured) ingredients in a wide range of manufactured foods from bread to ice cream. These products largely take the form of soya isolate except in bread where enzyme activity is required. The total annual production for human foods in the U.K. is currently about 40-50,000 tonnes all of which has to be imported and could be partially substituted by faba bean products.

Faba bean products

Three distinct faba bean products merit consideration as food ingredients:

1. flour (containing about 30 per cent protein) produced by milling hulled beans
2. concentrate (about 70 per cent protein) produced by air classification of whole or hulled bean flour or by wet techniques.
3. isolate (about 90 per cent protein) produced by aqueous or alkaline extraction and concentration by reverse osmosis or isoelectric precipitation.

In addition to their non-textured uses these products could be texturised by thermoplastic extrusion in the case of flour and concentrate or by spinning in the case of the isolate.

Faba bean products for human consumption are not entirely new. The first U.K.-produced spun meat analogue ("Kesp") was produced from iso-electrically precipitated faba bean isolate in the early 1970s by the Courtalds Company. Vegetein Inc. of Canada produce a number of faba bean flours and concentrates for use as functional ingredients and also an extruded snack containing both bean flour and corn meal. There has also been considerable work in France on the extrusion cooking of faba bean flours.

Proteins

When animal proteins are replaced in the diet by vegetable protein products we have to consider not only the protein quality of such products but also their effect on mineral intake, since animal proteins, particularly meat, are important sources of minerals including iron and zinc. In the U.K. it has been recommended (Panel on Novel Foods, 1980) that vegetable protein foods which simulate meat should contain at least 45 per cent crude protein and that they should have a protein efficiency ratio (PER) of not less than 1.6 (compared with casein 2.5). It is unlikely that currently available faba bean products could achieve such a high PER without methionine fortification. Since for food uses fortification with methionine *per se* is impracticable due to its ready oxidation to unpalatable by-products, genetic improvement of the methionine content even at the expense of lower yield might be an acceptable alternative. It has also been recommended (Panel of Novel Foods, 1980) that vegetable protein foods which simulate meat should be fortified with iron and zinc, not only to supplement their naturally low mineral content but also to counteract the effect of their high phytate content on mineral metabolism. The phytate content of faba beans and of products obtained from them is somewhat higher than that of soya products, reaching 4.2 per cent in air classified bean flour (Vose *et al,* 1976). Since the level of metals needed to overcome the complexing effect of this level of phytate may well make the products unacceptable in food preparation (for example by acting as catalysts for fat oxidation) economic methods for phytate removal need to be developed or new low phytate lines of faba beans produced for human consuption.

There is some evidence that within the U.K. the growth in the market for functional (non-textured) vegetable protein products continues to increase steadily and it could be in this area where faba bean products might be exploited. The functionality of faba bean products has received little consideration compared to soya products. It is however apparent that the two are comparable in many respects. For example, faba bean flours and concentrates have been found to be acceptable technologically as protein additives in bread, biscuits and pasta at levels of up to 10 per cent in trials carried out in the U.S. (Lorenz *et al,* 1979).

Anti-nutrition and toxicity

Whilst faba beans have long been used as food, this does not mean that they are free from antinutritional or potentially toxic components. The potential value of faba beans to the food processor may well be conditioned by the influence of processing on toxic and antinutritional substances naturally present and by any tendency for such substances to be formed during processing. In addition to phytate, probably the three most important of these factors in faba beans are the soluble carbohydrates, the trypsin inhibitors and the vicine glycosides.

It has been suggested that one of the factors responsible for the decline in the growth of the market for soya based meat substitutes is the tendency for those products based on soya flours to cause flatulence. The causative agents are believed to be the soluble carbohydrates stachyose and verbascose. These are largely removed during the processing of soya flours into concentrates (Horan, 1974). Whilst the processing of faba bean flours into concentrates is potentially more economic, being based upon air classification rather than extraction, the process does concentrate stachyose and verbascose into the protein rich fraction (Vose *et al,* 1976) and levels are comparable with those found in soya flours.

The trypsin inhibitors present in soya products, and especially those which have not been heat processed, considerably reduce the nutritional value. In exploiting the food uses of the faba bean it may be of advantage that the level of these inhibitors in faba beans is substantially less than that in soya beans. Although these inhibitors are more heat stable than those of soya (Warsy and Stein, 1973) they are inactivated by many of the heat processing operations used in the food industry (Melcion and Valdebouze, 1977). They are therefore unlikely to be such a problem as the non heat labile antinutritional factor found in the hulls of the faba bean (Edwards, 1977) which are usually removed prior to or during processing.

Favism

The capacity of faba beans to precipitate favism in certain susceptible individuals is a serious problem in certain areas. Within the U.K. only two susceptible individuals have been identified to date (Jemalian *et al,* 1977) but the potential problem may not be too serious since the vicine and related glycosides which are believed to be the most important causative agents are soluble in water and may be removed by wet processing (Olsen and Andersen, 1978). However since these glycosides are located largely within the protein bodies in the raw beans they are not removed during air classification.

There are many other factors which might influence the exploitation of faba bean products. These include the influence of processing on nutritional value, the effect of alkaline processing on possible lysinoalanine or D-amino acid formation, and the presence of haemagglutins and tannins. However it is hoped that this brief review of some of the most important factors has highlighted the potential of the faba bean as a novel protein food.

References:

Anon. (1978a). 'Field Beans'. Short term leaflet No. 60, Ministry of Agriculture and Fisheries and Food. HMSO, London, England.

Anon. (1978b). 'Study Group on Vegetable Proteins in Foodstuffs for Human Consumption'. Commission of the European Communities, Brussels.

Edwards, D.G. (1977). In 'Field Beans'. Bulletin No. 15, Scottish Horticultural Research Inst., Dundee.

Jamalian, J., Aylward, F. and Hudson, B.J.F. (1977). Qual. Plant, 27 (2), 207-211.

Lorenz, K., Dilsaver, W. and Wolt, M. (1979). Bakers Digest 51, 39-45.

Melcion, J.P. and Valdebouse, P. (1977). In 'Protein Quality from Leguminous Crops'. Commission of the European Communities, Brussels.

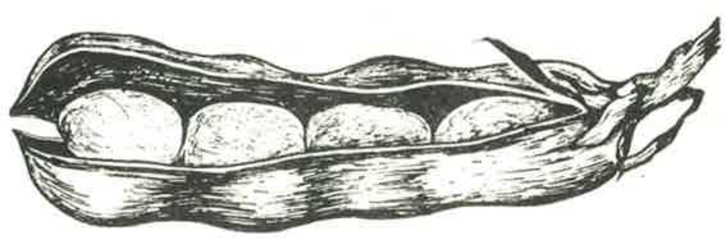
Olsen, H.S. and Andersen, J.H. (1978). J. Science Food Agric., 29(4), 323-331.

Panel on Novel Foods, 1980. 'Foods which simulate Meat'. Department of Health and Social Security. HMSO, London.

Vose, J.R., Basterrechea, M.J., Gorin, P.A.J., Finlayson, A.J. and Youngs, C.G. (1976). Cereal Chemistry 53 (6), 928-936.

Warsey, A.S. and Stein, M. (1973). Qual. Plant 23, 157-169.

Horan, F.E. (1974). J. Amer. Oil Chem. Soc., 51, 67A-73A.



Developments in industrial processing of Vicia faba protein in Europe.

H. Sejr Olsen
Novo Industri A/S, Novo Research Institute, Enzyme Applications R & D, Novo Alle, DK-2880 Bagsvaerd, DENMARK

Introduction

In northern Europe there are agronomic difficulties in growing soya beans. As an alternative crop, the faba bean *(Vicia faba)* can, to some extent, be grown successfully in the same areas. However, wet and cold summers as often seen in e.g. Denmark may prolong the growing and ripening periods, so that the harvest may not be possible until late autumn. The encouragement of a widespread growth of faba beans as animal feed in Denmark has unfortunately been rather limited during the last four years due to the low prices of imported soya beans.

Owing to increasing meat prices, the food industry is using an increasing amount of vegetable protein in meat products. High quality and low prices characterise the US soya proteins. This causes the European meat industry to use a higher proportion of imported soya proteins than those produced from European oil mills.

When vegetable proteins are evaluated for food use, both the so-called functional properties and nutritional aspects have to be considered. From an economic point of view the functional properties are considered to be the most important, as these greatly influence the final taste and eating value of the food products. The functional properties of proteins are dependent on their molecular protein structure, the technological process conditions during isolation, and on the physical and chemical conditions of the food products when they are used. The development of faba bean protein products has been described earlier (see references) as a model project for the production and characterisation of a new alternative food.

Production of *Vicia faba* protein

From a technological point of view the composition of faba beans shown in Table 1 seems well suited for protein production. The proteins are easily isolated in a pure form and a process based on water extraction, centrifugation and ultrafiltration has been developed at the Food Technology Laboratory, The Technical University of Denmark (Olsen, 1978a). A flow sheet of this process is shown in Fig. 1. The extractions were made at low temperature in vessels, and the insolubles, mainly consisting of starch, were separated by means of a decanter centrifuge. The extract was finally clarified in a solids-ejecting centrifuge before ultrafiltration. Different process designs of the ultrafiltration process were studied (Olsen, 1975; Olsen,1978a), but a continuous two-step process performed at 50°C was the final layout. The typical mass balance shown in Table 2 for protein from the production in this plant is calculated based on the information given by Olsen (1978a). The process costs are compatible with those of the traditional acid coagulation process often used in the protein industry.

Table 1. Composition of faba beans (Kl. Thuringer) (from Olsen and Poulsen, 1974).

protein (N x 6.25)	30 per cent
carbohydrates	44 per cent
cellulose	7 per cent
ash	3 per cent
fat	1 per cent
water	15 per cent

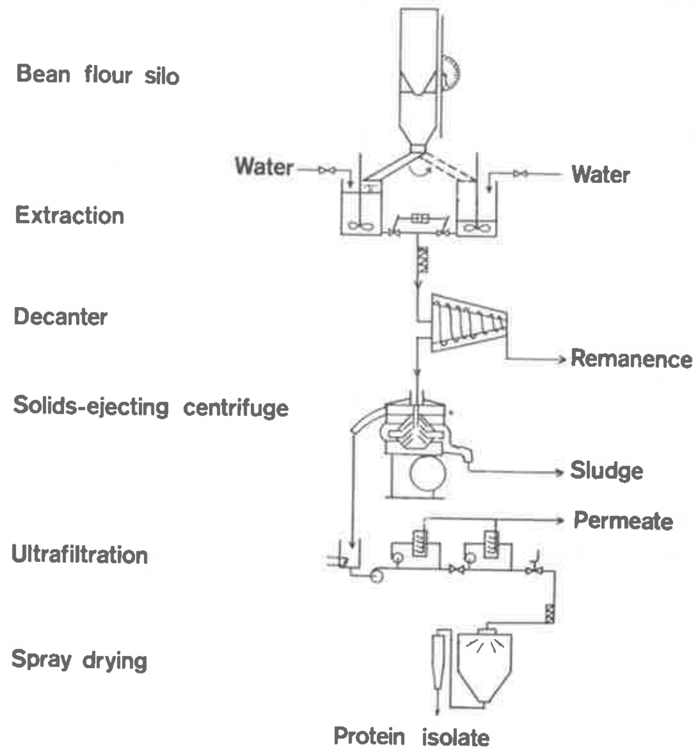


Fig. 1 Flow sheet of the pilot plant at Food Technology Laboratory (The Danish Technical University).

Functional properties

When comparing the protein solubility curves for ultrafiltered and acid precipitated protein isolate, respectively, it appears from Fig. 2 that the degree of denaturation of proteins recovered by ultrafiltration is much lower than for proteins recovered by acid precipitation.

The faba bean protein produced by this process is also found to have better functional properties than commercial, isoelectric, precipitated soya protein isolate when evaluated in meat emulsions (Olsen, 1980). As shown by immunoelectrophoresis (Olsen, 1978), faba bean protein produced by this process is found to be native compared to that treated by isoelectric precipitation, which may involve protein aggregation and denaturation.

Table 2 Mass balance from continuous pilot plant production of *Vicia faba* protein

process and fractions	mass of fraction (kg)	protein (%)	percentage dry matter	yield of protein (%)	yield of dry matter
raw material :					
bean meal[1]	100	31	89	100	100
extraction :					
slurry	600	5	14	100	100
separation :					
extract	430	5	7	69	34
total residue	170	5	40	27	76
ultrafiltration :					
concentrate	80	24	27	62	24
permeate	350	1	2	10	10
spray-drying :					
powder	22	87	95	62	24

[1]Dehulled Wieselburger

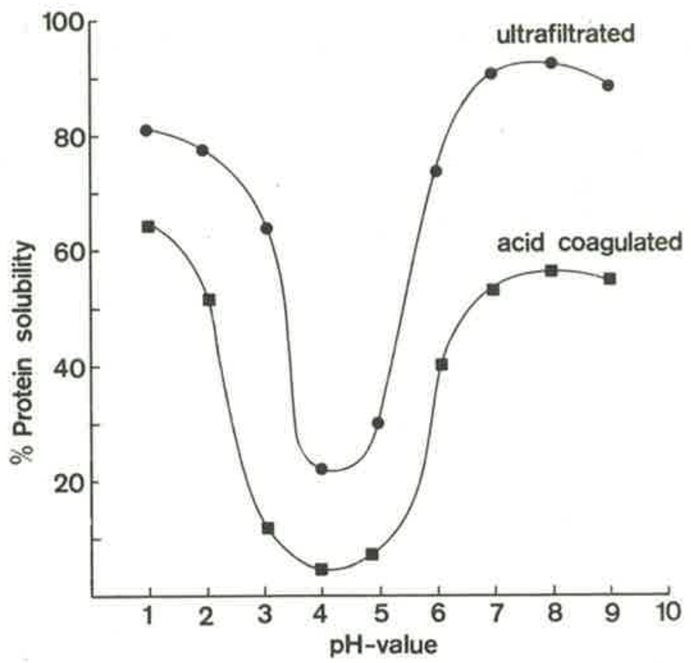


Fig. 2 Protein solubility curves

Enzymatic modification

While denatured protein is found to be limited in its functional properties, native proteins do not fulfil all possible requirements of the modern food industry. Enzymatic treatments may be used to process proteins for food areas where the natural proteins are regarded as useless. Two different kinds of products may be obtained by a treatment of faba protein with proteolytic enzymes. One is an isoelectric, soluble protein hydrolysate, which may be used as a nutritious protein ingredient in acid foods and drinks (Olsen, 1980). The other is faba protein having improved functional properties like emulsifying and whipping properties (Olsen, 1980). It may often be desirable to improve these functional properties when they are missing in the natural proteins, or if they have been reduced due to protein denaturation during processing.

A protein hydrolysate is characterised by its degree of hydrolysis (DH) defined as the percentage of peptide bonds cleaved (Adler-Nissen, 1976). Fig. 3 shows that the whipping properties at a DH of 4 per cent are very much improved after treatment of an acid denatured faba protein with the protease Alcalase (R), a commercial preparation of Subtilisin Carlsberg produced by Novo Industri A/S. The enzymatic modification procedure is outlined by Olsen (1980).

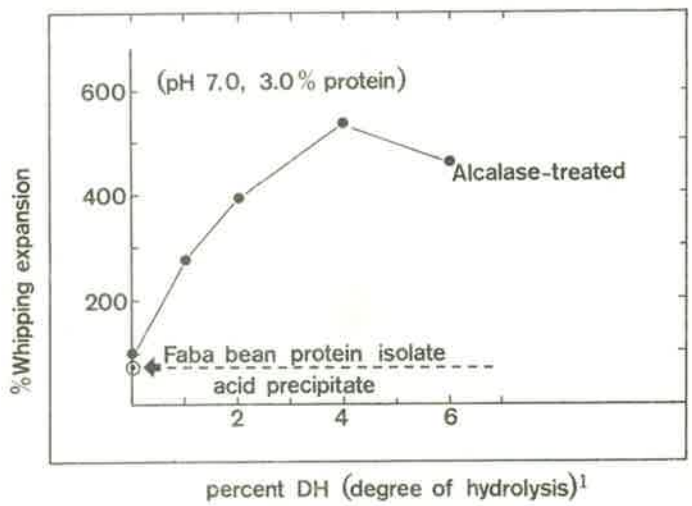


Fig. 3 Whipping expansion versus DH for faba bean protein hydrolysate

[1]Hydrolysis performed in pH-stat with Alcalase(R), pH equals 8.0, T equals 50°C

Nutritional aspects

As regards nutritional aspects, attention has mainly been paid to the low level of sulphur-containing amino acids, the contents of trypsin inhibitors, and the factor of favism. These aspects were examined as an effect of the technological production of protein isolates from faba beans, and the conclusion was that if the protein isolates are produced from clean and fresh raw materials and if the technological treatments do not involve extreme pH-or heat-treatments, faba bean protein isolates may be regarded as a food ingredient which can be utilised to the same extent as other protein foods (Olsen, 1980a).

Secondary products

Faba beans also contain starch, which has been demonstrated to be usable in the food industry, although the starch gels are more rigid and have a firmer texture than those of corn starch. In the food production of faba bean proteins, starch may appear as a by-product.

An industrial application of this starch for an enzymatic production of sweet syrups should be considered. Soya beans have oil as a valuable by-product, but faba beans have starch which, depending on the sugar prices, may be a valuable source of production of sweeteners for the food industry. Thus, faba beans may be considered as useful organic raw materials for industrial production of modern food products and ingredients.

Conclusion

Faba beans may be considered as a potential source of food proteins in countries where soya beans cannot be grown with satisfactory results. However, a successful realisation of this statement is very much dependent on plant breeding meeting the requirements of a shorter growing season and ripening period in a cold and sometimes wet climate.

References :

Olsen, H. Sejr and Poulsen, K.P. (1974). 'Pilot Plant Studies of Vegetable Protein Production'. In 'The Contribution of Chemistry to Food Supplies', by I. Morton and D.N. Rhodes, Butterworths, London.

Olsen, H. Sejr (1975). 'Isolation of Bean Protein by Ultrafiltration'. In 'Proceedings of the Symposium on Sep. proc. by Membranes, Ion-exchange, and Freeze-concentration in Food Industry.' IUFOST and FEEC, Paris, p. A 6-1, p A 6-21.

Olsen, H. Sejr (1976). 'Aspects nutritionnels de l'ultrafiltration industrielle dans la production de proteines.' Information Dietetique (3), 25-28.

Olsen, H. Sejr (1978). 'Faba Bean Protein for Human Consumption'. In 'Proceedings of the 11th FEBS Meeting', Vol. 44 : 'Biochemical Aspects of New Protein Food'. Editors : Jens Adler-Nissen, Bjorn O. Eggum, Lars Munck, Hans Sejr Olsen. Pergamon Press, Oxford pp. 31-42.

Olsen, H. Sejr (1978a). 'Continuous Pilot Plant Production of Bean Protein by Extraction, Centrification, Ultrafiltration, and Spray-drying'. Lebensm.Wiss.u.Technol. 11, 57-64.

Olsen, H. Sejr and J. Hinge Andersen (1978). 'The estimation of Vicine and Convicine in Faba Beans (*Vicia faba* L.) and Isolated Faba Bean Proteins.' J. Sci. Fd. Agric. 29, 323-331.

Bramsnaes, F. and Olsen, H. Sejr (1979). 'Development of Field Pea and Faba Bean Protein'. J. Am. Oil Chemists' Soc. 56 (3), 450-454.

Olsen, H. Serj (1980). 'A survey on Recent Developments in Industrial Processing of *Vicia faba* Protein'. In '*Vicia faba* : Feeding Value, Processing and Viruses.' Ed. D.A. Bond, ECSC, EEC, EAEC, Brussels-Luxembourg, pp. 233-255.

Olsen, H. Serj (1980a). 'Fremstilling of Karakterisering af Protein fra Fabonner (*Vicia faba* L.)'. Ph.D. Thesis, Food Technology Laboratory, The Technical University of Denmark. Novo Industri A/S, Bagsvaerd. (in Danish).

Adler-Nissen, J. (1976). 'Enzymatic Hydrolysis of Proteins for Increased Solubility'. J. Agric. Food Chem. 24 (6), 1090-1093.

TWELFTH NIGHT CAKE — ENGLAND

Once traditional on Twelfth Night (6th January). A whole dried (faba) bean was put into the cake for luck; the person who was served the slice containing the bean was proclaimed 'King Bean' for the night. In another version, both a bean and a pea were put into the cake. The man who found the bean was king and the girl who found the pea was Queen. If the bean was found by a girl, she could choose the King and if the pea was found by a man, he named the Queen.

4 eggs	2 oz. (50 g) almonds,
1/2 lb (1/4 kg) butter	blanched & chopped
1/2 lb (") sugar	1/2 tsp. grated nutmeg
1/2 lg (") plain flour	2 1/2 fl oz. (60 ml) brandy
1 lb (1/2 kg) currants	1 dried faba bean & (1
3 oz. (75 g) chopped	dried pea, optional)

candied peel
To garnish : Royal icing
crystallised fruits

Beat the eggs throughly over a pan of warm water; cream the butter and sugar until light and fluffy and gradually beat in the eggs. Carefully fold in the sifted flour and blend well before adding the currants, peel, almonds and nutmeg; blend in the brandy to give a soft dripping consistency. Add the bean (and the pea, if using).

Spoon the cake mixture into a 9 in. - 10 in. (about 24 cm) pan, double-lined with greaseproof paper; level the top and bake.

Turn out and leave to cool; cover with Royal icing and before it sets, decorate with pieces of crystallized fruit.

Cooking quality of faba beans (Vicia faba).

M.M. Youssef and A.M. El-Tabey
Dept. of Agricultural Industries, College of Agriculture, University of Alexandria, Alexandria, EGYPT

In most of the Middle East countries, faba beans (*Vicia faba* L.) are eaten in the stewed form (medammis) for breakfast as well as in sandwiches at any time of the day. Due to the popular consumption of stewed faba beans in Egypt, medammis can be considered the main national dish.

It is common knowledge that faba beans vary greatly in cooking quality obtained from various locations. Also, it has been noticed that storage has an effect on the cooking quality of faba beans.

I. Methods for measuring the cooking quality (hardness) of stewed faba beans

a. Subjective method

A ranking and re-ranking method can be applied by ten experienced panelists who are chosen by Duo-Trio test (Kramer and Twigg, 1962). Panelists are asked to evaluate the texture only (granulation and hardness), according to the following scale (using ten seeds).

property	maximum degree
no granulation and no hardness	10
granulation only	7
hardness	3

b. Tenderometer method (objective)

Many studies have used the tenderometer to measure the cookability of legumes (Makower and Burr, 1954; Sistrunk and Cain, 1960; Angel and Kramer, 1965; Bourne, Moyer and Hand, 1966; Abo El-Saoud, 1973, and Youseff, 1978). This method can be explained briefly as follows : a sample of 150 g of drained cooked beans is placed in the cup of the apparatus. The force required to move the spindles through the sample is read in pounds/ in^2.

c. Penetrometer method (objective)

Burr, Kon and Morris (1968) measured the cooking time of dry beans with an experimental bean cooker. The 'cooking time' for a sample (100 beans) is taken as the time required for 50 per cent of the beans to be penetrated by specific plungers. Youssef (1978) estimated cooking quality of stewed faba beans with a Universal Penetrometer (Precision Scientific Company, Chicago, Ill., U.S.A.). Readings for 100 seeds were taken for each sample. The average of 100 readings was found to be highly significantly correlated with the subjective method (r equals 0.79).

d. Cookability index (objective)

Chernick and Chernick (1963) modified a sieving method to determine the cookability of yellow peas. Youseff (1978) also used this method for faba beans. Twenty grams of peas were immersed in concentrated sulphuric acid for 30 minutes. Then the peas or beans were washed and allowed to soak overnight in tap water. The sample was drained and placed in a beaker containing 200 ml of a boiling 0.05 per cent solution of sodium bicarbonate and 0.05 per cent sodium chloride. The beaker was covered with a watch glass and boiling seeds and solutions were strained through 10, 20 and 30 mesh sieves. Portions retained on each sieve were dried and weighed. The hard cooking fraction was collected for 10 and 20 mesh sieves and the puree from the 200 mesh sieve. The ratio of the weight of the puree to hard cooking material constituted the cookability index.

II. Relationship between cooking quality and other physical properties of faba bean seeds

In the conclusion of a study by Youseff (1978), the relationship between cooking quality and other physical properties of faba bean seeds was shown as the following (Table 1.) :

Table 1. Correlation coefficients between the physical properties and the cooking quality of stewed faba beans.

No.	properties	portion of seed[1]	correlation coefficient
1	weight of 100 seeds	S	+0.68*
2	lightness (colour by C.I.E. method)	H	+0.78*
3	specific gravity	S	+0.66*
4	per cent of hulls to seed	S	- 0.95**
5	per cent of fraction easy to mill	H	+0.85**
6	per cent of fraction hard to mill	H	- 0.93**
7	viscosity (by visce/amylograph)	C	+0.72*
8	transition temp. (temp. at beginning of response of amylogram)	C	- 0.91**
9	hydration coefficient after stewing	S	+0.75*
10	total solids in stewing liquor		+0.80**
11	soluble solids in stewing liquor		+0.85**
12	insoluble solids in stewing liquor		+0.74*
13	lightness (colour by C.I.E. method)	C	- 0.24

[1]C equals cotyledons, H equals hulls, S equals whole seeds
Least significant values for r equals 0.66 at 0.05
equals 0.79 at 0.01

III. Factors affecting cooking quality of stewed faba beans

According to Gfelle and Halstead (1967), the inheritance of good cooking quality of peas appeared to be controlled by two recessive genes, although there was some indication of a gene-environment interaction. Also, Singh *et al* (1973) investigated 14 genotypes of pigeon pea (over two seasons) for phenotypic and genetic variation in the time needed for cooking. There were significant genotypic effects and genotype season interactions.

The cooking time (CT_{50}) when 50 per cent of the judges considered the beans cooked, has been determined for seven varieties of dry beans (including faba beans) known to require different cooking times. The correlation coefficient between moisture content and cooking times of these varieties was found to be 0.80 (Muenta, 1964).

Scanning electron microscopy (SEM) of the seed coat of faba beans has shown marked variations regarding the hilum scar belonging to different varieties. The hilum scar plays an active role in the dehydration process of the bean (McEwen, 1974).

Kon (1968) stored two lots of dry beans *(Phaseolus vulgaris)* that varied in their moisture content (8.1 and 13.3 per cent) for four years at 90°F. A very substantial and continuous increase in cooking time during storage was found for the high moisture beans.

Youssef (1978) found that the qualities of chemical constituents (i.e. starch properties, protein fractions etc.) are more important than their quantities with respect to the cooking quality of stewed faba beans.

Pod opening at maturity

References :

Abo-El-Saoud, E.I. (1973). 'Physical, chemical and technological studies on the adaptability of green cow pea *(Vigna sinensis)* varieties to freezing, canning and dehydration.' M.Sc. Thesis, p. 100, College of Agric. Univ. of Alexandria, Alexandria, Egypt.

Angel, S., and Kramer, A. (1965). 'Physical methods of measuring quality of canned peas.' Food Technol., **19** (8), 96-98.

Bourne, M.C., Moyer, J.C., and Hand, D.B. (1966). 'Measurement of food texture by a universal testing machine.' Food Technol., **20** (4), 170-174.

Burr, H.K., Kon, S., and Morris, H.J. (1968). 'Cooking rates of dry beans as influenced by moisture content and temperature and time of storage.' Food Technol. 22 (3), 88-90.

Chernick, A., and Chernick, B.A. (1963). 'Studies of factors affecting cooking quality of yellow peas.' Can. J. of Plant Sci. **43** (4), 174-183.

Gfeller, F., and Halstead, R.L. (1967). 'Selection for cooking quality in field peas.' Can J. of Plant Sci., **47** (4), 631-634.

Kon, S. (1968). 'Pectic substances of dry beans and their possible correlation with cooking time.' J. of Food Science, **33** (4), 437-438.

Kramer, A., and Twigg, B.A. (1962). 'Fundamentals of quality control for the food industry.' Avi Publishing Co., West Fort, Connecticut, U.S.A., p. 512.

Makower, R.U., and Burr, H.K. (1954). 'Estimation of maturity of frozen peas, tenderometer measurements of cooked products.' Food Technol. **8** (3), 201.

McEwen, T.J. (1974). 'Physiochemical properties of faba beans and their components.' Ph.D. Thesis, p. 163, Univ. of Manitoba, Winnipeg, Manitoba, Canada.

Muneta, P. (1964). 'The cooking time of dry beans after extended storage.' Food Technol., **18** (8), 130-131.

Singh, L., Sharma, D., Daodhar, A.D., and Sharma, Y.K. (1963). 'Variation in protein, methionine, tryptophan and cooking period in pigeon peas *(Cajanus cajan)* .' Indian Journal of Agricultural Science, **43** (8), 795-798.

Sistrunk, W.A., and Cain, R.E. (1960). 'Chemical and physical changes in green beans during preparation and processing.' Food Technol., **14** (7), 357-362.

Youssef, M.M. (1978). 'A study of factors affecting the cookability of faba beans *(Vicia faba* L.).' Ph.D. Thesis, p. 193, College of Agric., Univ. of Alexandria, Alexandria, Egypt.

Faba bean production for preserving as a vegetable in N.W. Europe.

G.P. Gent
Processors and Growers Research Organisation, The Research Station, Great North Road, Thornhaugh, Peterborough PE8 6HJ, ENGLAND, U.K.

Introduction

Immature seeds of *Vicia faba* are popular as a vegetable in most countries of north west Europe. Traditionally large-seeded types have been used for this purpose and the term 'broad bean' has been accepted for the product. Some classifications have grouped the varieties into a subspecies *V. faba* var *major* but new 'broad bean' varieties have been developed that have relatively small seeds and according to some definitions these should be included as either *V. faba* var *equina*, or var *minor*.

Significant areas of broad beans are also grown for canning or quick-freezing in England, Scotland, Holland and West Germany and processors usually consider the crop as the most important of the 'secondary vegetables'. Unfortunately this status means that processors frequently concentrate on the major vegetables, vining peas, green beans, Brussels sprouts or carrots. Broad beans are considered as an extension of the pea vining season, with the same harvesters being used for both crops. Consequently, the broad beans invariably suffer both in terms of yield and quality so the full sales potential of both canned and quick-frozen products has yet to be realized.

Husbandry and harvesting

Broad beans provide a number of benefits to farmers, particularly those growing a high proportion of cereal crops. They have a relatively short growing period, giving farmers the opportunity to undertake either pre-drilling or postharvest cultivations to eradicate perennial weeds. Also, annual weeds can be controlled by the use of pre- or post-emergence herbicides and the major pest, the black bean aphid *(Aphis fabae)*, can be efficiently controlled by either liquid or granular formulations of insecticides. The major disease in wet weather is chocolate spot *(Botrytis fabae)* and in most cases this can be kept in check by a program of MBC fungicide sprays. The beans enrich the soil with nitrogenous compounds from their root nodules and they are not affected by cereal diseases.

Broad beans are usually harvested by modified pea viners. These separate the seed from the pod and stem by the action of a spindle with projecting blades which rotate at high speed in a confined chamber. The blades hit the pods causing them to split open. The beans then fall out and they are separated from the trash by a rotary screen.

This system works far better for peas than for broad beans and in some situations the bean plants are cut and then left to wilt for about 24 hours to improve the speed and efficiency of vining. Unfortunately, new pea harvesters have been developed that incorporate a picking mechanism and again while this works very well for vining peas, it creates two problems for broad beans. Firstly the picking mechanism leaves many pods on the plants, so reducing the yield of harvested beans, and it makes it difficult to employ pre-harvest wilting of the crop.

Consequently harvesting remains one of the major problems with the crop and for several years the Processors and Growers Research Organisation (PGRO) has tried to bring together plant breeders and engineers to see if new plant types or harvesting systems could be developed. Unfortunately the relatively small area of the crop reduces the commercial possibilities for both plant breeders and engineers so that in the immediate future harvesting will still be undertaken by modified pea viners.

Varieties

Table 1 summarises results from PGRO broad bean variety trials. 'Threefold White' is still the standard variety for the U.K. processing industry and other varieties that are widely grown include 'Beryl', 'Eureka', 'Medes', 'Felissa', 'Primo' and 'Minica'.

Table 1. Summary of field data : Broad Bean varieties.

Variety	Maturity relative to Threefold White (days)	Yield as %of Threefold White	Size of bean	Straw length (mm)	Use
Polar *	-6	130	Small	96	C & F
Pax	-6	108	Medium	64	F
Feligreen	-4	90	Medium	53	C & F
Primo	-4	105	Medium	69	F
Felissa	-3	95	Small	51	C & F
Minica	-3	113	Small	66	F
Eureka	-1	110	Medium	70	C & F
Threefold White	0	100	Medium	76	C & F
Beryl	+9	85	v. small	71	C & F

Data recorded at Thornhaugh, England, mean of three years' trials
* Winter-hardy variety
F freezing
C & F canning and freezing
- =days earlier, + =days later

Late maturity is a very useful characteristic when broad beans are harvested after vining peas, for to ensure that the beans are at the correct maturity at the appropriate time, they are sown cosiderably later than the time for optimum field performance. Later maturing varieties (i.e. those with a longer growing season) can therefore be sown earlier and still be at the correct stage of maturity when harvested. The varieties 'Rowena' and 'Beryl' both mature appreciably later than 'Threefold White', but both also have seeds that are much smaller than those of the standard variety.

When 'Beryl' was first introduced in the mid 1970's its main use in the U.K. was to give produce that could be used as a substitute for imported lima beans (*Phaseolus lunatus)* in mixed vegetable products. However, it is now appreciated that the beans give attractive and distinctive canned and frozen products and the variety is now sold both in the U.K. and overseas as a small broad bean. The field performance of pigmented varieties such as 'Pax', 'Primo', and 'Minica' is generally superior to that of the white-flowered types, but although about 60 per cent of the U.K. crop is grown for quick-freezing their use is restricted by the harvesting problems already mentioned. 'Pax' and the winter-hardy white-flowered variety 'Polar' are the earliest maturing processing varieties. However, this factor can only be exploited when the broad beans are used for a complete harvesting program, rather than being harvested after vining peas.

Processed products

Broad beans can be processed by either quick-freezing or canning, but in the U.K. only varieties that have pure white flowers are acceptable for the latter use. Produce from white-flowered varieties such as 'Threefold (Triple) White', 'Archie' and 'Beryl' does not discolour during canning, while in contrast produce from pigmented varieties becomes brown as the leuco-anthocyanins are converted to anthocyanin upon cooking. However, pigmented varieties are used for canning in other countries, and these can be used for quick-freezing.

Produce from white-flowered beans can either be a pale green colour from varieties such as 'Threefold White' or 'Beryl', or a bright 'pea green' from varieties 'Staygreen' or 'Feligreen'. Processor preference is currently for the paler types, but 'Staygreen' and 'Feligreen' give a very distinctive product that appeals to many people. Both 'Threefold White' types and 'Staygreen' types can also be used for freezing, but a superior product can be obtained by using pigmented varieties such as 'Primo', 'Pax' or 'Minica'. Produce from pigmented varieties is of superior flavour and texture to that of white-flowered beans, but it is also much more prone to post-harvest discolouration. Consequently produce from varieties such as 'Primo' and 'Minica' needs harvesting very carefully and delivering to the quick-freezing factory within 45 minutes of vining to avoid discolouration.

Two other factors affect the quality of both canned and quick-frozen broad beans: seed maturity and cleanliness of the sample. Maturity of broad beans can be measured by the Martin Pea Tenderometer. This records the shearing resistance of a sample of beans weighing 142 g, and readings of 130 and 180 are accepted as the 'Practical Freezing' and 'Practical Canning' stages respectively. It is usually accepted that as broad beans mature their flavour becomes stronger, but at tenderometer values higher than the above their texture becomes very firm and the skins are too tough.

Freedom from extraneous matter is important with any processed vegetable. This is particularly so in the case of broad beans because during vining the pods and leaves are bruised and quickly become black around the broken surfaces. Any extraneous matter therefore not only looks unsightly but can discolour the beans themselves.

The search for an effective method of selection for seed yield and protein content in faba bean (Vicia faba).

A. Ph. de Vries
Institute of Plant Breeding, Agricultural University, 168, Lawickse Allee, Wageningen, HOLLAND.

The countries of the European Community experience a structural shortage of plant protein for cattle feeding. They therefore depend highly on the importation of soya. Efforts to become more independent of soya imports are considered useful. The Directorate of Agricultural Research in the Netherlands believes that improving the faba bean (*Vicia faba*) as a soya bean substitute for moderate climates may be one way of achieving this. Dry matter and protein yield level and stability need to be increased, however, before the Dutch farmer will be prepared to grow this crop. Because of the low heritability of yield it is useful to look for selection methods more effective than phenotypic selection.

Research on the comparison of different selection methods for faba beans, has consisted of:

1. the creation of two genetically heterogeneous starting populations (available as F_2 lines in 1978)
2. the identification of valid auxiliary characters for index selection (for yield selection some characters appeared to meet the condition of auxilliary characters: high correlation to yield and high heritability; for protein content no auxiliary characters could be traced).

A reasonably high heritability of protein content and the absence of a negative association between seed yield and protein content, lead to the following three types of selection in the F_2:

1. comparison of phenotypic and index selection for seed yield;
2. phenotypic selection for high and low protein content;
3. simultaneous selection for seed yield (using the index value) and protein content (phenotypic) according to independent culling levels.

In the F_2 populations about 5.5 per cent of the plants (i.e. 100 plants) were selected for seed yield and protein content (SYP) and for both characters separately, and about 2.2 per cent (i.e. 40 plants) for low/high protein content. For index selection we traced the maximal combination of the four characters that indicated the highest expected genetic advance averaged over both populations. These characters were:

– end of grain filling
– duration of generative stage
– plant length, and
– ratio of podless top to total plant length

The expected genetic response after phenotypic selection for SYP was 16.5 per cent averaged over both populations; after index selection a response of 23.7 per cent could be expected. The difference of 7.2 per cent corresponds to 2.6 g seed per plant (650 kg/ha) at our plant density). Plants selected for SYP were characterised much more by a higher number of seeds and pods (as compared to the population mean) than by a higher seed weight. The overlap of selected plants after phenotypic and index selection for SYP was only about 25 per cent.

Index selection may be expected to result in a quicker decrease in genetic variance. Special cross combinations proved to be favourable for SYP and for protein content selection, an effect still more pronounced for index than for phenotypic selection. The expected genetic response after phenotypic selection for low/high protein content amounted to about 10 per cent, which corresponds to a decrease/increase of 3 per cent protein.

In 1979, selection response was determined as the difference between the selected population and an unselected standard population. The average response for high and low protein selection amounted to 1.1 and 4.0 per cent protein content respectively. This asymmetry of selection response may point to a dominant inheritance of high protein content. In spite of a considerably higher seed weight of the low protein population, the correlation between protein content and seed weight did not prove to be significant. Probably some faba bean parental varieties having a low protein content caused both high seed weight and low protein content in these early generations.

In spite of a lower selection intensity the response for protein content was somewhat greater after simultaneous selection for yield index and high protein content (ICL). In fact, the results from the standard population were not representative as far as seed yield is concerned: the A and B F_2 populations showed exactly the same yield level, whereas the F_3 standard populations yielded 18.2 and 30.6 g respectively. An unprecedented attack by *Fusarium solani*, which was heavier in population A than in population B, disturbed the 1979 results to a high degree. This is why a conclusion on the response of index selection for seed yield could not reliably be drawn. However, because on average the ICL-populations were later, longer and had a smaller podless top to plant length ratio, I suppose that there was indeed a selection result. No indication was obtained that difficulties should be met when selecting both for seed yield and protein content. The relative selection efficiency of the four auxiliary characters was considerably lower in the F_3-populations than in the F_2. Can index selection be effectively applied twice in the same population using the same set of auxiliary characters?

Much of what has been pointed out for the ICL-populations also holds true for the populations following index selection for seed yield only. There was no consistant behaviour for selection response in populations A and B as far as measured on the basis of seed yield itself. On the other hand, two F_3 populations, which were on an average longer and later than the standard populations, had a longer generative stage and a smaller podless top to plant length ratio. The *Fusarium* stress made a real comparison of expected and realised response impossible, nor was it possible to draw a reliable conclusion on the effectiveness of index selection compared to phenotypic selection for yield. The inconsistency of the 1979 results leads to a prediction of selection response for the F_4 (1980), which does not inspire too much confidence: applying a selection intensity of 10 per cent (in reality 75 plants were selected, equalling 16-34 per cent selection intensity, because of differential loss by *Fusarium*) index selection should lead to a genetic gain of 24.8 and 5.3 per cent and direct selection to a genetic gain of 20.0 and 26.0 per cent in populations A and B respectively.

FRIED CRISPY FABA BEANS

Soak beans in cold water overnight and remove the skins. Split the beans. Dry them. Fry in hot oil until golden brown. Drain on absorbant paper and sprinkle with salt.

Serve as a snack.

The beans can also be roasted instead of fried but sprinkle them with salt before roasting.

Breeding work on Vicia faba in the Sudan

Farouk Ahmed Salih
Shambat Research Station, P.O. Box 30, Khartoum North, SUDAN

Vicia faba has been grown in Sudan for a long time for human consumption. Some 25,000 ha were put under faba beans during the 1978/79 season (Sudan Year Book of Agricultural Statistics, 1978). The Northern Province, with about 77 per cent of the faba bean area, is the main region of production, followed by the Nile Province (21 per cent) and Khartoum Province (2 per cent). Lift irrigation by pumps is now by far the main method of irrigation. Some basin areas are still under flood irrigation; these areas were of greater importance in the past.

The faba bean breeding work, begun in the 1961/62 season at Hudeiba Research Station, has had the following main objectives:—

Breeding and selection for powdery mildew tolerance or resistance

All local varieties have been found to be highly susceptible to this disease (Mutwakil 1963). Mutwakil concluded that the genetic mechanism controlling tolerance was not a simple one. Ibrahim (1972) suggested that the basis of resistance to this disease may be due to physiological reactions rather than anatomical ones. He found that the two resistant lines (from USSR and Germany) produced brown discolourations and phytoalexins could be detected. Since these substances are non-specific in toxity to fungi, an effect on powdery mildew cannot be ruled out. Besides that, he observed that susceptibility to powdery mildew increased with leaf age, a character of phytoalexin reaction, as older leaves lose the capacity to form this material.

All new selections from the 'Baladi' and 'Rebaya' varieties were found to be susceptible to powdery mildew, indicating that the tolerance obtained in the original selections was recessive (Mutwakil, 1964). However, selection was continued among the progenies of tolerant parents in an attempt to build up tolerance in case it was governed by more than one recessive gene. In the following seasons (Mutwakil, 1965; 1966; 1967; 1968) a series of crosses and backcrosses (to recurrent parent) were made between the most promising selected lines showing tolerance to powdery mildew, and between them and the high-yielding susceptible varieties. All the F_1 plants in these crosses were susceptible to the disease and the F_2 plants were segregating for the disease with different intensities.

Yassin (1969-1973) conducted research on powdery mildew in two strategies

(a) through hybridization, where some of the high yielding adapted susceptible cultivars were crossed among themselves in a diallel cross. Besides that, these adapted susceptible cultivars were crossed with the two sources of resistance from Germany and USSR (G and 21). Intensive plant selections with high numbers of pods and tolerance to powdery mildew were practiced in the recurrent and non-recurrent populations in every generation. The best lines were retained for future yield testing (Salih, 1975; 1976)

(b) by irradiation, when in 1975 three cultivars BF2/2, RB40, and H.72 were irradiated in Sweden. The M_1 generation was raised in Sweden and the other mutation generations were grown in Hudeiba. Ninety-six single plant selections and bulk selections were made in the three varieties in the 1975 season. The selected group of lines from each treated variety were planted in an isolation plot for more roguing, selections and multiplication of seed (Salih, 1976; 1977). The best lines were included in an elementary yield trial over two seasons. The outstanding lines (for seed yield) were included in another yield trial with H.72 and BF2/2 as controls for comparison (Salih, 1978; 1979; 1980).

Kambal (1979a) selected one strain, R-4-1-1, resistant to powdery mildew under glass-house conditions at Shambat. The resistance in this strain was found to be controlled by a single rescessive gene. Freigoun (1979) reported that the plants of this strain, when grown in Hudeiba Research Station, were heavily infested by powdery mildew. Rate of infection (per cent plants infected) was more than 75 per cent.

Generally the yields of the selected lines were not stable in the yield tests from season to season, and they did not significantly out-yield other varieties which were heavily infected with the disease.

The breeding program for resistance to powdery mildew is very promising, but the new resistant varieties have yet to prove their adaptability and superiority in yield to the standard, but susceptible, varieties. The lack of correlation between level of incidence of diseases and final yield of crop deserves very through investigation.

Breeding and selection for higher number of pods per plant

It has been throughly documented that the most important factor determining yield of faba beans in the Sudan is the number of pods per plant, and that the yield per unit area of land is correlated with this character (Mutwakil, 1963-1967; Kambal, 1969b; Ishag, 1971; Yassin, 1973b; Salih, 1975-1978). The main problem limiting the number of pods per plant was found to the phenomenon of flower and immature pod shedding.

Estimates of natural cross fertilization have ranged from 35.8 per cent to 42.1 per cent indicating that self pollination does not lead to complete self fertilization (Kambal, 1969a). Inadequate insect pollination has been considered as one major factor accounting for low pod set under field conditions, but of course this cannot account for the drop of immature pods. Kambal (1969a) and Kambal *et al* (1976) found that manual tripping (release of stigma and staminal tube from the enclosing keel petals) increases pod set in many varieties. Other varieties, however, e.g. WI, did not respond to manual tripping i.e. they were highly autofertile. In some lines the stigmatic membrane was relatively strong and difficult to rupture. By repeating the tripping process three times, the proportion of flowers with germinating pollen on the stigma increased to 50 per cent, compared with 20 per cent observed after tripping only once. Kambal *et al* (1976) provided evidence for the presence of a mechanical barrier to pollination in undisturbed flowers. Different genotypes can overcome the barrier in different ways. In the non-self-pollinating lines, the flower is so constructed that the passage of the pollen to the stigma along the ventral side of the style is blocked. The autofertile lines are capable of self-pollination despite limited pollen production, apparently due to modifications in the floral structure permitting the pollen to reach the stigma via a short route (designated the ventral passage). The ventral passage was present in all the self-pollinating lines studied and was blocked in all the non-self-pollinating lines. In contrast, some of the hybrids were capable of self-pollination despite blocking of the ventral passage, probably because of their ability to produce enough pollen to surpass critical levels needed for effective pollination via the long dorsal passage.

Kambal (1969a) suggested that inter-competition (for nutrient supply and growth regulators) between ovaries and between young pods could also be important in reducing pod set. Ishag (unpublished data) found that the application of a low amount of IAA (indole acetic acid) and CPA (chlorophenol acetate) increased yield, whilst large amounts decreased yield by reducing the number of branches. These observations were found in the BF2/2 variety; however, the two growth regulatiors had no effect on Giza 2.

Mutwakil (1963-1967) thought that crosses between lines with a high number of flowers with those of high percentage pod set were more likely to produce lines with a high number of pods than by selecting directly for this character. He found that progenies from crosses of 'Baladi' had a higher percentage of pod set (22 per cent) than the original parental population (15 per cent). Similar results were obtained in crosses with 'Rebaya 40'. In subsequent crosses, the number of pods per plant increased from 23 to 43-57 in 'Baladi' and from 23 to 37 in 'RB40'. This character was found to be negatively correlated with seed size and positively correlated with the percentage of flowers which set pods (Mutwakil, 1964). The number of pods per plant was the major factor determining yield in BF2/2 and RB30, whilst in 188 (from Shambat) the seed weight was an effective factor (Mutwakil, 1967). As a result of these selections and crosses, BF2/2 was found to out-yield the parental 'Baladi' by 50 per cent and was released in 1969 as the standard variety for the Northern Province, Rebaya 29 was released in 1972 as a suitable variety for the Southern region of the Northern Province under the name Hudeiba 72.

The objective of producing new varieties with high yield potential was further pursued by Yassin (1969-1972) who made a series of crosses, the first was between nine varieties, the second between RB40, BF2/2, 188, G.1 and IW in a diallel cross. Salih (1975) made more crosses between the high yielding adapted varieties and a group of Ford Foundation introductions showing resistance to root rot disease. Also some of the promising single plant selections from the crosses made by Yassin were crossed by Hudeiba 72 to add more genetic variability in them for more selection. Good selections in the F_1, F_3 and F_5 were made from populations of crosses made by Yassin in 1969 (Salih, 1976; 1977). These selections have been tested for yield in pilot trials for the last three seasons. The top yielder lines were included in a variety trial for yield assessment in comparison to Hudeiba 72 and BF2/2. For the other crosses, bulk selections were made in 1978/79 for yield testing in the coming seasons.

Breeding varieties of faba bean for the non-traditional areas of its cultivation

In view of the high rate of urbanisation in Sudan, the demand, and consequently the prices, for this crop is rising very rapidly. To meet this demand, either the acreage and/or productivity must be raised. The increase in the productivity of the land through research is continuing. There is very little scope for expanding the Agricultural land in the Northern and Nile Provinces because the land is scarce and faba beans cannot compete with horticultural crops, so the major aim is to grow faba beans in areas beyond its southern limits. The suggested areas are those south of the Gezira and North of Khartoum. The results of preliminary experiments made at Soba and Gezira Research Farm showed that the future for this crop in these areas is good. Accordingly, a breeding program was started in the 1980/81 season, with the objectives of developing a variety or varieties for these new areas with the characteristics : (1) early flowering and maturity (2) tolerance to heat and sodium toxicity (3) tolerance or resistance to wilt complex (root rot diseases) and (4) potentially high in grain yield.

A collection of 660 genetic stock lines (single plant selections, bulk selections of different crosses, line selections, open pollinated varieties etc.) were planted during October at Shambat and Soba Research farms in single rows for observation, selection, maintenance of seed and disease survey. The most promising lines of this season will be also subjected to severe conditions for more screening in the 1981/82 season.

Hard seededness in faba beans

Hard seededness is a type of seed dormancy resulting from the impermeability of the seed coat to water or gases or physical resistance to embryo expansion. The photomicrographs of the electron microscope of the seed coat of faba bean showed no discontinuity in the thick seed coat. A cross section of the seed coat showed the characteristic palisade, parenchyma, tracheid and hourglass cells, similar to those of the other legumes. The faba bean seed coat had the largest palisade and hourglass cells (Chaudhary and Buth, 1970), which are primarily responsible for the thickness of the seed coat.

The seed coat contains 89 per cent of the seed crude fibre, and any reduction in seed size is accompanied by at least a corresponding reduction in the seed coat contribution (Cerning *et al*, 1975). The fact that the seed coat apparently gets thinner as seed weight is genetically reduced is of importance to breeding programs as it should mean that small seeded cultivars need not produce a meal with a higher fibre content than large seeded cultivars (Rowland *et al*, 1977).

Causes of hard seed in faba bean have been attributed to genetic, environmental and crop husbandry factors (Donnelly, 1972; Baciu-Miclaus, 1970; Salih, 1981).

Studies at Hudeiba showed that there is considerable genetic variation between cultivars suggesting that it may be possible to obtain high yielding varieties with low hard seed percentage. The size of the problem can also be reduced by variations in cultural practices. However, more advanced research is needed in the area of seed physiology in order to reveal causes for hard seededness.

Breeding for light seed colour

Faba bean usually develops a brown colour in the seed coat when stored dry for some time, if cooked in open containers or if stored canned for a long period of time. However, some seeds still keep their light colour. This is usually assumed to be a transformation of leucoanthocyanin into anthocyanins and partially into brown polymers (Dickinson, *et al*, 1961). Marquardt *et al* (1978) reported that cultivars that produce flowers, testa, and hilum which are white in colour, are deficient in condensed tannins or in those components responsible for the formation of a dark coloured polymeric complex when exposed to oxygen.

The possibility of an association between the toughness of faba bean skins and their leucoanthocyanin content has also been pointed out.

The future for *Vicia faba* in Sudan will be good if

1. cultivars suitable for mechanical harvesting are obtained.
2. the ability to resist or tolerate heat and wilt complex infestations is introduced into varieties, particularly those grown in the south of the Gezira and north of Khartoum.
3. varieties are bred with white flowers, tannin-free testa and resistance or tolerance to powdery mildew. However, it is important that breeding towards such types should be accompanied by improved yield stability, and should not be at the expense of the potential yield of the present traditional types.

References :

Baciu-Miclaus, D. (1970). 'Contribution to the study of the hard seed and coat structure properties of soybean.' Proc. Int. Seed Test. Ass. 35, 366-617.

Cerning, J.A., Saposnik and Guilbot, A. (1975). 'Carbohydrate composition of horse beans (*Vicia faba* L.) of different origins.' Cereal Chem. 52, 125-138.

Choudhury, K.A., and Buth, G.M. (1970). 'Seed coat structure and anatomy of Indian pulses.' Bot. J. Linn. Soc. Suppl. 1, 63, 169-179.

Dickinson, D. Knight, M. and Rees, D.J. (1967). 'Varieties of broad beans suitable for canning.' Chemistry and Industry, 16 November 1967.

Donnelly, E.D., Watson, J.E. and John, A. McGiure (1972). 'Inheritance of hard seed in *Vicia*.' The Journal of Heredity 63, 361-365.

Freigoun, S.O. and Salih, F.A. (1979). 'Yield and disease evaluation for a selected number of lines tolerant to powdery mildew.' Annual Report, Hudeiba Research Station, Sudan.

Ibrahim, G. (1972). 'Basis of resistance in broad bean to powdery mildew.' Annual Report, Hudeiba Research Station, Sudan.

Ishag, H.M. (1971). Annual Report, Hudeiba Research Station, Sudan.

Kambal, A.E. (1969a). 'Flower drop and fruit set in field beans (*Vicia faba* L.).' Journal of Agricultural Science, Cambridge 72, 131-138.

Kambal, A.E. (1969b). 'Components of yield in field beans *Vicia faba* L.' Journal of Agricultural Sci. Cambridge 72, 359-363.

Kambal, A.E. (1979a). 'Occurrence and inheritance of resistance to the powdery mildew disease in *Vicia faba* L.' Sudan Agric. Journal (in press).

Marquardt, R.R., Ward, A.T., and Evans, L.E. (1978). 'Comparative properties of tannin free and tannin containing cultivars of faba beans (*Vicia faba* L.).' Canadian Journal of Plant Science 58, 753-760.

Mutwakil, A. (1963; 1964; 1965; 1966; 1967; 1968). 'Broad bean breeding.' Annual Reports, Hudeiba Research Station, Sudan.

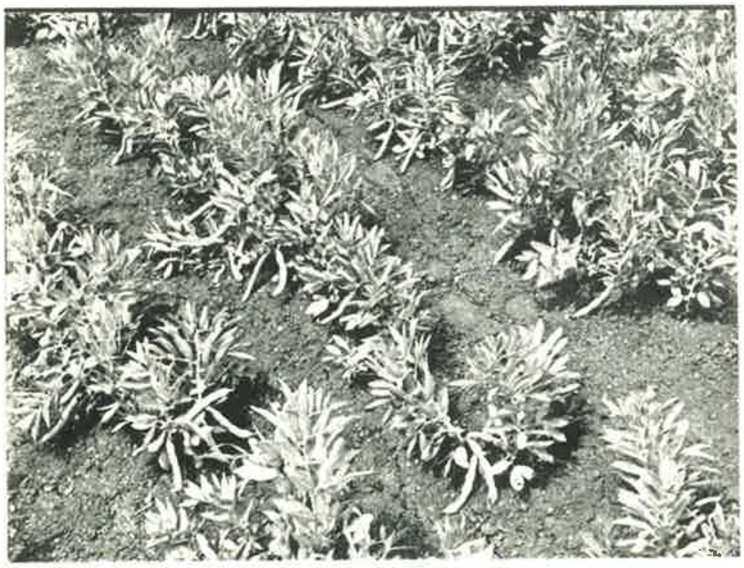
Rowland, G.G. and Fowler, D.B. (1977). 'Factors affecting selections for seed coat thickness in faba beans (*Vicia faba* L.).' Crop Sci. 17, 88-90.

Salih, F.A. (1975; 1976; 1977; 1978; 1979). 'Broad bean breeding.' Annual Reports, Hudeiba Res. Station, Sudan.

Salih, F.A. (1981). 'Hard seededness in faba bean.' A paper presented at the 'International Conference on Faba Bean', Cairo, 7-11 March, 1981.

Yassin, T.E., (1969; 1970; 1971; 1972; 1973). 'Broad bean breeding.' Annual Report, Hudeiba Res. Station, Sudan.

Yassin, T.E. (1973). 'Genotypic and phenotypic variances and correlations in field beans (*Vicia faba* L.).' Journal of Agricultural Science, Cambridge 81, 445-448.



Vicia Faba

Short Communications

General

Faba bean production and research in China

Zhou Xiu Tao
Research Institute of Crop Breeding and Cultivation, Shanghai Academy of Agricultural Science, Hua Cao Town, Shanghai, CHINA

History and area of faba bean cultivation

The history of faba bean cultivation in China goes back more than two thousand years. The crop was first introduced into China from Xi-yu, the region which now includes Xinjiang and parts of central Asia, by Chang Qian in the Han Dynasty around 100 BC. The cultivated area of faba beans in China has reached 1,600,000 ha, which is made up principally by the following provinces : Jiangsu, Zhejiang, Sichuan, Kansu, Qinghai, Yunnan, Hunan and Hupei (see Fig. 1). Most of the crop is grown along the Yangtze river.

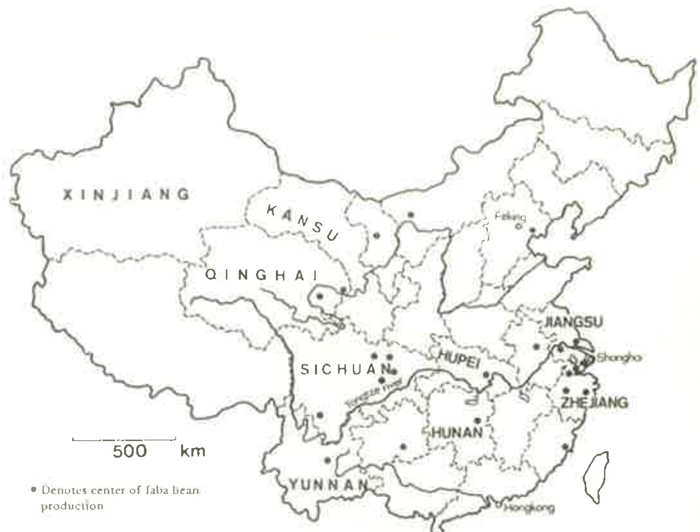


Fig. 1 The People's Republic of China

Over the past ten years the area planted to faba beans has decreased considerably. The reasons for this have been the lack of early-maturing varieties and the fact that the available varieties are not in complete set. Faba bean is considered a low-yielding crop as well as one which results in unreasonable changes to the cropping systems. Thus, in some provinces faba bean have in fact gone out of existence. For example, in the 1950's there were about 167,000 ha of land planted to faba beans in the Zhejiang province - this has now decreased to less than 67,000 ha.

Some aspects of faba bean cultivation in China

Faba beans in China come under two categories : the autumn types and the spring types. The weather in the regions of south and south-west China, as well as in the region along the Yangtze river, is mild, so faba beans are sown in autumn and harvested in summer i.e. sown in September and October, and harvested in May and June. Faba beans are often used as the crop following rice, or are interplanted with corn or cotton.

The principle characteristics of faba bean cultivation in south China are as follows :

The soil should be tilled to a depth of 14-16 cm and 300-375 kg/ha of superphosphate added to the basic fertilizer. Seeds should be sown in good time so as to enable the plants to establish good branches. Reasonable density is also required, and during the period when flower buds begin to emerge and also during full blooming, a dressing of 75-110 kg/ha of ammonium sulphate is important. In some regions, topping and pruning are practised during the period from February to the middle of March. In south China, the yield of faba bean is on average 3000 kg/ha, but yields of 3750-4500 kg/ha may also be obtained. At present, chocolate spot disease, root rot and broadbean weevil (*Bruchus rufimanus*) are the commonest diseases and pest that cause considerable damage to faba beans. Apart from these problems, early-maturing varieties are needed urgently.

In northern and north-western parts of China, faba beans are sown in early spring, and harvested in summer i.e. sown in March and during the first 10 days of April, and harvested in June and during the first half of August. Faba beans here are generally in rotation with wheat.

For the cultivation of faba beans in North China, the following points should be observed : the crop should be sown early as the high water content in the soil is beneficial to the emergence of seedlings, although this may expose the crop to the risk of late frosts. Beside the ample basic manure applied to stimulate vigorous growth of the seedlings and a dressing to prevent shedding of flowers and pods, irrigation in the early stages of flower bud emergence and full flowering should also be practised to facilitate flowering and pod bearing.

In general, the yield of faba beans in north China is 2250-3000 kg/ha, but in some cases yields as high as 6000 or 7500 kg/ha can be obtained.

Some aspects of faba bean research

The genetic resources of faba beans in China are rather rich. In the 1950's, some work was done on collection and research. But in the past 10 years work on studying and collecting varieties has been seriously devastated. In some provinces, genetic resources of faba beans have diminished. It is only in recent years that various provinces, cities and autonomous regions have begun to renew work on collecting and studying faba beans.

The following research work is now being carried out :

1. **Collection of germplasm resources.**
2. **Breeding work.** Some breeding work is now being done in the following provinces : Qinghai, Kansu, Sichuan, Zhejiang and Jiangsu. Work is concentrated on improving the farmers' varieties, breeding through systematic screening and crossing. Some new cultivars such as Jiangsu Qi-dou NO4, Qu-kou white skin and Cixi white have been released.

It can be reported that the faba bean varieties introduced from ICARDA in the spring and autumn of 1980 will be identified in the Crop Research Institutes of the Qinghai Academy as well as of the Zhejiang Academy of Agricultural Sciences in the spring and autumn of 1981 respectively.

3. **Experiments on high yielding cultural techniques.**

In the Qukuo region of the Qinghai province, some cultural techniques have been tested. These include deep ploughing, early sowing at high density, and rational application of fertilizers and irrigation. The application of NAA, urea and superphosphate at the early blooming, full blooming and pod filling stages respectively, produced on a 2 ha plot average yields as high as 7485 kg/ha. In 1976, a 2.6 ha plot even gave a yield of 7808 kg/ha. Other regions have also conducted experiments on high yielding techniques. Taking the Ninshia Autonomous Prefecture of the Kansu province as an example, the area planted to faba beans was 6700 ha in total, and the average yield per ha was 2250-3000 kg; here maximum yields of 6000-6750 kg/ha have been obtained. In the Nandong region of Jiangsu, where there are 67,000 ha of faba beans planted annually, the average yield was 2970 kg/ha in 1978, but the highest yields were over 4500 kg/ha. Faba beans in the Erhai region of Yunnan province covered an area of 6,880 ha in 1980, with an average yield of 3300 kg/ha; maximum yields were 3750-4500 kg/ha.

To summarise, there exists in China a high potential for extending the area planted to faba beans and increasing their yield per unit area.

The author is indebted to Dr. Zhen Zhuo Jie, Dr. Duon Xing Non and Dr. Zhoo Shon Kai for their guidance and help.

Breeding and Genetics

Looking for new sources of cytoplasmic male sterility in faba bean after mutagenesis.

G. Duc

INRA Station d'Amelioration des Plantes, BV 1540, 21034 Dijon Cedex, FRANCE

Two sources of cytoplasmic male sterility (CMS) are know in faba bean *(Vicia faba)* : cytoplasms 350 and 447. Both are unstable and so for this reason are not very helpful for breeding hybrids. This problem has initiated a breeding program within the framework of the A.C.V.F. (Association des Createurs de Varietes Fourrageres, linking I.N.R.A. and French private breeders) with the aim of looking for new sources of cytoplasmic male sterility in faba bean following mutagenesis. The literature indicates that this method has been successful in species such as barley (Favret and Ryan, 1964), sugar beet (Kinoshita, 1976) and Sorghum (Erichsen and Ross, 1963) in inducing cytoplasmic male sterility.

The purpose of such mutagenesis work is to find a new interaction between cytoplasm and nucleus leading to a stable male sterile phenotype. This means that screening for new cytoplasms is very dependent on the background genotype controlling their survival and expression.

Chemical mutagenic substances, either ethyl methane sulphonate (EMS) or an association of EMS and ethydium bromide, were used. Ethydium bromide is known to induce a lot of cytoplasmic mutations in microorganisms and was tested in these experiments for this reason. The following types of treatments were applied without significant differences in their effect :

seed	soaking time (hours)	solution
dry	24	EMS 1.5 per cent
	8	EMS 2.5 per cent
	6	EMS 2.5 per cent (+E.B. 0.5 per cent)
germinated	6	EMS 2.5 per cent (+ E.B. 0.5 per cent)

The treated seeds were sown in an isolated plot and M_1 plants coming from these seeds gave the M_2 progenies which we screened for male sterile plants.

Two types of work have been carried out, as follows :

1. **Inducing mutation of normal cytoplasm to "sterile" cytoplasm**

Since 1973, about 100,000 M_2 plants were screened in the spring and winter *minor* type lines or cultivars. Among the sterile plants which were found in M_2 and crossed by the control plants, only 20 gave sterile plants in the following progeny. Not all of these have yet been analysed from the genetic point of view, but none of them is of a cytoplasmic determination and one of them is known to have dominant genetic male sterility.

2. **Modifying the 447 male sterile cytoplasm**

In this experiment, male sterile plants (447 cytoplasm) were treated and the screening for new CMS determinants was based on the hypothesis of different behaviour in the presence of the dominant restorer genes of the 447 cytoplasm.

2.1 We looked for exceptions to restoration (i.e. male sterile plants in F_1)

--the standard behaviour is :

Male sterile x restorer → Restored F_1 (Male fert.)
(rr/447) (RR) (rR)

--after mutagenesis on male sterile seeds among 16,000 F_1 plants, one exception to this rule has been found and is now being studied.

2.2 We looked for exceptions to the permanence of restoration (i.e. male sterile plants in F_2)

--the standard behaviour is :

Restored F_1 —selfed→ F_2 Male fertile
(rR)

--among 15,000 F_2 plants, without mutagenesis, two exceptions to this rule have been found and are now being studied.

--after mutagenesis on male sterile seeds, out of 1000 F_2 plants which were observed, one exception has been found and is now being studied.

This mutagenesis program is continuing and this report must be considered as preliminary.

N.B. This short communication was written on behalf of the following members of the A.C.V.F. food legume section:-

P. Berthelem, J. Le Guen — I.N.R.A. Station d'Amelioration des Plantes, Domaine de la Motte au Vicomte 35650 Le Rheu

J. Picard, G. Duc — I.N.R.A. Station d'Amelioration des Plantes, BV 1540 21034 Dijon Cedex.

H. Thiellement — I.N.R.A. Laboratoire Amelioration des Plantes, Universite Paris-Sud - Bt 360 91405 Orsay

M. Verhaegen — Etablissements BLONDEAU B.P. No. 1 59235 Bersee

M. Masson — Etablissements CLAUSE 91220 Bretigny

References :

Erichsen, A.W. and Ross, J.G. (1963). Crop Science 3, 335-338.

Favret, E.A. and Ryan, G.S. (1964). Barley Newsletter 8, 42.

Kinoshita, T. (1976). Japanese J. Breeding 19, 445-457.

MHAMMAS BIL KHODRA — **TUNISIA**

- 6 oz (150 g) dried octopus, chopped
- 3 fluid oz (75 ml) olive oil
- 1 lb (500 g) pasta
- 4 oz (100 g) chickpeas
- 4 oz (100 g) faba beans
- 1 onion sliced
- 1 oz (25 g) parsley, chopped
- 1 oz (25 g) celery
- 4-5 carrots, chopped
- 3-4 turnips, chopped
- half a medium-sized cabbage, chopped
- 2 tbsp. tomato puree
- 1/2 tsp. hot sauce
- 1/2 tsp. chilli pepper
- 1 lemon
- salt

Soak the chickpeas and faba beans in cold water overnight. Next day, fry the onion in hot oil until brown. Add the octopus pieces, add the soaked chickpeas and faba beans, the chopped parsley and celery also the carrots, turnips and the cabbage. Mix in the tomato puree, hot sauce, salt and chilli pepper. Simmer in 1 3/4 pints (1 litre) water until the vegetables are cooked. Pour over another 3/4 pints (1/2 litre) of water, bring to the boil, add the pasta and cook until tender (15-20 minutes).

Effect of plot-to-plot distance on the percentage of intercrossing between faba bean plots

Mamdouh Omar and Geoffrey Hawtin
Food Legume Improvement Program, ICARDA, P.O. Box 5466, Aleppo, SYRIA

In faba bean yield trials it is common practice to grow the material in ranges, with an alley between each range for access. The individual plots usually consist of several rows planted perpendicular to the alley, and may be planted contiguously or with a gap between each. The effect of such a gap on yield determination has been discussed previously (Omar and Hawtin, 1980). In view of the low multiplication rate in faba beans, seed from yield trials may have to be retained for subsequent use. In this case trial designs which minimise plot intercrossing might have an advantage. A trial was therefore conducted to study the effect of different plot-to-plot distances on this factor.

Materials and Methods

Three-row test plots of 4 m in length were sown, with a row-to-row distance of 65 cm. The plants in the test plots were all homozygous for the recessive white hilum character. The test plots were planted in a single range and alternated with marker source (black-hilum) plots of 15 rows. Three distances between the test plot and marker-plot were studied: 1.3, 2.6 and 3.9 m respectively. The adjacent ranges were both planted uniformly with the marker source. An alley of 1.25 m was left between ranges.

The percentage of plot inter-crossing was determined from the percentage of black-hilum plants which occurred in the F_1/F_2 generation (see Hawtin and Omar 1980). As the majority of faba bean plants in the rest of the trial field also carried the black hilum gene, any intercrossing between white hilum test plots and other white hilum sources in the field were likely to be very small, but it was not possible to estimate the extent to which this may have occurred. Likewise it was not possible to estimate the percentage of crossing which may have occurred between test plots, but again this is expected to have been only slight.

The trial was repeated twice; at the edge of the field and in the center. The treatments, however, were not replicated within each location. The field was approximately 8 ha in size. Each row of the test plots was harvested separately, and each row divided into three : the two ends, and the center.

Results and Discussion

Although it was not possible to analyse the results statistically, there was a strong indication (Table 1) that inter-crossing between plots decreased as the distance between them increased. There was also a consistent trend for plot inter-crossing to be lowest at the center of the plot compared to the border rows, or the ends of the plot. This observation is consistent with that reported previously (Hawtin and Omar 1980) for isolation plots. Although there was no overall difference between the mean whole-plot inter-crossing at the edge compared to the middle of the field, there was an indication that less crossing occurred in the centers of the plots in the middle of the field than at the edge. This if it is a real effect, is hard to explain. It is possible that there were reduced numbers of pollinators at the center of the field, but that those which were present were preferentially active on plants adjacent to a space (plot borders) compared to plants in a dense stand (plot centers). Retaining seed from only the centers of plots in yield trials for subsequent use would help to reduce the effects of inter-crossing between plots. However this measure alone is not likely to provide adequately pure seed samples for most subsequent breeding purposes.

References :

Hawtin, G.C. and M. Omar (1980). 'Estimation of out-crossing between isolation plots of faba beans. FABIS 2, 28-29.

Omar, M. and G.C. Hawtin (1980). 'Plot technique studies on faba beans III : border effects for different plot designs.' FABIS 2, 15-16

Table 1. Percentage of inter-plot crossing with different plot-to-plot distances

position in field	plot-to-plot distance, m	mean, border rows	mean ends of rows	center of plot	plot mean
edge	1.3	21.5 (1580)[1]	21.6 (660)	16.7 (180)	
	2.6	18.5 (1650)	18.3 (510)	15.4 (210)	
	3.9	16.8 (1620)	15.9 (2180)	13.6 (210)	
					17.8
center	1.3	21.1 (2130)	22.5 (690)	10.7 (300)	
	2.6	18.5 (2160)	20.8 (870)	8.7 (240)	
	3.9	16.7 (2430)	15.8 (840)	10.7 (420)	
					17.8

[1] Numbers in parentheses indicate the number of plants tested.

Inheritance of some characters affecting the flower colour in *Vicia faba*

M.T. Moreno, A. Martin and J.I. Cubero
Centro Regional de Andalucia INIA, Apartado 240 and *Dept. de Genetica, E.T.S.I. Agronomos, Apartado 246, Cordoba, SPAIN.*

Basic standard colour.

Standard petals of *Vicia faba* are characterised by a basic colour (white or blue); several veins with brown, violet, red and/or yellow pigments can also be seen. A recessive gene (**df**) takes these pigments out of the veins, diffusing the pigments throughout the standard colour. These mutants are frequently called 'solid yellow', 'solid brown' etc.. Thus, a standard with blue as the basic colour and homozygous for **df** will show an overlap of two different colours, sometimes with a rather bizarre aspect (e.g. if the solid colour is yellow, the standard appears as blue-green).

'Basic' and 'solid' colours are easily differentiated:

(a) The basic colour covers all the standard area homogeneously, the latter covering only part, to a greater or lesser extent. There are at least two types of solid colours: one 'intense', almost reaching the edge of the standard area, and the other 'weak', covering only the central portion. Thus, the basic colour can always be seen.

(b) Solid colours, but not the basic ones, affect the wing petals: the surface of the wings are completely covered by brown, yellow etc. in **df df** genotypes, but the basic wing colour is always white.

(c) When seen under the microscope, a basic colour is expressed as a uniform tone dying the cytoplasm homogeneously: presumably the pigment is soluble. On the contrary, solid colours are manifested because the cells possess coloured bodies, the same as seen in the cells of the veins and those of the wing spots.

There are at least two kinds of basic blue: 'weak' and 'strong'. The former is sensitive to high temperature; it is better expressed in cool and humid environments, and it is easily lost under rising temperatures. The latter either does not show much sensitivity, or the cells contain much more pigment. The sensitivity to temperature interferes with the recording of data: a plant can be ascribed a white ground colour even if it is really 'weak' blue. In cases of doubt, young bud standards have to be observed. In any case, the comparison with an undoubtedly white basic standard is convenient. In cases where 'weak' variants are in the correct environment, differences between 'weak' and 'intense' can be very difficult to observe.

Crosses between 'intense blue' and 'white' basic coloured lines produced 9 'weak': 3 'intense': 4 'white' segregations. Thus, the presence of blue as the basic standard colour is dominant over white (**Wb wb**), and an independent recessive gene reinforces the blue colour or alternatively, produces temperature-insensitive pigment (**Bi bi**). The genotypes of the parents used were **WgWg bibi** (intense blue) and **wgwg BiBi** (white). 'Weak blue' lines are **WgWg BiBi**.

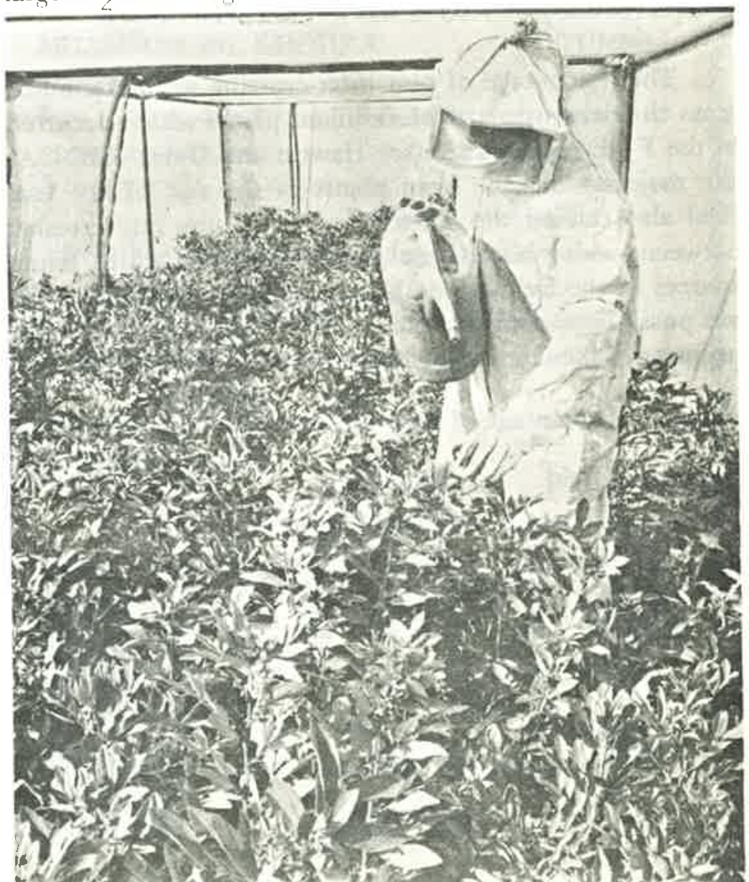
The **Wg** locus is independent of both red colour of seed coat and white colour of hilum loci.

Lemon wing spot.

Some crosses, including those with a white flowered mutant, have produced a new type of yellow colour, easily perceived in the wing spots. It has been called 'lemon' to differentiate it from the yellow already described in the literature (the latter showing a 'golden' tone). The analysis of several F_2 plants have shown that 'lemon' (**le**) is recessive of 'brown'; this locus is independent of Sjodin's topless, of the two known loci for white flowers and of 'short internodes'.

Washed wings.

Some lines show wing spots with a lower intensity of colour than 'wild' ones; these spots are rather irregular, mainly in the distal part of the spot. Their aspect suggest a 'washed' spot. A recessive gene (ww) controls this character, according to our results. The 'washed wings' locus is independent of 'short internodes' and of the two loci for white flower, but it seems to be linked with Sjodin's topless mutant ($P \leq 0.39$). This result is only provisional: larger F_2 are being studied.



Inside faba bean cage

Increasing the efficiency of hand crossing in faba beans

Mamdouh Omar, Peter Walker and Geoffrey Hawtin
Food Legume Improvement Program, ICARDA, P.O. Box 5466, Aleppo, SYRIA

Three studies were carried out in the 1979/80 season, in an insect-proof screen house at the ICARDA site at Tel Hadya in northern Syria. These were aimed at providing additional information for improving the efficiency of hand crossing in faba beans and were a follow-up to the studies of the 1978/79 season. The method of crossing was the same as that described previously (Omar and Hawtin, 1980).

The first experiment examined the effect of the time of day during each hour from 8 am to 5 pm. Fourteen emasculations followed by immediate pollination were made during each time period, on each of four different crosses. The success rate of crossing was measured by the percentage of pods set for each treatment. The analysis of the two-way table (cross x time of day) on a logit scale revealed no differences between the crosses and no evidence for cross x time interactions. The percentages of success were thus pooled over crosses. There was an apparent rise in success in the middle of the day compared to the beginning and end. The x^2 value for linear trend in the success rate was 0.5705 (1 d.f., not significant), but for a quadratic trend, x^2 was 13.04 (1 d.f., highly significant); there were no other significant components. The results are clearly shown by grouping the day into three consecutive 3-hour periods (Table 1.).

Table 1. Pods set following crossing during three 3-hour time periods

time	total pollinations	No. of pods set	% success
8 am-11 am	168	22	13.1
11 am-2 pm	168	40	23.8
2 pm-5 pm	168	18	10.7

The significant x^2 of 12.23 (2 d.f.) is almost entirely accounted for by the difference between the middle period and the two extremes. These results contrast with those of the previous season in which the period from 1 pm to 3 pm was the best. This may be due, at least partly, to the climatic differences between the two season : 1978/79 was drier and hotter than average (total precipitation during the season was 246 mm) whereas in 1979/80 a total of 428 mm of rainfall was received.

The second experiment examined different flower positions on the peduncle for eight different crosses. The basal, second or third flower was emasculated and immediately pollinated. All flowers other than the one crossed were removed. The numbers of pollinations made in each treatment differed because of limitations of time and available flowers.

Table 2. Effect of time of day of emasculation and pollination, and the period between them, on pod set.

treatment	emasculation	pollination	total pollinations	No. of pods set
1	morning	immediately	40	9
2	morning	afternoon, same day	40	19
3	morning	morning, next day	40	8
4	morning	afternoon, next day	40	7
5	afternoon	immediately	40	12
6	afternoon	morning, next day	40	7
7	afternoon	afternoon, next day	40	7

On the logit scale there was again no evidence of an interaction (cross x flower position) but two crosses showed a higher success rate than the rest. After adjusting for cross differences there was still a clear trend for less successful pollination when proceeding up the peduncle. The adjusted percentages of success being 64.5 per cent (basal flower) 51.9 per cent (second flower) and 35.0 per cent (third flower). On the logit scale the F-value for these differences was 14.04 (2 and 14 d.f.; $P \leqslant 0.001$).

In the third experiment seven timings of emasculation and pollination were practised in four crosses. As in the first experiment, cross differences were not significant and there was no evidence of a cross x crossing method interaction. Thus, frequency of success was pooled over crosses (Table 2). A x^2 value, calculated from this data, of 15.45 (6 d.f. $P \leqslant 0.01$) was clearly due to the superiority of treatments 2 and 5. It appears that, overall, pollination in the afternoon was superior to pollination in the morning, irrespective of when emasculation was carried out, providing there was not too long a time lag between emasculation and pollination (treatments 4 and 7).

Note on the analysis :

It would in general be incorrect to do an analysis of variance on percentages (or proportions) in a two-way classification; since the precision differs from cell to cell. Various transformations are possible; the one chosen here is the logit, defined by y equals $\log_e p/_{1-p}$ where p is the probability of 'success' in a cell. With an appropriate continuity correction the method is essentially as described in

Snedecor and Cochran except that marginal constants were fitted by the iterative method of Stevens (1948). In all three experiments the size of the interaction sum of squares confirmed that the model was a reasonable approximation.

References :

Omar, M. and Hawtin, G.C. (1980). 'Hybridization techniques for crossing in faba beans'. FABIS 2, 26.

Snedecor, G.W. and Cochran, W.G. (1976). 'Statistical Methods'. Iowa State University Press, 6th ed.

Stevens, W.L. (1948). 'Statistical analysis of a non-orthogonal tri-factorial experiment'. Biometrika 35, 346-367.

Characterisation of Vicia faba trisomics.

J.A. Gonzalez-Garcia, J.A. Padilla and A. Martin
Escuela Tecnica Superior de Ingenieros Agronomos, Apartado 246, Cordoba, SPAIN

Four trisomics were originally described by Martin (1978), but one was lost in the subsequent work. Chromosomes S_a and S_d (nomenclature of Evans, 1961) were identified as being the critical chromosomes of two of the three remaining trisomics; we have failed up to now to identify the critical chromosome of the third trisomic.

The trisomics can be easily separated from diploids because of the general aspect of the trisomic plant (less vigour, leaflet shape, development etc.). However, the differences between the trisomics are not sufficient to differentiate them.

Using trisomics as female, we have crossed them with a collection of mutants in order to discover the genes carried by the critical chromosome. The results of F_1 chromosome counting show that the transmission is 28.2 per cent for S_a, 27 per cent for S_d and 27.3 per cent for the third (unknown) chromosome.

We found in the progeny of S_d trisomics a secondary trisomic characterised by the presence of a short fragment of S_d carrying the centromere.

We are trying to obtain the complete set of trisomics by means of:

1. crossing diploids and tetraploids (after more than one thousand hybridizations, no triploid has been obtained)
2. irradiating tetraploid faba beans, and
3. looking into the progeny of Sjodin's asynaptic mutant (Sjodin, 1970).

References:

Evans, H.J. (1961). 'Chromatid abberations induced by gamma irradiation. I. The structure and frequency of chromatid interchanges in diploid ploid cells of *Vicia faba*'. Genetics 46, 257-275.

Martin, A. (1978). 'Aneuploidy in *Vicia faba* L.'. The Journal of Heredity 69, 421-423.

Sjodin, J. (1970). 'Induced asynaptic mutants in *Vicia faba* L.' Hereditas 66, 251-232.

A comparison trial of 18 local varieties of Vicia faba.

Muhammed Sadiq El Mott
Agricultural Research Department, Douma, Damascus, SYRIA

In breeding and selection trials conducted from 1970 to 1976, 18 varieties of local faba beans *(Vicia faba)* were selected. Each variety has its own particular characteristics. A comparison trial was then conducted in three-year rotations in different districts of Syria in order to study the productive capacity of these 18 varieties and to select the best yielding ones. This trial was conducted at Jableh on the coast, at Hama in the central part of Syria and at Deir ez-Zor in the east of the country.

The superior varieties had the following characteristics :

variety	seed size	pod size	seed size	seed filling	testa colour
Cyprus (selected)	large	medium	regular	half	greenish
8MAI	large	medium	"	"	pinkish
S VI	"	short	"	"	violet
Aquadulce	"	medium	"	"	pinkish
40 MB III	"	"	"	"	greenish
8MG I	medium	"	"	"	pinkish
3 MA I	large	"	long	"	violet

Materials and Methods

The trials were planted in plots in a completely randomised design with 18 treatments and three replicates. Each treatment was planted in a plot 11.70 m^2 in size, with three rows spaced at 65 cm. The length of each row was 6 m. The method of cultivation was either by planting the seeds at a depth of 5 cm in alternate holes spaced at 40 cm on both sides of the ridge, or in holes 20 cm apart on one side of the ridge only. The trial was planted between 15th November and 30th December. Fertilizer was applied at rates of 74.4 kg phosphate/ha, 26.6 kg N/ha and 125 kg K/ha.

In Deir ez-Zor the trial was irrigated five times. The first irrigation was applied at sowing, the second before flowering, the third after seed setting, the fourth 15 days after seed setting and the fifth 25 days before harvest.

In Hama, where the annual average rainfall is 360mm, the trial was irrigated twice. The first irrigation was applied before seed setting and the second 25 days before harvest. In Jableh, where the annual rainfall average exceeds 500 mm, the trial received no irrigation.

Trials were harvested in June.

Results

The results are summarised in Table 1. In the Hama district the Cyprus (selected) variety performed better than the others in the 1976/77 and 1978/79 seasons; the 8MAI variety was superior to the others in 1977/78. However, the 8MAI variety was the best performer over the three years.

In the Jableh district S VI was the best performer in 1977/78, Aquadulee in 1978/79 and 8MAI in 1979/80. However, 3MAI was the best performer over the three years. In the Deir ez-Zor district, 40MB III performed best in 1978/79 and 8MGI in 1979/80. 40MB III was the best over the two years.

Table 1. The mean results for each variety tested in each district of Syria (seasons 1977/78 to 1979/80)

Variety	Mean yield (kg/ha) for 1977/78, 1978/79, 1979/80 seasons		
	Hama district	Jableh district	Deir ez-Zor district
Windsor W	5831.6	3611.6	2330.5
40 MB III	5811.6	2906	2885.5
10 MB IV	5705	3177.6	2265
S VI	5704.3	3342.6	2177
Cyprus K	5398.3	3649.3	2412
Cyprus (selected) KM	6197.3	3108.6	1456
Aquadulce 39 MB	5753.3	4428.6	2326
3 MAI	6348.3	4725.6	2585
8 MAI	6251	3369.6	2401
Long boot 6 MBI	5478.6	4186.3	20275
Elegant 10 MBII	5709	2837.6	2659.5
42 MBI	5372.6	3175.3	2583
5 MGI	5008.3	3806.6	2652
8 MGI	5666.6	3010.6	2465
Green Golian GMGII	4884.3	3456.3	2159
15 MGII	5300	4443.3	2478.5
9 MAII	5655	3593.6	2317
J.W.	2564.3	2700.6	1848

Physiology and Microbiology

Transport of ^{14}C photosynthate in faba bean branches with or without pods

Kiyoshi Kogure
Faculty of Agriculture, Kagawa University, 2393, Ikenobe, Miki-tyo, Kagawa-ken, 761-07, JAPAN

Faba beans, which are generally cultivated during the autumn to spring months in Japan (Kogure, 1978) show no remarkable top growth except for vigorous branching in winter. We can sometimes count more than ten stems per plant, which are close together with increasing plant density (Tamaki, 1973). With branched stems, however, the percentage of pod bearing stems is low and unstable because of the shortage of assimilates (Soper, 1956).

A pot trial on the behaviour of ^{14}C-photosynthate assimilated at 45 days (Stage I) and 65 days (Stage II) after the start of flowering was carried out using the cultivar "Sanuki-nagasaya". The main axis and other stems of the plant were removed in winter, and the three earliest developed stems were used for the experiment. All stems had from 20 to 24 leaf-nodes and two pods. Pollination was carried out at 2 day intervals at successive nodes within each stem. Pods were retained such that there was a difference of 2 days between the two pods set within any stem and the pods set on the other stems (see Fig. 1 for positions of stems 1a, 1b and 2a). For labelling with ^{14}C, after covering pods with vinyl-film, the whole stem was enclosed in a vinyl-film bag and exposed to $^{14}CO_2$ for about 20 minutes. Plants were subjected to five treatments as shown in Fig. 1, including pretreatments of removing leaves (Treatments 4 and 5) and pods (Treatments 3 and 5).

Each stem was almost completely independent, and at Stage I, when the development of the vegetative organs were about to cease, the sink was the pods. At Stage II, in the seed maturing period, the sink was the seeds. As for the transport of ^{14}C-photosynthate among branched stems, the sink activity of pods and seeds was however directly linked to the developed and/or the pollination order. In Treatment 1, where the stem 1a was fed $^{14}CO_2$, almost all the ^{14}C-photosynthate was distributed in the pods or seeds of the stem 1a, and not in those of stems 2a and 1b. However, ^{14}C-photosynthate was distributed in pods and seeds on stem 1a when $^{14}CO_2$ was fed to leaves of stems 2a and 1b.

This may explain the strong competition among pods or seeds within stems of the same plant. And the establishment of competing ability seems to depend on the order of pollination among pods as shown in Treatments 2 and 4, and 3 and 5. By what means does this phenomena occur?

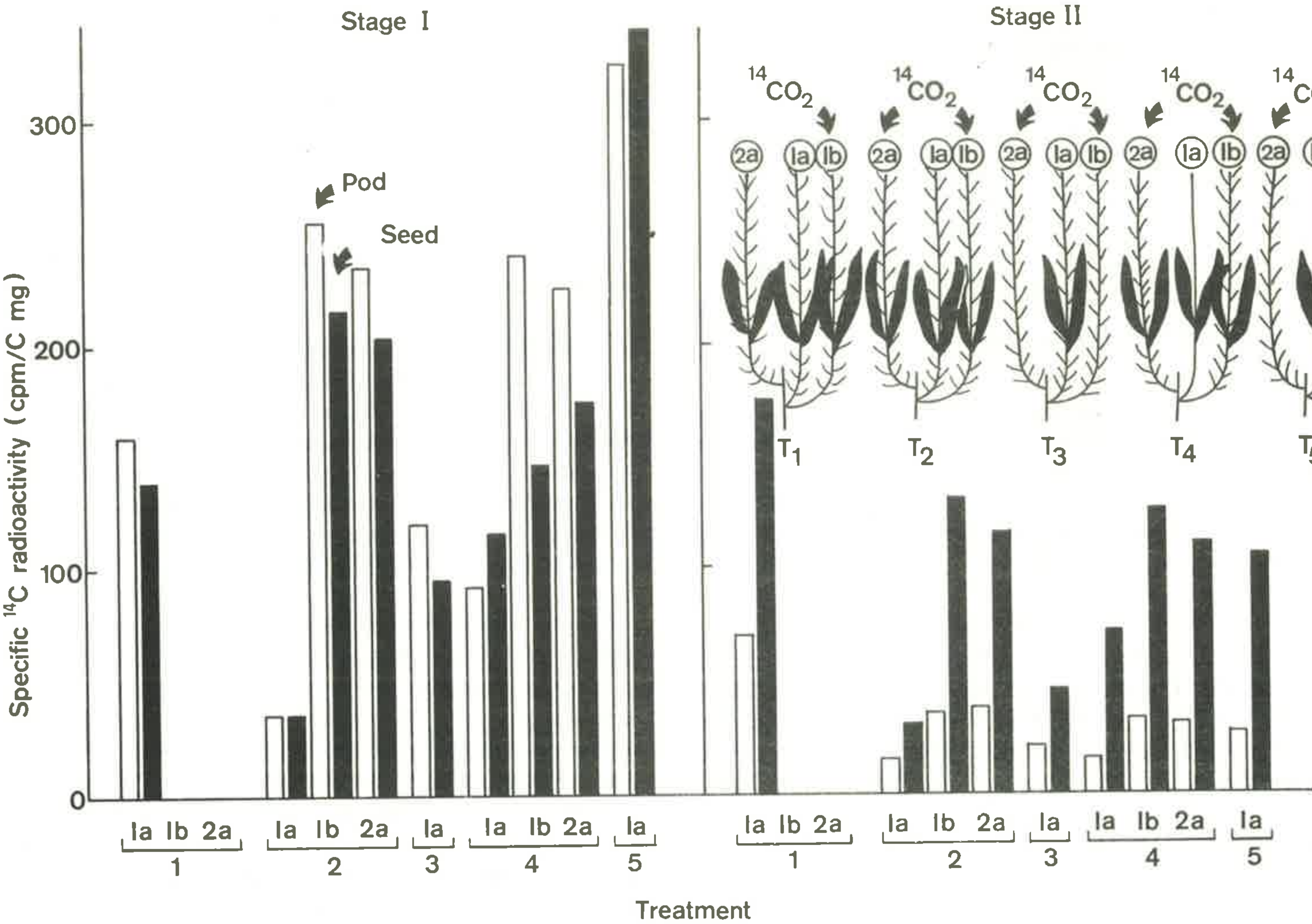


Fig. 1 Distribution of ^{14}C-photosynthate at harvesting time.

The respiration of pods at 50 days after the start of flowering was 12 to 14 per cent higher in plants of Treatments 3, 4 and 5 than in those of Treatments 1 and 2. But there were no significant differences between the three Treatments 3, 4 and 5.

From the results, it seems that the stems of faba bean plants behave essentially independently and make a source-sink unit within one stem. Although it is difficult to ascertain the reason for drawing assimilates into the pods or seeds of stem 1a, the leaves of late developed stems play an auxiliary role as sources of assimilates.

Screening of several strains of faba bean Rhizobium tolerant to moisture stress conditions

Rafiqul Islam
Research Support Group, ICARDA, P.O. Box 5466, Aleppo, SYRIA

Although faba bean is normally grown in the higher rainfall areas (> 500 mm rainfall) in several countries of the West Asia and North Africa region, or in lower rainfall areas with irrigation, efforts are currently being made by ICARDA to introduce rainfed faba beans into lower rainfall areas (300-400 mm of rainfall). If faba bean is to be grown as a rainfed crop in lower rainfall areas it is highly desirable that the crop nodulates well for optimum dinitrogen fixation and maximum grain production.

Hence studies were initiated on ICARDA's research site at Tel Hadya, where eight strains of *Rhizobium* (BB-10c,BB21b, BB-22b, BB-64a, BB-39a, BB-48a, BB-54b, IC-9253) were screened for nodule forming ability with two local faba bean cultivars : ILB 1814 (*major* type) and ILB 1811 (*minor* type). These studies were made under rainfed conditions during the 1979-80 growing season. The seeds were inoculated with peat inoculum slurried in cellulose gum. Nitrogen fertilizer at the rate of 120 kg N/ha was applied to one uninoculated treatment to measure the relative growth performance. The experiment was planted in late November 1979 and approximately 424 mm of rainfall was received during the growth period.

Harvests were made at early vegetative and mid pod-filling stages for the assessment of nodulation. A minimum of 32 plants were examined for nodulation from each treatment. Grain yield data were obtained at maturity.

Results and Discussion

The plants varied little between the treatments at the early vegetative stage except that some strains of *Rhizobium* produced more nodules than others. By mid pod-filling stage, however, the difference between the treatments considerably increased. Inoculation with some strains of *Rhizobium* significantly increased the production of nodules and nodule mass compared to the uninoculated controls for both the cultivars (Table 1). In general, the responses were greater for ILB 1814 than for ILB 1811. ILB 1814 produced the most nodule mass with the strain BB-48a and ILB 1811 with BB-54b (more than 60 and 25 per cent over the uninoculated control respectively). A few strains failed to increase either nodule number or nodule mass production for both of the cultivars. Application of nitrogen fertilizer significantly reduced both the production of nodules and the nodule mass for the two cultivars, in comparison to the uninoculated treatments.

Several strains of *Rhizobium* increased the grain yield but this increase was significant for only three strains (BB-39a, and IC-9253 in ILB 1814 and BB-54b and IC-9253 in ILB 1811 cultivars) when compared with uninoculated control. The percentage increases ranged between 4-16 per cent for ILB and 9-13 per cent for ILB 1811 respectively. (Table 1). Nitrogen fertilization failed to significantly increase grain production for ILB 1814 but did increase it for ILB 1811 compared to the uninoculated control.

The results indicated that both nodule production and grain yield for the two cultivars of faba bean were increased by artificial inoculation with some strains of *Rhizobium* under rainfed conditions, although the cultivars varied considerably in their responses with the different strains. In order to get the maximum benefit from symbiosis under the low rainfall situation, it is thus very important that both drought tolerant strains of *Rhizobium* and host cultivars are properly selected.

Root nodules on *Vicia faba*

Table 1. Production of nodules, nodule dry matter and grain by two cultivars of faba bean as affected by several strains of *Rhizobium*

treatment	ILB 1814 nod. No. /plant	ILB 1814 nod. dry wt. (mg/plant)	ILB 1814 yield (kg/ha)	ILB 1811 nod. No. /plant	ILB 1811 nod. dry wt. (mg/plant)	ILB 1811 yield (kg/ha)
uninoc.	77.0	240.9	2223	134.0	155.5	1515
BB-10C	125.0	293.8	2352	152.7	196.6	1577
BB-21b	82.0	259.6	2071	174.8	163.0	1597
BB-22b	144.0	284.8	2211	127.3	196.2	1596
BB-64a	71.7	225.3	2316	87.0	166.6	1489
BB-39a	154.6	299.6	2578	108.3	175.2	1549
BB-48a	138.6	386.1	2429	185.4	232.1	1764
BB-54b	147.2	290.0	2458	209.8	256.5	1827
IC-9253	199.7	193.6	2490	52.6	174.9	1779
120 kg N/ha	52.1	110.7	2367	45.7	104.1	2034
LSD 5 per cent	20.5	41.3	243	19.4	34.8	250

Screening of several strains of faba bean Rhizobium for tolerance to salinity

Rafiqul Islam and Widad Ghoulam
Research Support Group, ICARDA, P.O. Box 5466, Aleppo, SYRIA

Faba bean is frequently grown as an irrigated crop in the West Asia and North Africa region. In areas where there is inadequate drainage salts may be deposited near the surface of the soil making these highly saline. A survey of some of these fields in northern Syria, Egypt and Sudan showed that nodulation of the crops was generally very poor.

A preliminary study was carried out in an air-conditioned growth room to identify suitable strains of *Rhizobium* for faba bean which could nodulate effectively under saline conditions.

The plants were grown in Jensen's Agar media using Gibson's technique (Gibson, 1963). Jensen's média (Jensen, 1942) was prepared and NaCl was added to the medi at 0.16 per cent (6.6 m moles) in treatment S1, and 0.32 per cent (11.1 m moles) in treatment S2. Media without any added NaCl served as control treatment SO. 40 ml of media was added to each 200 x 25 mm test tube and the tubes were sterilised at 15 p.s.i. for 10 minutes before slopes were made. Faba bean seeds (cv. ILB 1811, local *minor* type) were surface sterilised with 0.2 per cent $HgCl_2$ and pre-germinated before planting in the tubes. After 2-3 days, when radicles were 5-6 cm long, the cotyledons were excised. Ten strains of *Rhizobium* (BB-10C, BB-32b, BB-39a, BB-54b, BB-48a, BB-22b, BB-85b, BB-80b, BB-66a, BB-40b) were grown separately in yeast mannitol broth and 1 ml of the *Rhizobium* suspension was added to each tube. At each salt concentration there were four replications for each strain of *Rhizobium* . The plants were grown under white warm florescent tubes having a light intensity of 14,000 lux. The temperature in the growth room was maintained between 20^{o} and 25^{o}C, day and night. The plants were subsequently watered with 1/4 strength nitrogen-free nutrient solution (Dart and Pate, 1959). After 40 days the plants were harvested and assayed for nodule number and their dry weight. The shoots and roots were dried at 80^{o}C for 24 hours and dry weights measured.

Results

Uninoculated plants did not develop any nodules and their growth was poorer than that of inoculated plants (Table 1). Increasing the salt concentration did not give any difference in the growth of uninoculated plants.

Inoculation with various strains of *Rhizobium* resulted in nodulation at all the salt concentrations. Nodulation was better in the absence of salt or with the lower rate of salt application (S1).

Strains of *Rhizobium* showed differences in their effect on nodulation under different levels of salinity. For example, strain BB-10C produced 33.8 nodules per plant in the SO medium, 9.5 nodules per plant in the S1 medium and no nodules in the S2 medium. BB-22b, BB-85b and BB-80b however produced good nodulation in the S2 medium.

Although the limited amount (40 ml) of growth media must have restricted the overall growth, inoculation with some strains of *Rhizobium* significantly increased dry matter production of the plants in both SO as well as in the salt added media. The *Rhizobium* strains BB-48a, BB-54b and BB-85b resulted in the highest yield of dry matter in the SO, S1 and S2 treatments respectively.

These results indicate that the strains of *Rhizobium* differ in their tolerance to different salt concentrations and effective strains of *Rhizobium* can be found for faba bean for saline soil. Further studies are planned for field experimentation with some of these promising strains before final recommendations can be made.

References :

Dart, P.J. and Pate, J.S. (1959). 'Nodulation studies in legume III. The effect of delaying inoculation on the seedling symbiosis of barrel medic *Medicago tribuloides* Desr. ' Aust. J. Bio. Sci., **12**, 427-444.

Gibson, A.H. (1963). 'Physical environment and symbiotic nitrogen fixation. I. The effect of root temperature on recently nodulated *Trifolium subterraneum* L. Plants.' Aust. J. Biol. Science, **16**, 28-42.

Jensen, H.L. (1942). 'Nitrogen fixation in leguminous plants. I. General characters of root nodule bacteria isolated from species of *Medicago* and *Trifolium* in Australia.' Proc. Linn Soc. N.S.W. **66**, 98-108.

FABA BEANS — **SYRIA**

- 1 onion, diced
- 1 clover garlic, chopped
- oil
- 1 lb (1/2 kg) faba beans, french
- Salt
- 8 fl. oz (200 ml) water
- 2 tbsp. coriander or parsley, chopped

Brown onion and garlic in oil. Add faba bean beans, coriander, salt and water. Cook until the beans are tender. Drain and serve.

Table 1. Production of nodules, nodule mass and total dry matter by several strains of faba bean *Rhizobium* in different salt concentrations.

Rhizobium strains	SO Nodule No. /plant	SO Nod. dry wt. (mg/plant)	SO Total dry wt. (g/plant)	S1 Nod. No. /plant	S1 Nod. dry wt. (mg/plant)	S1 Total dry wt. (g/plant)	S2 Nod. No. /plant	S2 Nod. dry wt. (mg/plant)	S2 Total dry wt. (g/plant)
BB-10C	33.8	17.2	0.54	9.5	4.1	0.50	0.0	0.0	0.39
BB-32b	9.3	5.9	0.45	8.5	4.1	0.45	4.0	3.7	0.38
BB-39a	11.3	8.4	0.42	14.5	6.3	0.47	14.5	5.7	0.46
BB-54b	28.0	7.9	0.63	22.3	5.3	0.56	5.0	7.5	0.50
BB-48a	16.0	12.1	0.65	10.5	5.4	0.38	13.5	8.1	0.41
BB-22b	15.3	3.7	0.40	34.0	16.5	0.50	24.3	7.4	0.46
BB-85b	7.0	5.3	0.62	33.3	15.7	0.43	17.8	10.7	0.51
BB-80b	7.3	3.8	0.47	19.5	8.9	0.38	16.5	6.2	0.40
BB-66a	16.0	10.2	0.63	18.3	14.3	0.55	0.3	0.1	0.40
BB-40b	27.3	12.4	0.48	27.3	13.3	0.46	5.5	2.3	0.35
uninoc.	0.0	0.0	0.36	0.0	0.0	0.34	0.0	0.0	0.35

L.S.D. 5 per cent :	Nodule No.	Nodule dry wt	Total dry wt
salt concentration	4.6	2.5	0.06
Rhizobium strain	9.4	4.2	0.11
Salt conc. x *Rhizobium* strain	16.0	7.2	0.18

Responses of several strains of faba bean Rhizobium to Tribunil and nitrogen fertilizer application

Rafiqul Islam and Fadel Afandi
Research Support Group, ICARDA, P.O. Box 5466, Aleppo, SYRIA

It was reported earlier (Islam and Afandi, 1980) that some herbicides (Treflan, Gesagard, Alachlor, Tribunil and Metribuzin) considerably reduced both the nodulation and yield of faba bean (local *major* cultivar ILB 1814), although the percentage reduction was less for tribunil than for the others. Artificial inoculation with a mixed culture of three strains of *Rhizobium* partially allieviated such an inhibitory effect on nodulation. This gave an indication that some strains of *Rhizobium* tolerated the herbicides better than others. This called for screening of strains of *Rhizobium* to identify those which could result in good nodulation under specific herbicidal treatments.

An experiment was conducted on ICARDA's research site at Tel Hadya during the 1979-80 growing season where the performance of four strains of *Rhizobium* (BB-10C, BB-21b, BB-32b and BB-48a) were studied under Tribunil application. The local cultivar ILB 1814 was used as the host crop and Tribunil was applied at the rate of 4 kg product/ha. Nitrogen fertilizer at the rate of 120 kg N/ha was applied in some treatments to find out whether such an addition could partly offset any adverse effect caused by Tribunil. The experiment was planted in late November, in a randomised complete block design with four replications. No irrigation was applied. Approximately 424 mm of rainfall was received during the growing season.

Two harvests (at early vegetative and early pod filling stages) were made for the assessment of nodulation and a minimum of 32 plants were assayed from each treatment. Weeds were removed at a very late stage of crop growth and their dry weight taken. Final grain yield was then recorded.

Results and Discussions

The weed intensity in the unweeded check was quite high — about 3 t weed dry weight/ha was produced. Weeding by hand or herbicidal weed control considerably benefitted the crop and resulted in a significant increase in yield.

The herbicide showed no phytotoxicity, and in fact encouraged the nodule number per plant when compared to the hand weeded treatment, both under uninoculated conditions as well as under inoculation with all the strains except BB-32b. Effect on nodule dry weight was similar, but less consistent. Thus, unlike the previous year there was no unfavourable effect of Tribunil on nodulation. The 1979-80 season was characterised by higher rainfall (424 mm) compared to the 1978-79 season (240 mm).

Clearly nodulation response to herbicidal application and its interaction with Rhizobial inoculation can change with the season.

The grain yield was also unaffected by herbicide application when compared to the hand weeded control under inoculated and uninoculated treatment. When compared to the uninoculated and the hand weeded treatment, significantly higher yields were obtained with two treatment combinations :

a) hand weeding plus inoculation with BB-10C

b) Tribunil plus inoculation with BB-48a

The last treatment also gave the best inoculation, suggesting that the strain BB-48a is quite compatible with the herbicide Tribunil. The results also suggest that Tribunil could be a safe herbicide for controlling weeds in faba bean fields.

Reference :

Islam, R. and Afandi, F. (1980). 'Effect of several herbicides on the nodulation and yield of faba bean *(Vicia faba)*. FABIS 2, 36-37.

Table 1. Production of nodules and nodule dry matter at early flowering stages, faba bean yield and the development of weeds as affected by several strains of *Rhizobium*

treatment: *Rhizobium*	treatment: weeding and nitrogen	Nodule No. /plant	Nod. Dry wt. (mg/plant)	Weed Biomass (kg/ha)	Yield (kg/ha)
uninoc.	unweeded	46.7	132.5	3255.6	1644
	hand weeded	56.4	162.2	Nil	2725
	Tribunil	90.4	196.1	59.4	2564
	Tribunil + 120 kg N/ha	28.2	45.9	152.3	2496
BB-10C	hand weeded	35.1	163.8	Nil	3081
	Tribunil	72.8	205.6	26.0	2836
	Tribunil + 120 kg N/ha	34.3	55.0	33.4	2750
BB-21b	hand weeded	57.8	119.1	Nil	2845
	Tribunil	72.6	139.2	52.0	2799
	Tribunil + 110 kg N/ha	48.8	99.1	50.1	2756
BB-32b	hand weeded	53.2	186.1	Nil	2791
	Tribunil	43.8	149.0	40.8	2731
	Tribunil + 110 kg N/ha	20.4	101.5	22.3	2585
BB-48a	hand weeded	88.9	293.4	Nil	2891
	Tribunil	102.9	298.6	69.2	3051
	Tribunil + 120 kg N/ha	33.8	165.6	74.4	2657
L.S.D. 5 per cent		10.5	27.5	175.0	294

FABA BEAN PIE — **NEW ZEALAND**

2 lb (1 kg) young fresh faba beans
1 large onion, chopped finely
1/2 tsp. dried sage
1/4 tsp. Marmite or yeast extract
3 tbsp. whole wheat flour
2 tbsp. milk
2 egg yolks, well beaten
2 tbsp. grated cheese
2 oz. (50 g) fresh whole wheat breadcrumbs

Cook the beans, onions and sage in a little water. When the beans are nearly cooked add the marmite or yeast extract to the remaining water. Turn into a greased pie dish.

Mix the flour with the milk (until smooth) add the egg yolks and cheese and stir well. Spread the mixture over the beans, sprinkle the breadcrumbs over and bake in a moderate oven (350°F) for 30 minutes.

Serves 4

Growth, dry matter and seed yield of faba beans (Vicia faba) as influenced by planting density.

R.K. Pandey
Department of Agronomy, G.B. Pant University of Agriculture and Technology, Pantnagar, INDIA

Faba beans are grown on a small scale for green pods and dry seeds in India. However, the crop offers a great potential as a grain legume, as the seed yield of this crop compares very well with other winter grain legumes (Pandey, 1980) and may become an important component of some cropping systems. Although faba beans have been cultivated for several decades, there is no systematic information available on the crop's production technology. One of the constraints to high seed yields in farmer's fields appears to be low plant density. In view of this, a field study was carried out to determine the optimum plant density for seed production.

Materials and Methods

A field experiment was carried out with six plant densities : 11.1, 16.6, 22.2, 33.3, 66.6 and 133.2 plants/m^2. These densities resulted from row and plant spacing combinations of (60 x 15), (60 x 10), (30 x 15), (30 x 10), (30 x 5) and (15cm x 5cm), respectively. A randomised block design with three replications was used. The plot size was 6m x 4m. Two ecotypes (UP-1 and Bihar-1) were planted on Nov. 5, 1979. Seeding was done continuously by hand in rows which were thinned 20 days after planting to maintain the desired plant stand. The crop was irrigated 45 days after planting. A 1 m row length from the second row was sampled for plant dry weight at 85 and 115 days after planting. The light transmission ratio of the canopy was determined by measuring the photosynthetic active radiation in and out of the canopy using a Lambda Quantum radiometer after 115 days of crop growth. The total plant dry weight and the net plot seed yield were recorded after discarding the guard rows.

Results and Discussions

The total plant dry weight/m^2 increased approximately linearly with plant density at 85 days after planting (Fig. 1). However, at 115 days, plant weight increased linearly only up to a plant density of 66.6 plants/m^2, and thereafter it levelled off. The total dry matter/ha at harvest, which did not include the fallen leaves and roots, also increased with plant density from 11.1 to 133.3 plant/m^2.

The crop growth rate in the period 85-115 days after planting, increased linearly up to 66.6 plants/m^2; thereafter it tended to level off (Fig. 1). At 133.2 plants/m^2, the canopy intercepted almost 95 per cent photosynthetic active radiation (Table 1.) and the lower plant density permitted higher transmission.

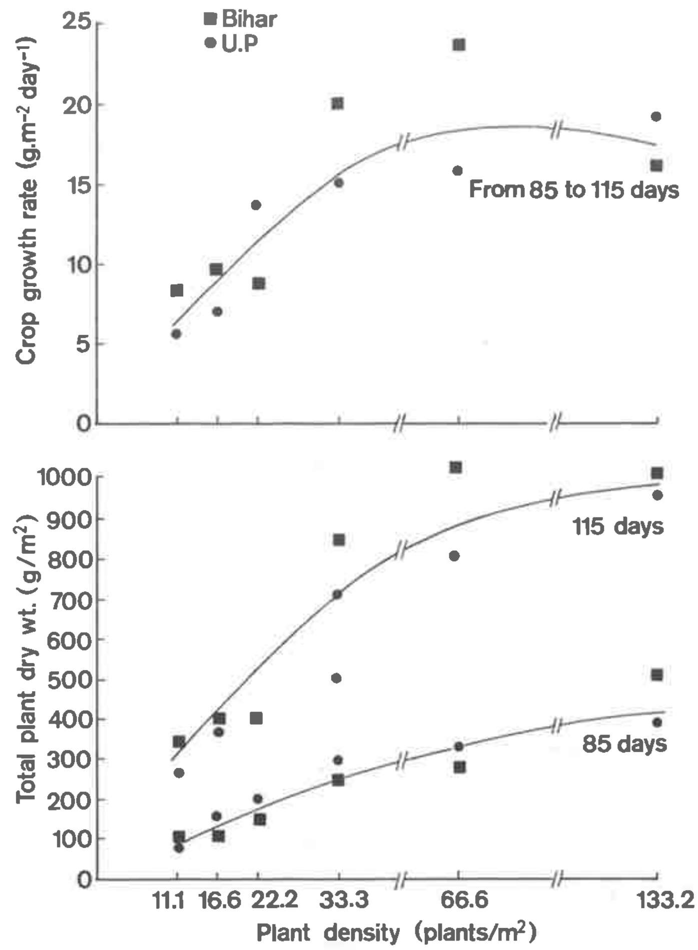


Fig. 1 Effect of plant density on plant dry weight and crop growth rate.

The seed yield increased almost linearly from 11.1 to 133.2 plants/m^2 in both genotypes (Table 1.), although the differences in seed yield at 66.6 and 133.2 plants/m^2 were not significant. At higher densities, plants were taller and had fewer branches then at lower densities. Pods/plant were significantly fewer at higher plant densities. The seeds/pod and 100-seed weight remained almost unaffected by plant density.

In conclusion, the results of this preliminary study showed that the seed yield of faba beans increased as the plant density was raised from 11.1 to 133.2 plants/m^2, although the differences in yield between plant densities of 66.6 and 133.2 plants/m^2 were not significant.

Reference :

Pandey, R.K. (1980). 'Growth and yield potential of faba beans in sub tropical environment'. FABIS 2, 37-38.

Table 1. Influence of plant density on seed yield of faba beans.

genotype	plant density (plants/m2)	total dry matter (kg/ha)	seed yield (kg/ha)	per cent light transmission	branches/ plant	plant height (cm)	pods/ plant	seeds/ pod	100-seed weight (g)
	11.1	2129	1035	95.0	3.9	64.7	31.8	1.49	22.1
	16.6	2519	1255	92.1	2.7	67.7	35.6	1.42	22.4
	22.2	4083	2218	45.3	2.8	69.7	29.6	1.41	22.1
U.P. 1	33.3	4704	2440	21.9	2.7	75.3	27.7	1.43	22.0
	66.6	5406	2514	14.2	2.6	82.7	21.4	1.53	24.3
	133.2	6703	2966	2.8	2.3	85.3	14.7	1.44	22.7
	11.1	1889	907	92.2	3.2	67.0	35.9	1.32	20.7
	16.6	2637	1939	93.4	3.2	69.0	34.6	1.37	21.1
	22.2	4777	2139	61.4	3.1	70.0	29.9	1.40	22.3
Bihar-1	33.3	4826	2468	56.6	2.5	76.7	26.9	1.45	20.7
	66.6	5148	2669	22.9	2.4	80.0	21.2	1.38	21.8
	133.2	6489	3107	5.0	2.1	81.7	17.1	1.35	22.2
	S.E.	460	177	2.9	0.27	5.1	2.8	0.07	1.2
	L.S.D. 5 o/o	1361	518	8.6	0.80	15.1	8.3	—	—

Response of faba beans to water regime

Hakim W. Tawdros
Water Requirements Research Section, Soil and Water Research Institute, Agricultural Research Center, Giza, EGYPT

An experiment was conducted to study the effect of enforced drought due to closure of the canals (in January) on the yield of faba beans. Also, the number of irrigations before and after the annual closure was tested. The main findings can be summarised as follows :

1. withholding irrigation through the annual cut-off of irrigation water did not affect grain yield production of faba beans.
2. faba bean yields responsed to the number of irrigations through pod development. Mean values from plots having three applications during this period were about 220 kg/ha higher than those having only two irrigations during the same stage.

These findings could be ascribed to the importance of water supply through the period of pod formation. In this respect, Ralph (1955) has concluded that water requirement reaches a maximum during flowering and pod development. That is the period when most dry matter is accumulated and adequate water is needed for maximum yield. Also, Tawdros *et al* (1969) found that the peak period of water use by *Vicia faba* in Egypt occurred during February and March.

References :

Ralph, S. (1955). 'Water and our crops'. USDA Year Book of Agriculture R.P., 341-404.

Tawdros, H.W., Mischa, W.I. and El-Serogy, S. 'Influence of irrigation practices on yield of horse beans'. 1st Arab Conference of Physiological Sciences, Cairo.

Germplasm store

The effect of irrigation frequency on grain yield and yield components of faba bean.

Gaafar Elsarrag Mohamed
Hudeiba Research Station, P.O. Box 31, Ed-Damer, SUDAN

Faba beans are grown extensively in the northern Sudan under pump irrigation. Only limited acreages are grown in flooded plains under flood irrigation or in basins that can be flooded during the high rise of the river (the Nile) and these are, in most cases, given supplementary irrigation. However, irrigation cost is increasing with the increase in fuel prices and thus studies which examine the economical use of crop water without affecting grain yield under arid and semi-arid conditions are very important.

In this short communication the grain yield response of faba bean to irrigation frequency, and its variation with plant development, is examined. Three watering regimes (7, 10 and 14 day intervals) were applied continuously or interchanged in differert combinations according to the phase of plant growth. The plant development was divided into the following three phases:

1. from planting to the start of flowering (vegatative).
2. from the start of flowering up to 100 per cent pod setting (reproductive and early grain filling).
3. from 100 per cent cent pod setting up to maturity (late grain filling).

A randomised complete block design with four replications was employed. The crop was sown on 28 October and given all the standard husbandry practices.

The response of faba beans (in terms of grain yield) to irrigation frequency was highly significant. Watering every 7 days throughout plant growth produced 1466 kg/ha, while the equivalent 10 and 14 day regimes yielded 1016 and 1004 kg/ha respectively. Irrigating every seven days in the first phase of plant development followed by a 10 day regime in the second phase produced 1442 kg/ha, but a 7 day regime in the first phase followed by a 14 day regime in the second phase produced only 1166 kg/ha. A 10 day regime in the first phase of plant development followed by a 7 day regime in the second phase produced 1504 kg/ha.

The mean effect of irrigation frequency at each phase of plant development on grain yield, number of pods per plant, number of seeds per pod and 1000-seed weight is summarised in Table 1. A 7 day regime in the first phase of plant development (regardless of any subsequent treatment) produced 174 and 183 kg/ha more than the equivalent 10 and 14 day regimes, respectively. But a 7 day regime during the second phase yielded on average 188 and 349 kg/ha more than the equivalent 10 and 14 day regimes. Similar comparison between these regimes during the last phase of plant development showed that the 7 day regime produced only a very small increase in yield over the other two treatments.

As is evident from Table 1., the irrigation frequency during the second phase of plant development has a pronounced effect on the number of pods per plant. The 1000- seed weight seems to be influenced to a greater extent by the water regime during the early stages of plant growth. In contrast, the mean number of seeds per pod is not affected by a change in the irrigation frequency.

It could be concluded that under the conditions of the experiment (at Hudeiba Research Station) the best combination is to irrigate every 10 days in the first phase of plant development and every 7 days during the reproductive and early grain filling phase. Further economy in water supply during the late grain filling stage may be possible, but further examination is required.

Table 1. The mean effect of irrigation frequency at each phase of plant development.

Phase of plant development:	Phase I			Phase II			Phase III		
Watering intervals (days)	7	10	14	7	10	14	7	10	14
grain yield (kg/ha)	1354	1180	1170	1414	1226	1065	1243	1227	1235
No. of pods per plant	15.2	16.4	16.2	18.4	16.4	13.1	16.6	16.2	15.1
No. of seeds per pod	2.33	2.20	2.30	2.38	2.2	2.26	2.19	2.29	2.36
1000-seed weight (g)	394.4	368.5	379.6	381.0	386.5	375.0	382.0	382.0	378.4

Effect of date of planting and number of fungicide sprays on foliar diseases and yield of faba beans

Hosni A. Mohamed, A. Nassib, M.E. El Rafei and Shaaban A. Khalil
Plant Pathology Institute and Field Crops Institute, Agric. Res. Center, Giza, EGYPT

Date of planting is one of the main methods that has been used effectively in disease control in faba beans. Bekheit (1950) found that infection with chocolate spot was more severe when faba beans were planted October 1st, decreasing with later plantings. Also, Hegazy (1964) concluded that infection with chocolate spot decreased with delaying planting up until December 1st. However, Bekheit *et al* (1951) showed that infection with chocolate spot was heavier in later plantings (November 1st). Nassib and Tadros (1976), sprayed plants of Giza 1 faba beans sown on 1st Oct., mid-Oct. and at the end of October with Dithane M 45. They concluded that late sowing and spraying with the fungicide during January and February increased yield.

It was intended to investigate the effect of date of planting, together with number and date of fungicide application on foliage diseases and yield of faba beans during the 1979-80 season.

Materials and Methods

Faba bean cultivar Giza 3 was planted at Sakha at three different dates : October 15, October 30, and November 15. For each date of planting, six spraying treatments were made (Table 1). Spraying was done at two week intervals with Dithane M 45 at the rate of 250 g/100 l water. Notes were recorded on percentage of the three foliar diseases, every two weeks until the end of the experiment. Plants, at the end of the season, were found to be infected with *Orobanche* and data on yield were recorded only for the November 15 planting.

Table 1. Number and date of spraying with fungicides

treatments	date of sprays 1	2	3	4
1	*	*	*	*
2	*	*	*	—
3	—	*	*	*
4	—	*	*	—
5	—	—	*	*
6	—	—	—	—

* equals sprayed
— equals not sprayed

Results and Discussion

Results from the first planting, planted on October 15, showed that no rust or downy mildew appeared in any treatment until the end of February. Traces of leaf spots appeared on January 27 on plants which were not sprayed with Dithane M 45.

Percentages of leaf spots increased and were higher the lower the number of fungicide applications. The percentage ranged from 2.75 per cent (for plants receiving all sprays) to 16.5 per cent (for non-sprayed plots). In plots planted on October 30, no rust appeared until the end of February. However, leaf spots appeared in all treatments when notes were recorded on January 27. Percentages of infection in all treatments were low and differences were not significant (Table 2) when notes were recorded on February 13th. Treatments can be classified into two groups. The first two treatments which were originally lighter in infection remained less infected. These two treatments received earlier sprayings. Notes recorded on February 27 showed that percentages of infection were lower in treatments receiving earlier fungicide applications, and a higher number of sprayings. Percentages of infection with downy mildew were higher than leaf spots when notes were recorded on January 27. Percentages of infection increased gradually in treatments receiving fewer numbers of sprayings and at later dates (Tables 2 and 3).

Table 2. Average percentage of leaf spots on Giza 3 plants when planted October 30, Sakha 1979/80.

No. and date of spraying with Dithane M 45	Average % leaf spots recorded on Jan. 27	Feb. 13	Feb. 27
4	8.25	11	11
3 (early)	8.25	13.75	16.5
3 (late)	11	22	19.25
2 (early)	11	22	30.25
2 (late)	11	19.25	33
—	11	22	35.75

Table 3. Average percentage of downy mildew on Giza 3 plants planted October 30, Sakha, 1979/80.

No. and date of sprays	Av. % downy mildew recorded on Jan. 27	Feb. 13	Feb. 27
4	13.75	11	16.5
3 (early)	22	22	27.5
3 (late)	16.50	19.25	22
2 (early)	22	30.25	33
2 (late)	19.25	30.25	33
—	22	41.25	41.25

Planting on November 15, resulted in no rust infection until January 27. When notes were recorded on February 13, percentages of infection varied depending on the number and dates of spraying. Percentages of infection increased slightly for all treatments until March 13. All through the period and in all treatments, percentages of leaf spots were higher than downy mildew.

Infection of faba bean plants with *Orobanche* limited the data obtained from this experiment. High infections were observed, especially in earlier plantings. Therefore this experiment was terminated earlier for the two early plantings and notes were only recorded for a short period. No data on yield were obtained except in the last date of planting, which may not be accurate. Differences between treatments were not significant.

This experiment was to be repeated during the growing season 1980/81 using more dates of planting and fewer fungicide treatments.

N.B. The work described here was partially supported by the ICARDA/IFAD Nile Valley Project on faba beans.

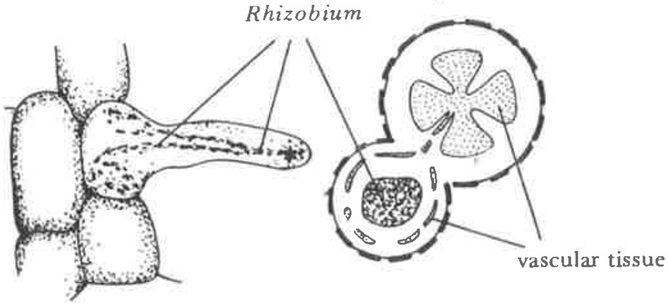
References :

Behkeit, M.R. (1950). 'Remarks on reaction of field bean cultivars to brown leaf spot and relation of date of planting to disease severity.' Report Agric. Research, Min. Agric. (January) pages 44-45 (in Arabic).

Bekheit, M.R., Fahmy, I., Rizk, Z. and El Yamany, T. (1951). 'Testing of some fungicides to control chocolate spot and rust in faba beans and also the effect of date of planting and different Agricultural practices.' Report Agric. Research, Min. Agric. (October) page 21 (in Arabic).

Hegazy, M.F.H. (1964). 'Studies on some factors affecting *Botrytis fabae* Sard. causing chocolate spot disease of *Vicia faba* L.' M.Sc. thesis, Fac. Agric., Ain Shams Univ., EGYPT.

Nassib, A.M. and Tadros, K.M. (1976). 'Studies on the effect of spraying with Dithane M 45 (Mancozeb) in relation to date of sowing on the control of chocolate spot *(Botrytis fabae* Sard) and seed yield of field beans *(Vicia faba* L.).' Agric. Res. Rev. 54, 135-143.



Rhizobium leguminosarum infecting root hair

Transverse section of *Vicia faba* root with nodule

Effect of nitrogen and phosphorus fertilization on faba bean in the northern part of Sudan.

Farouk Ahmed Salih
Shambat Research Station, P.O. Box 30, Khartoum North, SUDAN

Heipko (1963/64) established that *Rhizobium* bacteria for nodulation of faba beans was present at Hudeiba. However, results have shown that inoculation with a Sudanese strain of rhizobium has increased nodulation of plants by about 18 per cent, whereas a French strain tended to decrease nodulation. The application of nitrogen has been found to decrease nodulation, and the French strain was more sensitive in this respect than the Sudanese strain (Ishag, 1970/71).

Nitrogen has been included in many experiments at Hudeiba to study its effect on the incidence of powdery mildew *(Leveillula taurica)* and yield (Ali, 1964/65; Ali and Khalifa, 1964/65; Baghdadi and Khalifa, 1967/68; Abu Salih, 1972/73). Results have indicated that nitrogen has no effect on either the level of the disease or yield. However, Khalifa (1966/67) reported that nitrogen increased yield from 1502 kg/ha when the crop received no nitrogen to 1698 kg/ha when 43 kg/ha was applied to a crop sown at one plant per hole and watered every week. Yield increased from 1714 kg/ha (no nitrogen) to 2161 kg/ha (43 kgN/ha) for a crop sown at two plants per hole, which received water every two weeks.

Salih (1976/77) found that nitrogen, applied at the rate of 43 kg/ha given at sowing, did not significantly increase seed yield when compared to the control (no nitrogen). However, splitting a similar dose of nitrogen into three equal portions applied at sowing, at one month later and at two months from sowing increased seed yield by about 20 per cent. This result may be explained by the fact that the number of nodules per plant reached their highest number after eight to nine weeks from sowing (Heipko, 1963/64; Ishag, 1970/71) and then declined. The plants would therefore be expected to suffer from nitrogen deficiency late in the season when the number of nodules would have dropped (and possibly the remaining nodules may have been rendered less active). Hence the crop may respond to the third dose of nitrogen which was applied two months from sowing.

Salih (1977/78), however, obtained the reverse to the 1976/77 season's results. He found that nitrogen application at sowing gave in general an increase in seed yield of 7 per cent and 8 per cent over that obtained when N was applied one month after sowing and in a split application respectively. The differences between nitrogen rates, however, were not significant. The average seed yields of the control, the 43 kg N/ha and 86 kg N/ha applications were 2204, 2346, and 2392 kg/ha, respectively. Similar work has been done by El Hilo (1966).

Last and Nour (1961) observed that the yield of faba bean was increased in the Zeidab scheme by the application of phosphorus when broadcast on top of the ridges. Ayoub (1971) reported that the crop did not respond to separate application of nitrogen, phosphorus, potassium, gypsum (at the rate of 12 tons/ha) and manure (at the same rate). Babiker (1975/76; 1976/77; 1977/78) found that faba beans responded to the application of nitrogen and that there was an interaction between amount of nitrogen and watering treatments, resulting in an increase in 1000-seed-weight and number of flowers produced. An interaction was also found between nitrogen and phosphorus, resulting in an increase in the dry weight of the plant per unit area of land.

Salih (1979) studied the effects of different rates of nitrogen and phosphorous on faba bean yield when applied as broadcast, or banded or placed in holes with the seed, separately or in combination with each other. The results showed that none of the fertilizer treatments or methods of application has an effect on the seed yield or any of the yield components (Table 1.)

This low or nil response of the faba bean to fertilizer application, especially nitrogen, was perhaps a reflection of the high nitrogen status of the soil, or may have been due to the presence of active *Rhizobium* strain or strains for the crop in the farm soil, as the inspection of the plant roots revealed nodules in large numbers and size.

References :

Abu Salih, H.S. (1972/73). 'Effect of spraying, time of sowing and nitrogen application on the incidence of Sudanese broadbean mosaic.' Annual Report, Hudeiba Research Station.

Ali, M.A. and Khalifa, O. (1964/65). 'Effect of plant population watering intervals and nitrogen on powdery mildew in broad bean.' Annual Report, Hudeiba Research Station.

Ayoub, A.T. (1970/71, 1971/72, 1972/73). 'Ful Masri Fertilizer experiment.' Annual Reports, Hudeiba Research Staion.

Baghdadi, A.M. and Khalifa, O. (1967/68). 'Control of powdery mildew attacking Ful Masri (*Vicia faba* L.) : Control by Cultural practices.' Annual Report, Hudeiba Research Station.

El Hilo, H.A. (1966/67). 'Effect of fertilization on the yield of broad bean.' Annual Report, Hudeiba Research Staion.

Heipko, G.H. (1963/64). 'Factorial experiment with Ful Masri.' Annual Report, Hudeiba Research Station.

Ishag, H.M. (1970/71). 'Effect of inoculation and nitrogen on nodulation and yield of broad bean.' Annual Report, Hudeiba Research Station.

Khalifa, O. (1966/67). 'Effects of cultural practices on powdery mildew and on yield.' Annual Report, Hudeiba Research Station.

Last, F.T. and Nour, M.A. (1961). 'Cultivation of *Vicia faba* L. in Northern Province.' Empire Journal of Experimental Agriculture 29, 60-72.

Salih, F.A. (1976/77, 1977/78). 'Effects of nitrogen rates and times of application on the yield and yield components of faba bean.' Annual Report, Hudeiba Research Station.

Salih, F.A., (1979/80). 'Effect of different nitrogen and phosphorus fertilizer levels and different methods of application on faba bean yield and its components.' Annual Reports, Hudeiba Res. Station.

Table 1. Effect of nitrogen and phosphorus fertilization and method of application on seed yield and its components.

	seed yield (kg/ha)	plant population (1000 plants/ha)	1000 seed weight (g)	No. of pods/ plant	No. of seeds/ pod
method of fertilizer application					
broadcast	1423	75.6	351	25.5	2.27
band	1290	62.7	345	26.9	2.42
placed with seeds in holes	1447	83.0	360	25.1	2.40
SE	53	2.14	5.76	1.06	0.05
nitrogen fertilizer rate (kg/ha)					
0	1402	80.7	348	24.9	2.42
43	1330	71.1	359	25.8	2.37
86	1428	69.6	349	26.9	2.31
SE	53	2.14	5.76	1.06	0.05
phosphorus fertilizer rates (kg/ha)					
0	1457	74.6	355	26.7	2.37
43	1318	73.0	350	25.0	2.36
SE	43	1.75	4.70	0.87	0.04

The effect of soil moisture stress on yields and water use by faba beans

Hakim W. Tawdros
Water Requirements Research Section, Soil and Water Research Institute, Agricultural Research Center, Giza, EGYPT

To study the effect of different soil moisture levels on the yield of faba bean, three field plot trials were carried out at Sakha (Northern Delta), Sids (Middle Egypt) and Matanaa (Upper Egypt).

The data obtained in these experiments showed that irrigating faba beans in the range of 40-60 per cent depletion in available water was found to be the economical level. Watering faba beans at 80 per cent depletion in available water was found to decrease grain production by nearly 17-20 per cent.

Water consumptive use by faba beans in the Northern Delta was found to be 37, 32 and 28 cm for wet, medium and dry soil moisture levels respectively. The corresponding values for Middle Egypt were 41, 38 and 33 cm in the same order. The respective values for Upper Egypt were 47, 41, and 36 cm. It was noticed that evapotranspiration rates increased as the soil moisture level increased with more frequent irrigations.

Daily water use was low at the beginning of the growing season. A gradual increase in daily rates was observed as the plants grew. The evapotranspiration rate was at a maximum through the period of pod development. A decline in water use then occurred at the end of the growing season due to maturation.

Time of sowing – a major factor for higher seed yields of faba bean in Northern India.

R.K. Pandey
Department of Agronomy, G.B. Pant University of Agriculture and Technology, Pantnagar, INDIA.

Introduction

In India, faba beans are grown on a small scale for human and animal consumption. With the increasing demand for protein-rich grain legumes, faba beans may become an important crop in our cropping system. Although the seed yield of the faba bean compares very well with other grain legumes presently grown on a large scale, there is practically no information on the production factors affecting the crop. In view of this, a research program was initiated to evaluate the potential of the faba bean as a grain legume in the existing cropping system, and to develop suitable agronomic practices to realise the crop's full yield potential.

Materials and Methods

In the 1979-80 season, a field experiment was conducted to study the effect of time of sowing on the performance of faba beans. The crop was grown on a silty loam soil with a moderately high fertility level. Diammonium phosphate (16-45-0) was broadcast at a rate of 100 kg/ha before sowing. A local selected ecotype 'Biharol' was planted on seven dates: Oct. 30th, Nov. 15th, Nov. 30th, Dec. 15th, Dec. 30th, (1979) Jan. 15th and Jan. 30th, (1980). Each treatment was replicated three times in a randomised block design. Six row plots were sown by hand with a row to row spacing of 30 cm. After emergence, plants were thinned to 10 cm spacing. The crop was irrigated and weeds were removed by hand. The data on plant attributes were recorded.

Results and Discussion

The time of sowing had a marked effect on flowering time, maturity and productivity/day (Table 1). The delay in planting hastened the days to flowering and maturity. The first flowering node was lower in late planted compared to early planted crops. The productivity per day was drastically reduced by delayed planting. The highest seed yield was obtained when the crop was planted on Oct. 30th, and planting later than this date reduced the seed yield (Figure 1). A sharp reduction in yield was obtained when the crop was planted on Nov. 30th or at later dates. The reduction in seed yield was accompanied by a reduced number of fruiting nodes and pods/plant. Seed weight also decreased with later planting dates. Seed/pod remained little affected by sowing date.

Table 1. The effect of time of sowing on the days to flowering and maturity, and productivity per day.

Date of planting 1979-80	Days to flowering	Days to maturity	Node position of first flower	Productivity (kg/ha/day)
Oct. 30	38	153	5.5	13.4
Nov. 15	38	143	5.3	13.4
Nov. 30	36	130	4.7	7.5
Dec. 15	36	124	4.9	2.0
Dec. 30	33	112	4.5	1.5
Jan. 15	31	107	4.0	1.4
Jan. 30	28	90	4.0	1.3
LSD 5 %	1.0	0.6	0.6	–

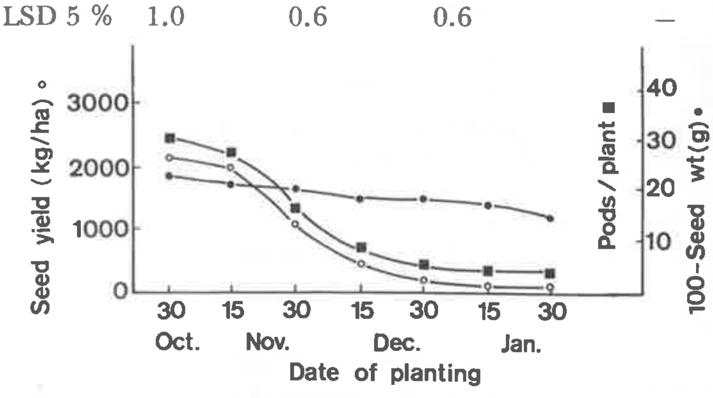


Fig. 1 Effect of planting date on yield and pods/plant.

Flowering in faba bean is promoted by long days and warm temperatures (see Fig. 2). When the crop was planted during October/early November, it received short photoperiods and lower temperatures for a longer duration compared to later planted crops. This led to a build up in vegetative growth and canopy structure for larger seed production. On the other hand, a crop planted after Nov. 30th received fewer short days of low temperatures, and the increased day-length and the warmer temperatures after January enhanced the process of flowering and maturity. Apart from this, faba beans under farm conditions are grown on residual moisture after the rainy season. As the crop season advances, faba beans grow on a diminishing moisture supply. The moisture stress at pod formation and seed filling may be one of the factors limiting yields.

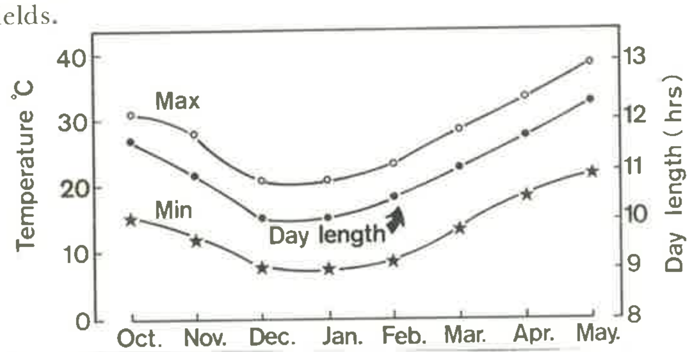


Fig. 2 Maximum, minimum temperatures and photoperiod during the growing season.

These limited data suggest that the planting time of faba bean is a crucial factor for high seed yield. However, future studies should include a larger number of genotypes and different plant densities in order to get more precise information on the yield potential of faba beans in a subtropical environment.

References:

Pandey, R.K. (1980). 'Growth and yield potential of faba bean (*Vicia faba*) in sub-tropical environments'. FABIS 2, 37-38.

Pandey, R.K. (1980). 'Pulse physiology' Research report on rabi pulses 1979-80, presented at the All India Pulse Workshop held at Udaipur, Sept. 11th-14th, 1980.

A review of the effect of seed rate and plant population on grain yield of faba bean in Sudan

Farouk Ahmed Salih
Shambat Research Station, P.O.Box 30, Khartoum North, SUDAN

Faba bean is the most important food grain legume in the Sudan. The effect of seed rate on the grain yield of the crop has been studied by Last and Nour (1961) who found that the highest yield for three varieties was obtained at a seed rate of 70 kg/ha. However, when this seed rate was doubled, the local variety, Baladi, out-yielded the introduced varieties Rebaya 34 and Rebaya 40. El Saeed (1968) found that the yield of RB34 and Baladi increased with an increase in seed rate from 35 to 70 kg/ha; thereafter the rate of increase diminished and levelled off at about 140 kg/ha. Heipko and Dafalla (1961/62) found no difference in yield between RB 34 and RB 40, when different seed rates of 58, 87 and 116 kg/ha were used.

As the density of plant population increased, yield per plant decreased, but yield per unit area of land increased; the number of seeds per pod and seed size were not very much influenced by crop density (Heipko and Kaufmann, 1964/65; El Saeed, 1968; Kambal, 1968; Ishag, 1970/71). The number of pods per plant dropped from 18.5 at a seed rate of 35 kg/ha to 7.7 at 280 kg/ha (El Saeed, 1968). The yields obtained from plant spacings of 10 x 60, 20 x 60, 30 x 60, and 40 x 60 cm were 2837, 2818, 2611 and 2339 kg/ha respectively (Ishag, 1970/71). The number of pods per plant and number of seeds per pod increased progressively with increasing plant spacing, but the reverse was true for 1000-seed weight.

The yields of the plant populations of 83,300, 166,600 and 249,900 plants/ha were 2387, 2754, and 2815 kg/ha respectively (Ishag 1970/71). These high plant populations came from planting 1,2 and 3 seeds per hole respectively, at plant spacing of 20 x 60 cm. Heipko (1963/63) found no significant difference in yields of two varieties grown on 60 cm ridges at spacings between holes of 15, 25 and 35 cm.

Recently, the response of faba bean variety H.72 to three seed rates was studied with other factors in a factorial experiement under Hudeiba conditions. The results presented in Table 1. showed that increasing the seed rate from 59.5 kg/ha to 119 kg/ha gave a slight but

Table 1. Effect of different seed rates of faba bean on grain yield and yield components.

seed rate (kg/ha)	grain yield (kg/ha)	plant population (100 plant/ ha)	1000 grain weight (g)	No. of pods/ plant	No. of seeds/ pod
59.5	764	76.5	334	19.0	2.50
119.0	850	82,3	350	16.4	2.38
178.5	1028	98.6	337	13.6	2.54
SE	± 59	±4.67	±5.89	± 0.88	±0.06

N.B. The seeds were sown by hand sowing on ridges 60 cm apart.

non-significant increase in yield. However, a significantly better yield was obtained with the highest seed rate of 178.5 kg/ha compared with the lowest (Salih, 1979/80). The grain yield obtained from the seed rate of 178.5 kg/ha surpasses the yields of the seed rates of 59.5 and 119 kg/ha. by 11 per cent and 34 per cent respectively. Also, the seed rate of 119 kg/ha gave less grain yield of 21 per cent to that obtained from 178.5 kg/ha. This finding was in line with earlier work by Last and Nour (1961) and El Saeed (1968). Increasing the seed rate significantly reduced the number of pods per plant. Seed rate had no effect on 1000-seed weight and number of seeds per pod.

Salih studied the effect of four plant populations of 83,300 (P_1), 166,600 (P_2), 249,900 (P_3) and 253,200 (P_4) plant/ha on the grain yield of faba bean cultivar H.72 in two separate experiments, at Hudeiba Research Station and at the Zeidab scheme in the 1979/80 season. The above plant populations came from planting 1, 2, 3 and 4 seeds/hole respectively at a hole spacing of 20 x 60 cm. The results from Hudeiba in Table 2.A show that the seed yields of P_2, P_3 and P_4 significantly out-yielded P_1 by 41.7 per cent, 46.7 per cent and 66.7 per cent respectively. Similar results were obtained from Zeidab site, where the grain yields of P_2, P_3 and P_4 surpassed (but not significantly) that of P_1 by 25.2 per cent, 34.2 per cent and 39.4 per cent respectively (Table 2.B). The number of pods per plant and percentage plant stand decreased progressively and significantly from P_1 to P_4 (Salih, 1979/80).

Table 2. Effect of four different plant populations on the grain yield and the components of the variety H.72.

plant population (plants/ha)	grain yield (kg/ha)	plant stand (%)	1000 grain weight (g)	No. of pods/ plant	No. of seeds/ pod
		A – Hudeiba site			
83,300 (P_1)	1058	46.1	362	36.0	2.39
166,600 (P_2)	1500	38.7	389	28.6	2.17
249,900 (P_3)	1552	33,0	375	22,9	2.42
253,200 (P_4)	1764	29.1	331	18.7	2.42
SE	± 116	±3.09	±18.3	±2.67	±0.13
		B – Zeidab site			
83,300 (P_1)	1868	45.3	369	49.1	2.85
166,600 (P_2)	2338	35.3	390	33.8	2.77
249,900 (P_3)	2507	30.0	404	25.4	2.51
253,200 (P_4)	2605	26.4	382	19.8	2.67
SE	± 226	± 3.77	± 10.8	± 3.48	±0.13

For two consecutive seasons (1978/79, 1979/80) an experiment was conducted to study the "plasticity" or the grain yield response of four different varieties of faba bean at two different plant populations (166,600, and 333,200 plants/ha) under Hudeiba conditions. These two plant populations were established by planting on the centre of the ridge (M_1) and planting on both sides of the ridge (M_2), at hole spacing of 20 x 60 cm, with two seeds/hole. The results showed that doubling the plant population (333,200 plants/ha) gave increases in grain yield of 4 per cent and 19 per cent over that of the plant population of 166,600 plant/ha, in 1978/79 and 1979/80 seasons respectively (Salih, 1978/79, 1979/80). The loss in the established plant stand was greater in the double plant population than in the normal population in both seasons. Also, the plant population of 333,200 plants/ha reduced the number of pods per plant, and as a result the 1000-grain weights were increased compared to the weights of the normal population.

The interaction of variety x population, for any character studied, was not significant. But it was observed that both varieties NEB152.S and NEB153 performed better in yield under the plant population of 333,200 plant/ha (Salih. 1978/79, 1979/80).

It appears therefore, that the response of this crop to variations in seed rate of plant population is characterised by some "plasticity" i.e. when fewer plants per unit area of land are grown, yield per plant increases (mainly through a higher number of pods) in such a way that the expected loss in yield per unit area of land is more or less compensated for, and vice versa.

Finally, it is recommended that the optimum plant population of those studied for faba beans is 333,200 plant/ha (equivalent to a seed rate of 119 kg/ha) following planting at a hole spacing of 20 x 60 cm with two seeds/hole.

Vicia faba

References :

El Saeed, E.A.K. (1968). 'Agronomic aspects of broad beans *(Vicia faba* L.) grown in the Sudan.' Experimental Agriculture 4, 151-159.

Salih, F.A. (1978/79, 1979/80). 'Effects of method of sowing on the seed yield of four varieties of faba bean.' Annual Report, Hudeiba Research Station.

Salih, F.A. (1979/80). 'Faba bean seed rate trial.' Annual Report, Hudeiba Res. Station.

Salih, F.A. (1979/80). 'Interactions between plant population density and watering intervals.' Annual Report, Hudeiba Research Station.

Heipko, G.H. and Dafalla, A.D. (1961/62). Annual Report, Hudeiba Research Station.

Heipko, G.H. and Kaufman, H. (1964/65). Annual Report, Hudeiba Research Station.

Ishag, H.M. (1970/71). 'Plant population studies in field beans.' Annual Report, Hudeiba Research Station.

Kambal, A.E. (1968). 'A study of the agronomic characters of some varieties of *Vicia faba*.' Sudan Agricultural Journal 3 (1), 1-10.

Last, F.T. and Nour, M.A. (1961). 'Cultivation of *Vicia faba* L. in Northern Sudan.' Empire Journal of Experimental Agriculture 29, 60-72.

Pests and Diseases

Effect of fungicides on rust reaction of faba beans.

Hosni A. Mohamed, Shaaban A. Khalil, Nagi Abou Zeid, Mohamed El Sherbeeny, Ismail A. Ismail
Plant Pathology Institute and Field Crops Institute, Agric. Research Center, Giza, EGYPT

Rust caused by *Uromyces fabae* (Pers) de Bary is one of the most destructive diseases attacking faba beans, especially in the northern parts of Egypt. Percentages of infection ranged up to 100 per cent during the 1979/80 growing season (Mohamed *et al*, 1980).

Several fungicides have been used to minimise losses caused by rust (Bekheit 1950, Bekheit *et al* 1951, El Helaly 1939a; 1939b; 1950; Mansour *et al*, 1975), but the disease still remains a problem in faba bean production.

The studies reported here were designed to test the efficiency of some fungicides on the control of rust under both greenhouse and field conditions.

Materials and Methods

Five fungicides were tested for their effectiveness against rust in faba beans. These were Plantvax 20, K W G 0599, Sicarol, Roval and Dithane M 45.

In the greenhouse test, 38 day old seedlings were sprayed with the fungicides either before or after rust inoculation. Fungicides were used at 0.5x, 1x and 2x the recommended dose. Notes were recorded 15 days after rust inoculation, by counting the number of pustules and calculating the average number per leaflet.

In the field test, two experiments were planted, one at Sakha (Kafr El Sheikh governorate) on November 15th, and the other at Nubaria (Beheira Governorate) on October 22nd, 1979. Each plot was 4.8 x 3.5 m in size and each treatment was replicated four times. Fungicides were spray applied four times at two week intervals.

Notes were recorded on disease incidence every two weeks until the end of the experiment. Plants were harvested and threshed, and seeds were weighed for each plot. Data were statistically analysed for percentages of infection and yield.

Results and Discussion

Greenhouse test :

Data in Table 1 show that spraying Dithane M 45, K W G 0599, or Plantvax 20 at any of the doses, one day before rust inoculation, did not permit rust to develop. Rovral application resulted in lower infection than in the unsprayed plots.

Table 1. Average number of pustules per leaflet of faba bean seedlings inoculated with isolate 1 of *Uromyces fabae*

Fungicide	Average No. pustules/leaflet sprayed with concentrations			
	no spray	½ x r.d.[1]	1 x r.d.	2 x r.d.
sprayed before inoculation :				
Dithane M 45	80.1	0	0	0
Rovral	80.1	1.62	0.96	0.12
Sicarol	80.1	0	0	0
K.W.G. 0599	80.1	0	0	0
Plantvax	80.1	0	0	0
sprayed after inoculation :				
Dithane M 45	80.1	28.82	13.41	6.37
Rovral	80.1	63.73	17.50	3.29
Sicarol	80.1	4.94	3.88	0
K.W.G. 0599	80.1	0.25	0.59	0.57
Plantvax	80.1	3.01	1.23	0.49

[1]r.d. equals recommended dose.

When fungicides were sprayed one day after rust inoculation, the number of pustules varied with fungicide. Numbers were the highest when Rovral was sprayed, and next highest with Dithane M 45. Lower numbers of infection centers were noted when K W G 0599 was sprayed at any dose before rust inoculation, and with Sicarol at the highest dose. The number of infection centers in general decreased with increasing dose of fungicide.

Field test :

Results in Tables 2 and 3 indicate that percentages of infection for all treatments increased as the season progressed. This increase in percentage of infection differed according to the treatment. Traces of infection were observed in certain treatments at Sakha on February 14th when notes were recorded 15 days after the first spray of the fungicides. On March 3rd, about two weeks after the second spray, treatments differed significantly with respect to the percentage of rust infection. Percentages of rust increased but this increase differed according to the treatment. This indicates that fungicides differed with respect to their effectiveness in controlling rust. Also, results indicated that rust infected the plants in the second part of February when environmental conditions were favourable and the host was susceptible. Percentage infection increased again until the end of the season, but this increase differed for these treatments. It was mostly slight for Plantvax 20, K W G 0599, Dithane M 45 and Sicarol. On the other hand, it was high for Rovral and the non-sprayed plots.

At Nubaria, percentages of infection, 15 days after the first spray, were higher than those at Sakha, and ranged from 13.75 per cent to 27.50 per cent. This may be due to earlier planting beside differences in environmental conditions.

Results summarised here indicate that Dithane M 45, K W G 0599, and Plantvax 20 were the best fungicides tested, with respect to their efficiency in controlling rust at both stations. This is in agreement with results obtained from greenhouse tests.

It is suggested that Dithane M 45, which is recommended for rust and leaf spot control, could be further used for the control of faba bean rust until another fungicide proves more effective in decreasing the amount of infection and increasing seed yield.

Table 2. Average percentage of rust at different periods when Giza 3 faba bean plants were sprayed with different fungicides, Sakha 1979/80.

Treatment	Average per cent rust recorded on		
	Feb. 14	March 3	April 7
Plantvax 20	0	5.50	11.00
K.W.G. 0599	0.5	17.75	22.00
Dithane M 45	0	27.50	35.75
Sicarol	0	33.00	35.75
Rovral	0.25	35.75	71.50
Not sprayed	0.75	44.00	94.00

Table 3. Average percentage of rust at different periods when Giza 3 faba bean plants were sprayed with different fungicides, Nubaria 1979/80.

Treatment	Average per cent rust recorded on			
	Jan. 28	Feb. 26	March 9	March 29
Plantvax 20	13.75	24.75	13.75	44.00
K.W.G. 0599	19.75	27.50	46.75	55.00
Dithane M 45	13.75	30.25	33.00	68.75
Sicarol	13.75	38.50	77.00	91.00
Rovral	19.25	46.75	71.50	88.25
Not sprayed	27.50	66.00	88.00	100.00

References :

Bekheit, M.R. (1950). 'Control of chocolate spot and rust of beans.' Report Agric. Research, Min. Agric. (May) pages 174-148 (in Arabic).

Bekheit, M.R., I. Fahmy, Z. Rizk and T. El Yamany (1951). 'Testing some fungicides to control chocolate spot and rust of faba beans and also the effect of date of planting and different agricultural practices.' Report. Agric. Research, Min. Agric. (October) page 21 (in Arabic).

El Helaly, A.F. (1939 a). 'Preliminary studies on the control of field bean rust.' Tech. Bull. Min. Agric. 201 (in Arabic).

El Halaly, A.F. (1939 b). 'Further studies on the control of bean rust with some reference to the prevention of chocolate spot of beans.' Tech Bull., Min. Agric. 236.

El Helaly, A.F. (1950). 'Bordeaux mixture for the prevention of rust and chocolate spot of beans.' Phytopathology **40**, 699-701.

Mansour, K., Z. Risk and W. Fouad (1975). 'Studies on the control of chocolate spot and rust of horse beans.' Agric. Res. Rev. **53**, 89-95.

Mohamed, Hosni A., M.E. El Rafei, N.A. Abou Zeid, S.A. Omar, Wadaia F. Habib, I.A. Ismail, M. Roaf, and H. Khidr (1980). 'Plant pathology Research Studies. ICARDA/IFAD Nile Valley Project on faba beans.' Annual coordination Meeting 1979/80, Cairo, mimeograph 49 pp.

Faba bean diseases in southern Alberta 1978-79.

S.P. Sumar, R.J. Howard and M. Mohyuddin
Alberta Horiticultural Research Center, Brooks, Alberta
TOJ OJO, CANADA

The increased production of faba beans in Alberta in recent years has necessitated a thorough identification of prevalent and potentially serious diseases. During 1978 and 1979 cropping seasons, comprehensive disease surveys were conducted in the commercial faba bean fields of southern Alberta.

Twenty-one and 15 fields were selected for disease surveys during 1978 and 1979 respectively. These included the main cultivars and were representative of the geographical areas of production. Fields were traversed in a large semi-circle, and at 10 randomly selected sites 10 plants (in 1978) or all plants within three meters of row length (in 1979) were examined. Disease incidence was recorded as the percentage of diseased plants among the total plants examined. In most cases, fields were visited at least twice and often three times over the growing season. The surveys were essentially qualitative and no attempt was made to rate disease severity. Field diagnoses were confirmed by laboratory isolation and identification of the pathogens.

Foliar diseases were the most prevalent problems during both years (Table 1.). Of these, Alternaria leaf spot was encountered in all late season field visits. *Alternaria alternata* (Fr.) Keissler was isolated from the leaf lesions, but subsequent re-infection of faba bean seedlings in the greenhouse using various isolates failed to reproduce the disease. This suggests that *A. alternata* is probably a weak pathogen only developing infections in late season on older senescing tissue.

Ascochyta blight, caused by *Ascochyta fabae* Speg., is the most destructive faba bean disease in Manitoba and is a potentially serious disease in Western Canada as a whole (Bernier, 1975). However, it was recorded in only a few fields in 1978, and was not found in 1979. Faba bean seed tests at Brooks (unpublished results) have revealed that all Alberta-grown seed stocks were free of infection by *A. fabae* and, at the present time, Ascochyta blight is not thought to be established in Alberta.

Chocolate leaf spot was the most prevalent disease in 1979. Isolations of diseased leaves yielded only *Botrytis cinerea* Pers., which, like *A. alternata*, was non-aggressive and unable to re-infect young, healthy faba bean plants. Powdery mildew, occurring each year, was common towards the later part of the season. The causal fungus was found to be *Microsphaera penicillata* (Wallr. ex. Fr.) Lev. var. *ludens* (Salmon) Cooke, as has been reported previously (Kharbanda and Bernier, 1977). Root rot *(Fusarium* spp. and *Rhizoctonia solani* Kuhn) incidence was higher in 1978. Physiological edema on pods, seen as small black warts, were observed each year in a number of fields. A few instances of herbicide damage, either from aerial drift of 2,4-D or soil borne residues of other herbicides (see Fig. 1), were observed during both surveys. In 1979, trace levels (0.1 per cent incidence) of Sclerotinia stem rot and bean yellow mosaic were recorded.

Table 1. Faba bean diseases prevalent in southern Alberta during 1978 and 1979

Disease	1978 No. of fields with disease (%)	1978 Incid.[1] (%)	1979 No. of fields with disease (%)	1979 Incid.[1] (%)
Chocolate leaf spot	—	—	100.0	17.8
Alternaria leaf spot	100.0	16.0	100.0	6.9
Powdery mildew	57.1	10.0	88.9	17.5
Ascochyta blight	19.0	3.4	—	—
Root rot	71.4	2.3	40.0	0.7
Edema (on pods)	47.6	2.3	77.8	2.1

[1]Mean seasonal incidence based on total plants examined in all fields.

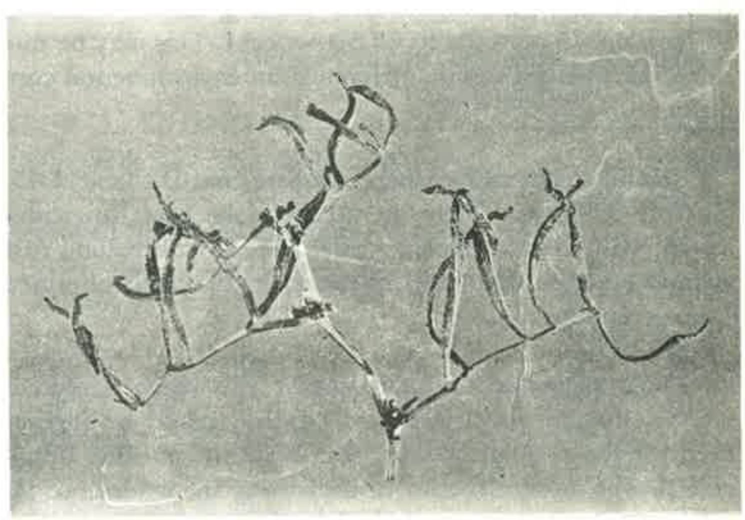


Fig. 1 Damage to faba bean plant due to soil application of the herbicide Pichloram

In the absence in Alberta of foliar pathogens such as *A. fabae* and *Botrytis fabae* Sard., which can be very destructive under favourable conditions (Bernier, 1975), faba beans should continue to be an attractive alternative to some of the more established field crops in Alberta. The main diseases prevalent in Alberta at the present time appear to be causing only minor economic losses to growers. However, this situation could change as production of this crop becomes more intensive and widespread.

References :

Bernier, C.C. (1975). 'Diseases of Pulse Crops and Their Control'. In : 'Oil seed and pulse crops in Western Canada' Ed. J.T. Harapiak. Western Co-operative Fertilizers Limited, Calgary, Alberta pp. 439-454.

Kharbanda, P.D. and C.C. Bernier (1977). 'Powdery mildew of *Vicia faba* in Manitoba'. Can. J. Plant Science 57, 745-749.

Variation within the fungus 'Botrytis fabae' Sard.

Hosni A. Mohamed, Nagi Abou Zeid, Wadaia F. Habib
Plant Pathology Institute, Agric. Res. Center, Giza, EGYPT

Leaf spots are the limiting factor of faba bean production in the northern parts of Egypt. They are caused by several pathogens. The most important, destructive and widespread is *Botrytis fabae* Sard. which causes chocolate spot in faba beans, and which was first reported by El Helaly (1936; 1938). Studies on this fungus has been confined to laboratory experiments (Hegazy 1964; 1968).

It was desired to study the range of variation within the fungus *Botrytis fabae* in order to help in detecting the pathogenic capabilities within the fungus. This involved testing lines for their reaction to the disease and elucidating the reason for the differences between reaction in the same entries when planted at different locations.

Materials and Methods

Samples were collected from different locations in the northern parts of Egypt. Isolations were made by cutting the diseased parts of the plant into small pieces which were surface disinfected using 0.1 per cent mercuric chloride, rinsed in sterilized distilled water, then dried between filter paper before plating on potato-dextrose-agar medium. Isolates were purified then identified, and pathogenicity tests were carried out.

Pure isolates were propagated on bean leaf extract-dextrose-agar medium which encourage spore production. Bottles were incubated for 21 days at 18-20°C. Spore suspension was prepared by adding sterilized distilled water to the culture. The bottles were shaken gently to separate the spores, then the spore suspension was thoroughly mixed, using a blender, for 5 minutes, to homogenize the spores. The mixture was filtered through a sterilized cheese-cloth. Spores were counted using a haemocytometer then diluted to 12.5 x 10^4 spores/ml and used immediately.

Leaflets were obtained from plants of the different entries grown in pots in the greenhouse. Detached leaflets were washed with sterilized distilled water then placed on the lower surface on a filter paper in plastic tray. Distilled water was added to maintain adequate moisture. Inoculation was done by placing two drops of the spore suspension on each half of the leaflet. Notes were recorded after 24 and 48 hours.

Results and Discussion

Results summarised in Tables 1 and 2 show that isolates differed in their virulence on the tested faba bean entries. The most virulent was the Nubaria isolate followed by the Alexandria isolate. The least virulent was the Sakha isolate. This may be due to the fact that the Sakha isolate was maintained for a period on artificial media. Re-isolation from infected material has to be done periodically to assure that the isolate retains its pathogenic capabilities, and that it does not lose this through culturing for many generations on artificial media.

Average percentage of infection increased through prolonging the period from 24 to 48 hours. However, 24 hours were sufficient to detect reaction to the fungus (Tables 1, 2).

It may be concluded that *B. fabae* isolates differed in their virulence on faba bean entries. Also, the detached leaf technique proved to be an efficient method for testing virulence of isolates of the fungus, as well as the reaction of bean entries to the disease.

N.B. The work described here was partially supported by the ICARDA/IFAD Nile Valley project on faba beans.

Table 1. Average percentage of infection of detached leaflets of faba bean entries by 5 isolates of *Botrytis fabae* , after 24 hours.

	Average per cent of infection by isolate				
entry	Sakha	Nubaria	Ismailia	Gemeiza	Alexandria
Giza 1	8.8	24.2	2.2	15.4	11.0
Giza 2	11.0	41.8	6.6	11.0	30.8
Giza 3	6.6	50.6	13.2	15.4	33.0
Giza 4	4.4	38.6	6.6	19.8	15.4
Rebaya 40	13.2	57.2	26.4	28.6	44.0
F. 402	8.8	24.2	15.4	24.2	15.4
Aquadulce	8.8	52.8	11.0	24.2	19.8
Intr. 289	8.8	35.2	2.2	19.8	22.0
300	2.2	44.0	11.0	8.8	26.4
301	6.6	33.0	0	22.0	28.6
302	2.2	13.2	4.4	8.8	22.0
295	6.6	33.0	4.4	22.0	41.8
NEB 938	0	35.2	2.2	33.0	15.4

Table 2. Average percentage of infection of detached leaflets of 13 faba bean entries by 5 isolates of *Botrytis fabae*, after 48 hours.

	Average per cent of infection by isolate				
entry	Sakha	Nubaria	Ismailia	Gemeiz	Alexandria
Giza 1	11.0	52.8	4.4	28.6	15.4
Giza 2	6.6	55.0	11.0	26.4	33.0
Giza 3	11.0	57.2	19.8	26.4	37.4
Giza 4	6.6	55.0	8.8	37.4	19.8
Rebaya 40	17.6	57.2	26.4	44.0	48.4
F. 402	11.0	44.0	15.4	35.2	17.6
Aquadulce	11.0	55.0	11,0	39,6	24.2
Intr. 289	11.0	48.4	11.0	33.0	26.4
300	13.2	52.8	17.6	30.8	26.4
301	11.0	57.2	11.0	28.6	37.4
302	8.8	24.2	26.4	28.6	22.0
295	13.2	44.0	46.2	28.6	46.2
NEB 839	2.2	39.6	6.6	37.4	15.4

References :

El Helaly, A.F. (1936). 'Studies on the brown spot disease of field beans *(Vicia faba)* in Egypt.' Report of Agric. Res., Min. Agric. (March) page 105 (In Arabic).

El-Helaly, A.F. (1938). 'Brown spot of field bean. Part I. Studies on fungus from genus *Botrytis* causing the disease in Egypt.' Tech. Bull. No. 191 Min. of Agric. 12 pp (in Arabic).

Higazy, M.F.H. (1964). 'Studies on some factors affecting *Botrytis fabae* Sard. causing chocolate spot disease of *Vicia faba* L.' M.Sc. thesis, Fac. of Agric., Ain Shams Univ., Egypt.

Higazy, M.F.H., (1968). 'Effect of some factors affecting infection with *Botrytis fabae* Sard. on broad beans with special reference to nutrition.' Ph.D. thesis, Fac. Agric., Ain Shams Univ., Egypt.

Blister beetle damage on faba bean (Sudan).

FUL MEDAMES — EGYPT

1 1/2 lb (3/4 kg) faba beans, small, dry and soaked
1 1/2 tbsp. ground cumin
4-6 cloves garlic, peeled and crushed
4 onions, chopped

To garnish :
4 hard-boiled eggs (warm)
the juice of 2 lemons
chopped tomatoes
olive oil
salt and pepper

Cover the soaked and drained beans with about two inches of water, add the cumin, garlic and some pepper and bake in the oven at 300°F for about three hours until the beans are soft and the sauce is thickened.

Serve granished with crumbled eggs, lemon juice, onions, chopped tomatoes, olive oil and red pepper. Eat with Arabic (or pita) bread.

Can also be eaten cold with yoghurt and french dressing.

Influence of 'Ronilan' on the severity of chocolate spot and yield in faba bean.

Salim Hanounik
Consultant to ICARDA, Tobacco Research Institute, P.O. Box 507, Lattaqieh, SYRIA.

A trial was conducted to study the influence of different rates of 'Ronilan' (a 50 per cent W.P. formulation of vinclozolin) on the severity of chocolate spot and yield of faba beans *(Vicia faba)*. Seeds of a *Botrytis fabae*-susceptible local faba bean landrace were planted in 4m x 6m plots, in rows 65cm apart with a plant to plant distance of 20cm. Chemical treatments employing 'Ronilan' at rates of 0, 0.75, 1.0 and 2 g/l of water, were begun eight weeks after planting, at biweekly intervals until six applications were completed. A randomised block design consisting of four replications was used. The trial was artificially inoculated with *B. fabae* (twice). The first inoculation was made when the plants were 10 weeks-old and the second two weeks later.

An isolate of *B. fabae* was obtained from a naturally infected faba bean leaf, propagated on faba bean-dextroseagar (FDA), and used at a concentration of 800,000 spores per ml of water. This suspension was sprayed on plots at a rate of about 25 cc per plant. After inoculation, the plants were covered with portable 4m x 6m x 0.65m polyethylene moist chambers for 48 hours. These chambers were designed especially for the maintenance of high humidity in the vicinity of inoculated plants in the field. Relative humidity and temperature at the time of inoculation ranged between 94-96 per cent and 14°-16°, respectively. After three weeks, disease readings were recorded employing the following 1-9 rating scale.

rating	reaction
1	no disease symptoms
3	few small discrete lesions
5	lesions common, some coalesced lesions
7	large coalesced lesions with some defoliation
9	extensive lesions with severe defoliation

The yield of green seeds was recorded, and expressed on a per plant basis.

The results (Table 1) indicated that as the rate of 'Ronilan' was increased from 0 to 2 g per liter of water, the severity of chocolate spot decreased from a rating of 8.5 to 3.0, and faba bean yields increased from 11.62 to 32.35 g of green seeds per plant.

Table 1. Influence of 'Ronilan' treatments on severity of chocolate spot and yield in faba bean under field conditions.

Treatment[1] Ronilan 50 WP[2] (g/l)	Treatment[1] *Botrytis fabae* (spores/ml)	disease severity	green yield of seeds (g/plant)	decrease in yield below control (%)
0.0	800,000	8.5	11.62	67.49
0.75	800,000	6.5	15.87	55.60
1.00	800,000	5.0	27.87	22.04
2.00	800,000	3.0	32.35	9.50
Untreated control (water only)	–	1.5	35.75	0.00

1 Ronilan 50WP was applied using 600 l of water/ha.
2 Ronilan 50WP is a BASF product released in 1977 in Europe, primarily for *Botrytis* control in grapes and strawberries. In the UK Ronilan is now cleared for use on dwarf green beans, strawberries and tomatoes.

In untreated plots, however, where neither chemical treatments nor artificial inoculations were made, faba bean yields averaged 37.75 g of green seed per plant. These plots had an average disease rating of only 1.5. Thus chocolate spot, in the absence of a 'Ronilan' treatment, caused 67.49 per cent loss in faba bean yields under the conditions of this test. When artificially inoculated plots were treated with 0.75, 1.0 or 2.0 g of 'Ronilan' per liter of water, losses due to chocolate spot were reduced to 55.60 per cent, 22.04 per cent and 9.5 per cent respectively. The application of 'Ronilan' therefore could prove useful in the control of chocolate spot in faba beans under field conditions.

Methods of evaluating faba bean materials for chocolate spot.

Shaaban Ali Khalil[1] *and J.G. Harrison*[2]
[1] *Legume Research Section, Agricultural Research Centre, Giza EGYPT*
[2] *Mycology Section, Scottish Horticultural Research Institute, Dundee, SCOTLAND, U.K.*

Introduction

Chocolate spot caused by *Botrytis fabae* sard is the most serious disease of faba beans (*Vicia faba* L.) in northern Egypt, and sometimes causes a total crop failure in heavily infected fields. Breeding programs concentrate on securing varieties adapted to the different local conditions. Such efforts have resulted in the release of the new standard variety Giza 3, adapted to the Northern Delta region. The investigations described here were mainly designed to evaluate the breeding material by growing lines under field conditions using the detached leaves technique, and by comparing them with their growth under controlled conditions in the greenhouse using attached successive leaves.

These studies were conducted at the Scottish Horticultural Research Institute (SHRI), Dundee, Scotland, U.K., during the 1979 growing season.

Field experiment

Six varieties of faba bean (*Vicia faba* L.) were grown under field conditions in a European Community (EEC) experiment. The varieties were :

'Dacre'
'Maris Bead'
'Blaze'
'Kristall'
'Russian'
'Minica'

A randomised complete block design with three replicates was used. Each plot was 7.0 x 1.93 m in size. Spacing between and within rows was 15 cm (40 plants/m^2) with single seeded hills. The varietal reactions to chocolate spot (*B. fabae*) were recorded at three stages of plant growth : after 100, 120 and 140 days from sowing. This was done by detaching leaves from different node positions along the main stem. The first test covered the nodes 5 and 6, the second covered nodes 9 and 10, and the third the nodes 13 and 14. Detached leaves from five plants (taken at random from each plot) were used for each test. Cut leaves were immediately placed on moist tissue paper in plastic trays 20 x 30 x 10 cm, and then inoculated on the upper surface with droplets of spore suspension (5 x 10^5/ml) of *B. fabae* using a micrometer syringe, one droplet (0.05 ml) per leaflet. Each tray was sealed in a polythene bag to conserve moisture, and kept at room temperature. The mean dimensions of the inoculation sites (lesions) were recorded 6 times, at 24 hour intervals.

Table 1. Mean value of lesion dimensions (mm) on detached leaves, 6 days after inoculation (field experiment).

Variety	lesion dimensions (mm) 100 days node 5	node 6	mean	120 days node 9	node 10	mean	140 days node 13	node 14	mean	Mean
Dacre	8.7	5.3	7.0	1.9	2.2	2.0	5.4	4.3	4.88	4.63
M. Bead	7.6	5.6	6.6	1.7	2.4	2.0	5.4	4.2	4.80	4.48
Blaze	7.9	6.6	7.2	1.6	0.7	1.1	1.8	2.7	2.25	3.55
Kristall	9.1	4.8	6.9	2.4	3.2	2.8	5.7	5.5	5.60	5.12
Russian	17.2	14.3	15.7	18.7	18.7	18.7	defoliation			17.23
Minicia	3.6	2.6	3.1	3.1	1.7	2.4	3.1	3.0	3.05	2.85
mean	9.02	6.53	7.75	4.9	4.82	4.83	4.28	3.94	4.12	6.31
L.S.D. 1 %			9.86			4.21			2.419	
5 %			7.23			3.09			1.757	

Glasshouse experiments

Four varieties were used ('M. Bead', 'Russian', 'Kristall' and 'Minica') in a randomised complete block design with three replicates. The plants were grown in 150 mm diameter plastic pots containing a peat/sand compost, watered daily and kept at 15°C. Each pot contained four plants (one cultivar). The attached leaves, covering the five nodes 5, 6, 7, 8 and 9 along the main stem of each plant, were inoculated 35 days from sowing date. The mean dimensions of lesions were recorded four times, at 24 hour intervals.

Results and Discussion

The final measurements of lesion dimensions from the field and glasshouse experiments were statistically analysed.

The results presented in Table 1, reveal significant differences between leaves from two successive nodes (nodes 5 and 6). The lower node leaves were more sensitive than the upper ones when leaves were inoculated 100 days from sowing date. However no significant differences were observed either between leaves from nodes 9 and 10 or from nodes 13 and 14 when inoculation was done 120 and 140 days from sowing date respectively.

On the other hand, differences between cultivars were highly significant over the three tests, indicating that the 'Russian' variety was more sensitive than the others and had been severely affected (completely defoliated) in the field before the third test was made (140 days from sowing). However, 'Minica' and 'Blaze' were markedly resistant. It is of interest to notice that all the tested materials were more sensitive during the early stage than at the flowering and fruiting stages. These results are in agreement with Last and Hamley (1956).

Results presented in Table 2 show that in the greenhouse experiment there were significant differences between successive leaves. The lower leaves seemed to be more tolerant to chocolate spot than the upper leaves. This indicates that the rate of lesion spread was most rapid in the youngest leaves, as has been reported by Mansfield and Deverall (1974) and Griffiths and Amin (1978). Differences between cultivars were highly significant.

Table 2. Mean values of lesion dimensions (mm) on the five attached leaves (nodes 5 to 9) four days after inoculation (greenhouse experiment).

variety	node number 5	6	7	8	9	Mean	LSD 5 %
M. Bead	3.53	5.17	3.13	4.40	2.93	3.38	
Russian	5.20	4.90	9.67	9.63	10.03	7.89	
Kristall	0.67	2.07	3.60	4.13	6.87	3.47	
Minica	0.90	1.17	1.57	1.30	2.07	1.40	
mean	2.57	3.32	4.49	4.87	5.47	4.15	1.90
LSD 1 %						3.13	
5 %						2.32	

References :

Griffiths, E. and Amin (1978). 'Susceptibility of bean *(Vicia faba)* leaves to infection by *Botrytis fabae* sard'. International congress of plant pathology, held at Munich (1978), 16-23.

Last, F.T. and Hamely, R.E. (1956). 'A local lesion technique for measuring the infectivity of conidia of *Botrytis fabae* Sardina.' Annals Biology 44, 410-418.

Mansfield, J.W. and Deverall, B.J. (1974). 'Changes in wyerone acid concentrations in leaves of *Vicia faba* after infection by *Botrytis cinerea* or *B. fabae*.' Annals of Applied Biology, 77, 227-235.

Effect of fungicides on leaf spots and yield of faba beans in Egypt.

Nagi Abou Zeid, Hosni A. Mohamed, Mohamed H. El Sherbeeny, Shaaban A. Khalil
Plant Pathology Institute and Field Crops Institute, Agric. Res. Center, Giza, EGYPT

Leaf spots are a limiting factor in faba bean production in the northern part of Egypt. Percentage of infection amounted to 100 per cent under natural infection during the growing season 1979/80 (Mohamed *et al* , 1980). Losses due to foliage diseases (leaf spots, rust and downy mildew) were estimated as 55.70 per cent of the seed yield when fungicide-sprayed and unsprayed plots were compared (Mohamed *et al*, 1980).

Several fungicides have been tested for their efficiency in controlling these diseases (Bekheit, 1950; Bekheit *et al*, 1951; El Helaly, 1939; 1950; Mansour and Kamel, 1975).

Several newly imported fungicides have been tested during the growing season 1979/80 in an attempt to a find a fungicide that will control this group of diseases effectively.

Materials and Methods

Fifteen fungicides, including Dithane M 45, were tested for their effect on leaf spots under field conditions. Plants were left for natural infection, at both Sakha and Nubaria Agric. Exp. Stations. This was severe during this growing season. Planting was done on November 15th at Sakha and on October 22nd, 1979 at Nubaria. Each plot was 4.8 x 3.5 m in size and each treatment was replicated four times. Fungicides were sprayed four times at two week intervals.

Notes were recorded on disease incidence every two weeks until the end of the experiment. At the end of the season, plants were harvested, threshed and seeds were weighed for each plot. Data were statistically analysed for percentage infection and yield.

Results and Discussion

To determine the effect of fungicides on percentage of leaf spots during the growing season, notes were recorded periodically, at two week intervals, prior to fungicide spray. It is clear from the data in Table 1 that percentage infection of the different treatments at Sakha differed slightly when notes were recorded 15 days after the first spray of the fungicides. When notes were recorded for the second time, i.e. prior to the application of the third spray, percentage infection did not differ except for Macroprax which increased from 11 to 16.5 per cent. Notes recordded on March 22nd, indicated that environmental conditions were favourable for infection during the first part of March, as percentages of infection increased significantly for all treatments, indicating differences in the efficiency of these fungicides in decreasing amounts of infection compared with the unsprayed plots. Increase in amounts of infection during late March and early April was either slight or not even evident, except for a few cases such as Cuprozan for which percentage infection increased from 68.75 to 85.75 per cent.

Table 1 Average percentages of leaf spot infection at different periods when Giza 3 plants were sprayed with fifteen fungicides (Sakha 1979/80).

	Average per cent leaf spots			
fungicide	Feb. 13	Feb. 28	March 22	April 7
Ronilan	11	11	74.25	77.25
Rovral	13.75	11	77	82.75
Cuprozan	13.75	11	68	85.75
Sicarol	11	13.75	66	77.00
Dithane M 45	11	11	41.25	41.25
Cupronyl	11	11	71.50	80.00
Macroprax	11	16.50	52.25	52.25
Agrimycin	11	13.75	33	33
Miltox	11	11	88	88.25
Remidin	11	11	60.50	55
White Zineb	11	11	46.75	33
Manesan 80	11	11	82.50	66
Calxin M	13.75	11	77	82.50
Bavistan	11	11	68.75	77
Mancozan	11	13.75	82.50	71
not sprayed	19.25	19.25	97	94

At Nubaria, average percentages of infection at the start of the experiment were higher than those at Sakha (Tables 1,2), indicating that environmental conditions were favourable for infection. This was beside the presence of spores of the causal pathogens during this early period, and host susceptibility. Percentage infection increased gradually throughout the period, with the exception of the latest period during March. A sharp increase in percentage infection was noted in certain treatments such as Rovral, Cuprozan super D, Agrimycin, Bavistin and Remidin (Table 2).

The fifteen fungicides varied in their effectiveness in leaf spot control. Differences between most of these fungicides and the unsprayed plots were significant with respect to percentages of leaf spots. They can be grouped according to their effectiveness in controlling leaf spots, as they did not behave similarly in the two stations. Some fungicides were effective in decreasing percentages of infection at both stations, such as Dithane M45; others were effective at only one station, such as Macroprax, Miltox, Remidin, White Zineb and Agrimycin. The rest of the fungicides were ineffective at both stations.

Table 2 Average percentage of leaf spot infection at different periods when Giza 3 plants were sprayed with different fungicides (Nubaria 1979/80).

treatment	Average per cent leaf spots			
	Jan. 28	Feb. 26	March 7	March 26
Ronilan	27.50	57.75	77	100
Rovral	27.50	33	49.50	82.50
Cuprozan	27.50	49.50	60.50	88.25
Bayleton	24.75	41.25	55	71.50
Dithane M 45	30.25	35.75	35.75	41.25
Cupronyl	27.50	41.25	52.25	85.50
Machrprax	27.50	35.75	60.5	86.00
Agrimycin	27.50	49.50	52.25	97.00
Miltox	24.75	41.25	49.25	52.25
Remidin	30.25	46.75	52.25	88.25
White Zineb	30.25	46.75	66	88.00
Manesan 80	27.50	41.25	52.25	68.75
Calxin M	24.75	33	63.25	68.25
Bavistin	27.50	46.75	57.75	88.50
Maneozan	24.75	38.50	60.50	71.50
not sprayed	41.25	66	85.25	100

Many of the fungicides significantly affected yield. The fungicides producing the highest yield were Dithane M 45 followed by Calxin M, Manesan 80, White Zineb and Mancozan.

The increase in yield over the unsprayed plots when Dithane M45 was sprayed was 36 per cent at Sakha and 50.8 per cent at Nubaria. This suggests a high return due to the use of this fungicide in controlling leaf spots of faba beans.

It may be concluded that Dithane M45, at the rate of 250 g/100 l water can be sprayed four times at two week intervals to decrease percentage of infection and obtain high yields of the crop. This fungicide is already recommended to the farmers for the control of leaf spots and rust of faba beans.

N.B. The work described here was partially supported by the ICARDA/IFAD Nile Valley Project on faba beans.

References :

Bekheit, M.R. (1950). 'Control of chocolate spot and rust of beans.' Report Agric. Research , Min. Agric. (May) pages 174-178 (in Arabic).

Bekheit, M.R., Fahmy, I., Rizk, Z. and El Yamany, T. (1951). 'Testing some fungicides to control chocolate spot and rust of faba beans and also the effect of date of planting and different agricultural practices.' Report Agric. Tesearch, Min. Agric. (October) page 21 (in Arabic).

El-Helaly, A.F. (1939). 'Further studies on the control of bean rust with some reference to the prevention of chocolate spot of beans.' Tech. Bull., Min. Agric. 236.

El-Helaly, A.F. (1950). 'Bordeaux mixture for the prevention of rust and chocolate spot of beans.' Phytopathology 40, 699-701.

Mansour, K. and Kamel, B. (1975). 'Studies on the effects of phosphorus fertilization and spraying with the fungicide Dithane M45 on the control of chocolate spot and amount of yield of horse beans.' Agric. Res. Rev. 53, 123-134.

Mansour, K. , Risk, Z., Fouad, W. (1975). 'Studies on the control of chocolate spot and rust of horse beans.' Agric. Res. Rev. 53, 89-95.

Mohamed, Hosni A., El Rafei, M.E., Abou Zeid, N.A., Omar, S.A. Wadaia, F., Ismail, I.A., Raof, M. Khidr, H. (1980). 'Plant Pathology Research Studies.' ICARDA/IFAD Nile Valley Project on faba beans. Annual Coordination Meeting 1979/80, Cairo, Monograph 49 pp.

Further approach towards the adoption of chemical control of Orobanche crenata in faba bean.

M. Kamal Zahran, Tawfic S. El-N. Ibrahim, Farag H. Farag, El-Hassannien El-Sh. Hassannien[1] and Helmi M. Farrag[2]

[1]Weed Control Research Section, Plant Protection Research Institute, Agricultural Research Centre, Giza, EGYPT

[2]Food Legume Research Section, Field Crops Institute, Agricultural Research Centre, Giza, EGYPT

Orobanche parasitism is considered as a serious menance to the production of faba bean (*Vicia faba* L.) in Egypt. The research approach to give control measures for this parasite has great importance.

A series of field trials at different sites in seven different provinces during the 1980 season were undertaken to further evaluate effective herbicidal applications. The herbicides used were lancer (glyphosate 360 g a.e./l) and kerb (pronamide : propyzamide 50 per cent w.p.), two chemicals which have already given appreciable efficacy against *Orobanche* in faba beans (Schmitt and Weltzien, 1979; Zahran *et al* ., 1976 and 1980). Likewise, three different cultivars of faba bean, (Giza 2, Giza 4 and F 402) were tested for tolerance to *Orobanch crenata* Forsk. with and without herbicide applications. It has already been noted that some faba bean cultivars show fair resistance to *Orobanche* parasitism (Basler and Haddad, 1979; Nassib *et al*., 1979 and ICARDA, 1980).

The results obtained in our study can be concisely noted as follows : it was quite clear that all herbicidal treatments had an appreciable effect on *Orobanche*.

The following treatments appeared to be the best of those tested :—
a) Three sprays with lancer, each at 0.086 kg (a.e.)/ha, at 3-week intervals starting at the beginning of flowering.
b) The use of kerb as post-em. at the rate of 4.76 kg (a.i.)/ha, 4 weeks after sowing (at 2500 l/ha volume spray). Under the conditions of this work it is noticeable that the use of kerb as PPI (with deep incorporation) at 4.76 kg/ha had a considerable effect.

Noticeably, kerb as PPI at all the rates tested was responsible for a significant reduction in number of survivors of crop plants, and a significant decrease of yield in consequence. This might be due to the shallow incorporation of the herbicide into the soil (about 5 cm) (Table 1).

Table 1. Effect of different treatments on *Orobanche* and faba bean (Giza, 1980, field trial).

herbicide	application	rate kg/(a.i) x 10^3	*Orobanche* spikes /ha	*Orobanche* wt. kg/ha	faba beans plants /ha x 10^3	faba beans seeds yield kg/ha
Lancer	Post-em.	0.086x3	9.5	20.23	94	915
Kerb	Post-em.	4.760	69.3	209.44	78	680
Kerb	Post-em.	3.570	92.5	195.76	77	753
Kerb	Post-em.	2.975	87.8	199.92	79	681
Kerb	PPI	4.760	43.7	119.90	27	278
Kerb	PPI	3.570	57.1	233.24	36	304
Kerb	PPI	2.975	97.2	195.64	32	207
Check	—	—	289.2	696.15	79	408
LSD (5 %)			76.9	153.96	16	285

In demonstration fields (totalling 4.2 hectares) at three different localities in Sohag province, kerb was applied post-em. as a foliar spray, 4 weeks from sowing at the rate of 4.76 kg (a.i.)/ha with 2500 l/ha volume spray. The effect of such an application was clear, since it gave reduction of 81 per cent in No. of parasite spikes and 54 per cent in weight of spikes. Consequently, the faba bean yield increased significantly by 60.9 per cent (Table 2).

The faba bean cultivar Family 402 appeared to have some tolerance to *Orobanche* parasitism, compared to the other two varieties (Giza 2 and Giza 4). The respective rate of infestation for these three varieties could be expressed as the following percentages : 23, 44 and 100 (respectively).

The productive capacity of Family 402, Giza 2 and Giza 4 can be estimated by the relative values of 100, 92.3 and 81.9 (respectively) for seeds, and 100, 94.5 and 92.6 (respectively) for straw.

In respect of tolerance, it has already been noted that some faba bean cultivars show fair resistance to *Orobanche* (ICARDA, 1980; Basler and Haddad, 1980).

References :

Basler, F. (1979). 'Broomrape *(Orobanche* spp.) control in broadbeans *(Vicia faba)*. FABIS 1, 27.

Basler, F.; Haddad, A. (1979). 'Selection of *Orobanche* resistant cultivars of broadbeans and lentil.' In proceedings, Second International Symposium on Parasitic Weeds, North Carolina, (1979), 254-259.

International Center for Agricultural Research in the Dry Areas. (1980). 'Weed Control research in Northern Syria.' ICARDA Project Report (1980) No. 5, 43 pp.

Nassib, A.M., Ibrahim, A.A.; Saber, H.A. (1978. 'Breeding for broadbean resistance to broomrape *(Orobanche crenata)* in Egypt.' A paper presented at the Food Legume Improvement and Development Workshop held at ICARDA, Aleppo, Syria, 2nd to 7th May, 1978.

Table 2. Effect of kerb as post-em. on *Orobanche* and faba bean in demonstrative fields (Sohag province, 1980).

Site	*Orobanche* spikes No./ha x 10^3 treatment	*Orobanche* spikes No./ha x 10^3 control	*Orobanche* spikes yield (kg/ha) treatment	*Orobanche* spikes yield (kg/ha) control	faba bean seeds (t/ha) treatment	faba bean seeds (t/ha) control
Sacolta	4.1	21.4	75.4	184.5	3.76	2.18
Tima	4.0	20.1	70.0	142.5	4.25	3.00
Shandweel	5.3	29.7	73.8	152.5	3.48	1.95
mean	4.5	23.7	73.0	159.8	3.83	2.38

Schmitt, U.; Weltzien, H.C. (1979). 'Chemical control of *Orobanche crenata* in broadbeans.' Paper given at the 31st International Symposium on Crop Protection. Medelingen vande Fakulteit Landbouwetenschappen, Gent (1979) 44 (2), 711-715.

Zahran, M.K. *et al.* (1976). 'Control of parasitic plants (broomrape and dodder) in different crops in Egypt.' Ann. Rep. (EG-ARS- 15 PL 480 Project).

Zahran, M.K. *et al* . (1980). 'Chemical control of *Orobanche crenata* in *Vicia faba.'* FABIS 2, 47.

Control of aphid-borne viruses in faba bean by mulching with silver polyethylene film

Yasunobu Tachibana
Ehime Fruit Tree Experiment Station, 1618 Shimoidaicho, Matsuyamashi, Ehime-ken, JAPAN

In 1969, Inouye identified seven distinct viruses in faba bean plants in Japan (Inouye, 1969). Among these, the bean yellow mosaic virus (BYMV) and the pea seed-borne mosaic virus (PSbMV) are the prominent viruses which are transmitted by aphids. They are widespread throughout the faba bean growing areas in Osaka prefecture (Tanaka *et al,* 1973). In Ehime prefecture, infection periods of the aphid-borne viruses can be divided into two seasons. The early infection occurs at an early stage of faba bean growth from just after planting to mid-December, and the later infection occurs from the flowering stage in late February to the harvesting stage in mid-May.

When infected seedlings were planted in the field, typical mosaic symptoms were soon observed, and subsequent transmissions by vector were prevalent. However, in a field which did not have infected seedlings, the disease symptoms were seldom observed and transmission was delayed.

Rate of the disease transmission by vector decreased with increasing distance from the infected seedling. Severity of the disease outbreak correlated significantly with the ratio of the number of infected seedlings to the healthy ones in the field (Tachibana *et al,* 1979).

Infection with the viruses reduced considerably the number of pods, resulting in a seed weight decrease. Thus, small sized seeds increased markedly in the infected plants. Infection during the plant growing stages affected the yield. By delaying the infection, the yield reduction was small (Tachibana, 1979).

Tanaka *et al* (1973) noticed that repeated spraying of insecticides against the vectors had no effect on the virus disease incidence in faba beans. To prevent virus infection, I studied the effect of mulching on infection in 1977 and 1978. Silver polyethylene or vinyl plastic film was covered on the surface of the rows planted with faba beans. The films were left during the period from the transplanting stage to harvesting. At the pod bearing stage, the percentage of diseased plants was 20 per cent in the mulched plot, compared with 98 per cent in the non-mulched plot. At harvest, the weight of dry seeds per plant was 123 g in the check plot, while that of the mulched plot was 181 to 210 g (Table 1). Silver polyethylene film was more effective in suppressing the virus transmission than any other film.

Table 1. Effect of control of virus disease by mulching with various films.

Treatment	% of diseased plants January	% of diseased plants April	Total No. of pods per plant	Weight of seeds (g/plant)
silver polythylene film mulching	2.0	12.2	62	210
vinyl plastic film mulching	2.0	18.5	59	202
silver-stripe polyethylene film mulching	5.3	20.0	56	181
non-mulching	38.5	98.0	41	123

From the results obtained, it was concluded that aphid flight to the plant and subsequent sucking was effectively repelled by a mulching of silver polyethylene film, resulting in marked suppression of the virus transmission. Thus, the film covering on the row might increase the number of pods and seed weight per plant. From the practical point of view, I suggest that this method is very useful for seed production in faba bean growing.

References :

Inouye, T. (1969). 'The legume viruses of Japan'. Rev. Plant Protection Res. 2, 42-51.

Tanaka, Y. Kimura, Y. and Hiraoka, K. (1973). 'Studies on the control of broad bean mosaic disease (2)'. Bull. Osaka Agr. Res. Center **10**, 77-92. (In Japanese)

Tachibana, Y., Shigematsu, Y. and Yoshioka, K. (1979). 'On the seed transmission of virus disease in broad bean plants. (1). Disease prevalence from seed-borne plant in the field'. Proc. Assoc. Plant Protec. Shikoku **14**, 25-30. (In Japanese)

Tachibana, Y. (1979). 'Countermeasure for control of broadbean mosaic disease'. Agr. and Hort. 54, No. 6, 774-778. (In Japanese).

Screening of aphid resistance in faba bean lines.

Oreib Tahhan[1] *and G. Hariri*[2]
[1]*Food Legume Improvement Program, ICARDA, P.O. Box 5466, Aleppo, SYRIA*
[2]*University of Aleppo, Aleppo, SYRIA*

The faba bean (*Vicia faba*) plants in the Near East and North Africa region are attacked during the spring by three main aphid species. These are *Aphis fabae* Scop., *A. craccivora* Koch and *Acyrthosiphon pisum* (Harris).

Field tests for the blackbean aphid (*A. fabae*) resistance in 552 BPL lines of faba beans were carried out at Tel Hadya, near Aleppo. In late March 1979, heavily infested faba bean plants were collected from Lattaquieh on the Syrian coast, where aphid infestation starts earlier than in the Aleppo area. Insects were distributed on each plant of the BPL faba bean lines to ensure a successful artificial infestation. Three and four weeks later, all stages and forms of aphid from random samples of each line were counted. Numbers ranged from 4 to 8450 aphids/plant in the first count and from 8 to 7339 aphids/plant in the second count. The average numbers of aphids on BPL 1076 and BPL 678 were 9 and 6650 aphids/plant respectively in both counts. Twenty BPL lines had less than 85 aphids/plant and 10 BPL lines had between 3270 to 6650 aphids/plant.

The number of nymphs, alatae and apterous adults on eighty lines were studied. Each adult produced from 1 to 48 nymphs (average 6.6 nymphs) in the first count and from 0 to 36 nymphs (average 5.4 nymphs) in the second count. This reduction may be due to the rise in temperature and to the age of the plants. The alatae adults numbered from 0 to 278 aphids/plant (average 23.8 aphids) in the second count.

In the 1980 season, 10 susceptible and 40 less susceptible lines were tested in the field under natural conditions of aphid infestation. These lines were infested by *A. craccivora* at much lower insect numbers than with *A. fabae* and *A. pisum* in the 1979 season. The *A. craccivora* population may have been limited by the abundance of the coccinellid predator *Coccinella septempunctata* L. which was present in greater numbers than in the 1979 season. Other coccinellid predators with fewer numbers such as *C. undecimpunctata* L. and *Adonia variegata* Goeze, chrysopids, *Chrysopa* sp. and syrphid flies were also observed.

The occurrence of insect eggs in pistils of faba beans.

G.G. Rowland[1], *M.L. Parker*[2] *and D.A. Bond*[2]
[1]*Crop Development Centre, University of Saskatchewan, Saskatoon S7N OWO, CANADA.*
[2]*Plant Breeding Institute, Maris Lane, Cambridge CB2 2LQ, ENGLAND.*

During the course of a study to determine fertilization percentages in faba beans at the Plant Breeding Institute, Cambridge, insect eggs were observed in the neck of the pistil between the style and ovary. These pistils came from flowers collected in 1980 from field plots of 'Maris Bead', 'Erfordia', '74-RM-925' (an experimental line from the Crop Development Centre) and 'TI' (a terminal inflorescence line). Inflorescences were collected up to the seventh flowering node after the uppermost flower in an inflorescence had opened, so that presumably all flowers had had an opportunity to be pollinated. Flowers were then fixed in 70 per cent ethanol and stored until needed. They were then hydrolysed in 1N KOH for one hour, the pistils removed, stained with aniline blue (2 per cent w/v in 20 per cent K_3PO_4) and examined by U.V. flourescence microscopy.

Whilst examining the second flowering node, insect eggs of about 0.35-0.4 mm long were found and since their frequency was quite high, it was decided to keep an accurate count of their appearance in the third flowering node. Of the 441 pistils examined at the third flowering node, 290 (or 66 per cent) of them contained insect eggs. The frequency of appearance did not diminish at subsequent nodes. There were usually four or five eggs at the top of the ovary and these lay in the path of the pollen tubes growing down the style and attempting to reach the ovary. It could not be determined whether these eggs had any effect on fertilization, but their presence certainly could not have been beneficial.

Further up the stem, larvae began to appear in a small number of the flowers. The larvae had often apparently eaten most of the pistil. They were certainly responsible for some of the bud drop on the upper flowering nodes.

These larvae, along with slides of the eggs (see Fig. 1), were sent to Dr. A.J. Cockbain of the Rothamsted Experimental Station. He identified them as being *Apion* larvae and most likely *A. vorax*. He was unable to unequivocally identify the eggs as being those of *A. vorax*. However, adult *A. vorax* which were particularly common in 1980, are known to lay eggs of this size in flower buds.

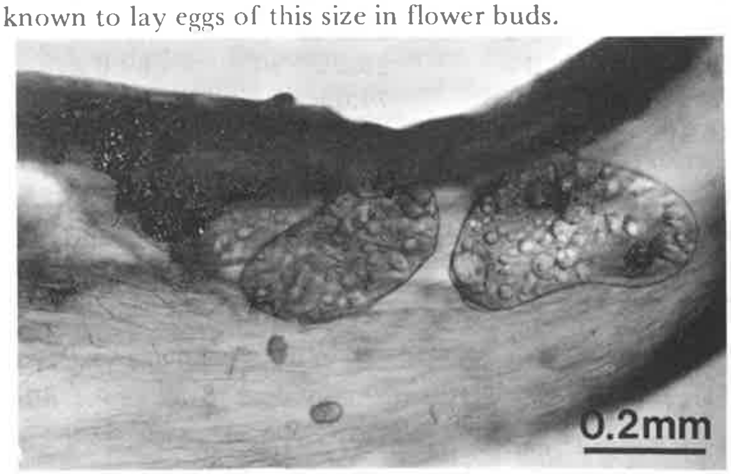


Fig. 1 Three insect eggs in the neck of the pistil between the style and ovary.

Differential response of five promising faba bean cultivars to major insect pests in the field.

Siddig Ahmed Siddig
Shambat Research Station, P.O. Box 3O, Khartoum North, SUDAN

The susceptibility of five promising cultivars of faba bean to the lesser army worm (*Spodoptera exigua*), thrips (*Caliothrips sudanensis*) and aphid (*Aphis craccivora*) was investigated.

Seeds were sown on 15th October in 14 x 3 m plots in a randomised block design with five treatments and replicates. Sowing was made at two plants per hole, with 20 cm between plant holes and on ridges 60 cm apart.

Damage by the lesser army worm was estimated 21 days from sowing by determining the percentage number of damaged plants. Estimates of thrips damage were made by finding the percentage number of damaged fruits. Aphid damage was estimated by counting the number of honey dew droplets per 10 leaves.

The results given in Table 1 clearly indicate that the variety Giza was only lightly infested by the lesser army worm, although the difference in infestation was not significant. On the other hand, the variety BF 2/2 was significantly less infested by thrips than the other varieties studied. RB 29 also showed lighter infestation by aphid, but the differences between cultivars were not significant.

Table 1. Differential response of five promising cultivars of faba bean to attack by major pests.

Cultivar	Damage by *Spodoptera* (%)	Thrips damage (%)	Honey dew droplets of aphid per 10 leaves
Giza	25.8 a	62.6 b	90.0 a
RB 29	35.6 a	65.6 ab	41.0 a
BF 2/2	42.0 a	23.0 c	69.0 a
IW 5	39.7 a	74.0 a	82.0 a
RB 40	49.1 a	70.4 a	80.0 a
	SE 11.4	SE 3.3	SE 16.7

Figures followed by the same letter are not significantly different at $p \leqslant 0.05$.

Infestation of faba bean seeds by Bruchus dentipes Baudi (Coleoptera: Bruchidae).

Orieb Tahhan[1] and G. Hariri[2]
[1]Food Legume Improvement Program, ICARDA, P.O. Box 5466, Aleppo, SYRIA.
[2]University of Aleppo, Aleppo, SYRIA

Faba bean (*Vicia faba*) seeds in the Near East are subject to attack by three main *Bruchus* species. These are *Bruchus dentipes* Baudi, *B. pisorum* L. and *B. rufimanus* Boh. (Hariri, 1980). A study during the seasons 1978/79 and 1979/80 was conducted at ICARDA's Tel Hadya site to investigate faba bean infestation by *B. dentipes.*

It has been found that adult insects overwintering in the faba bean seeds leave the sowed dry seeds after their hard coats are softened by soil moisture (around December to January). In spring, when the temperature rises above 15°C, the overwintered adults feed on pollen, then mate and lay their eggs singly on soft faba bean pods, with maximum activity during April and early May. The hatching larvae feed by boring into the soft seed, and complete their development in hard harvested seed in the store.

Dissection of 50 infested seeds at weekly intervals showed that each seed was infested by 1 to 6 larvae, the majority with one larva (37 to 80 per cent). Pupation took place in September with a peak in the last week of the month; adults appeared under 'windows' in the seed coat during September to October as shown in Fig. 1. Adults numbered 1 to 3 in each seed and remained there until sowing. Keeping the seeds in the store until next late April/ early May ensured 100 per cent mortality of adults which were then unable to leave the hard seeds. The death of the store population of larvae, pupae and adults due to the attack by the itch mite, *Pyemotes* sp., was observed. The mortality reached up to 29 per cent for larvae and much less for the other stages.

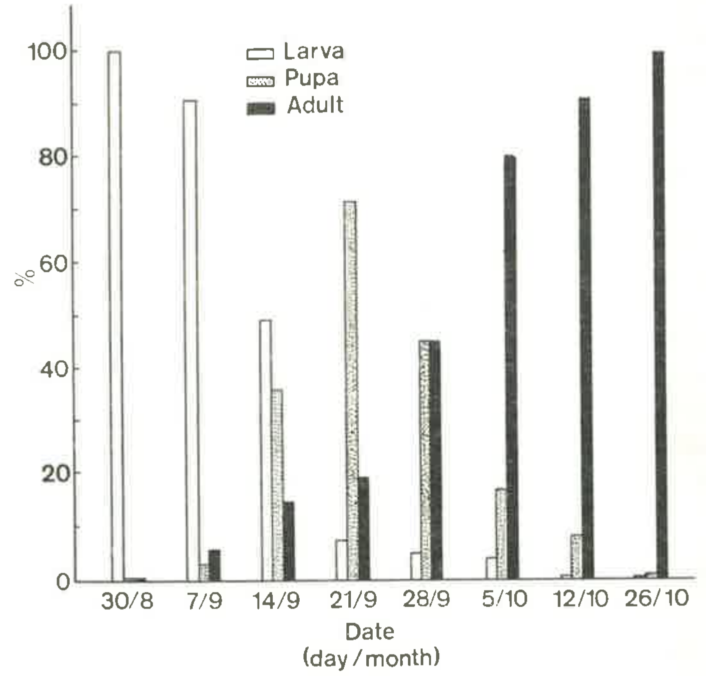


Fig. 1. Percentage larval, pupal and adult stages of *Bruchus dentipes* Baudi.

According to the number of windows appearing in the seed coat, the infestations were estimated for local cultivars and pure lines from the germplasm, to range from 37.0 to 76.6 and 0.0 to 76.6 per cent respectively.

Larval infestations of harvested seeds from plots of chemically treated local faba beans are shown in Table 1.

Table 1. Larval infestations of harvested seeds following different plot treatments.

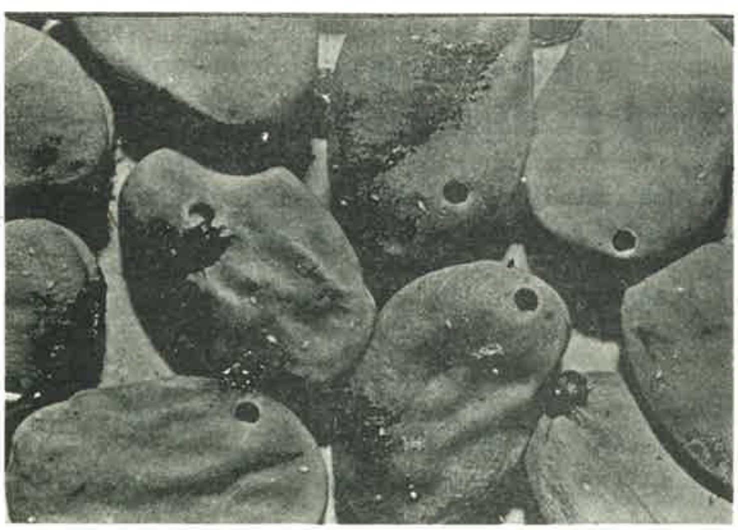
Treatment	% larval infestation
Carbofuran 1.5 kg a.i./ha	65.1
Dimethoate 0.3 kg a.i./ha	68.4
Methidathion 0.5 kg a.i./ha	58.8
Methomyl 1 kg a.i./ha	58.6
Fenitrothion 0.5 kg a.i./ha	56.7
Carbofuran 1.5 kg a.i./ha plus Fenitrothion 0.5 kg a.i./ha	52.5
Control	76.6

Carbofuran was applied as 5 per cent granules in furrows at sowing. Insecticides were applied in three foliar sprayings from flowering to maturity at two week intervals.

Fumigation of stored seeds shortly after harvesting with methyl bromide gave 94 per cent kill of young larvae.

References :

Hariri, G. (1980). 'Distribution and importance of bruchid attacks on different species of pulses consumed in the Near East'. A paper presented at the International Colloquium on Ecology of Bruchids held in Tours, France, 16th to 19th April, 1980.



Callosobruchus chinensis on faba bean seeds

Feeding oviposition and chemical control of Sitona limosus (Rossi) (Coleoptera: Curculionidae) on faba bean plants.

Oreib Tahhan[1] *and G. Hariri*[2]
[1]*Food Legume Improvement Program, ICARDA, P.O. Box 5466, Aleppo, SYRIA.*
[2]*University of Aleppo, Aleppo, SYRIA.*

During 1978, 1979 and 1980, a survey of *Sitona* species infesting food legume plants was carried out at ICARDA's Tel Hadya site near Aleppo. *S. limosus* (Rossi), *S. lineatus* (L.) and *S. crinitus* (Mbst.) were found to be the most abundant species associated with fields where there were food legumes such as lentils, chickpeas and faba beans. *S. limosus* was more associated with faba bean than lentil and chickpea fields when these crops were grown close together.

S. limosus adult, like that of other species of the same group, feeds on the leaf margins by chewing out small semicircular sections. The degree of injury depends on the age of the host plant; therefore, the young plant may be severely injured or killed. If a young plant is fed on by an insect, the plant may not be able to feed its young roots. The insect larva feeds on the roots preferring the nitrogenous nodules.

Field estimation of young faba bean plants infested by *S. limosus* adults during early spring showed that all plants with 30 to 50 leaflets each were attacked with a variable degree of leaflet infestation of each plant ranging from 8 per cent to 27 per cent (average 12.8 per cent). In Atareb (a village 30 km west of Aleppo) where lentil plants were the only food legume crop grown, *S. limosus* adult infestation of leaflets (average 12 leaflets per plant), reached up to 70 per cent with one to three chewed areas per leaflet.

Laboratory measurements of the adult feeding area on faba bean leaves indicated that a pair of adults newly emerged from aestivation (November) may consume from 4.1 to 6.6 cm^2/day over a 10 day period, with an average of 5.1 cm^2/day. Oviposition started 3 to 4 days after the beginning of feeding and continued throughout the female life until May. Females laid 603 to 4950 eggs each with an average 1919 eggs and a daily laying from 7 to 32 (average 18 eggs/day). These figures are comparable to other studies in the region in which the females laid up to 4328 eggs with an average 1955.2 when fed on faba bean leaves (Plaut, 1973).

In faba bean experimental plots chemically treated with 1.5 kg a.i. of carbofuran granules ('Furadan') per hectare at planting (to control larval and adult stages of *S. limosus*), infestation of leaflets was 12.8 and 3.2 per cent (L.S.D. 5 per cent equals 2.0) in untreated and treated plots, respectively. Carbofuran treatment increased the faba bean yield by 16 per cent in treated plots.

Reference:

Plaut, H.N. (1973). 'Habits of adult *Sitona limosus* (Coleoptera : Curculionidae)'. Ann. Ent. Soc. Am. 66, 931-936.

A note on chemical control of faba bean insect pests.

Oreib Tahhan[1] *and G. Hariri*[2]
[1]*Food Legume Improvement Program, ICARDA, P.O. Box 5466, Aleppo, SYRIA*
[2]*University of Aleppo, Aleppo, SYRIA*

Insecticide trials on faba bean field plants were carried out during the 1980 season at ICARDA's Tel Hadya site. The trials were aimed at controlling insects associated with the above and below ground parts of the plant. The infestation of leaflets by *Sitona limosus* (Rossi) and *Apion* spp. adults was estimated in treated and untreated plots. Other infestations by *Heliothis* spp. larvae, *Cydia* sp. larvae, *S. lineatus* (L.). *Acyrthosiphon pisum* (Harris), *Aphis craccivora* Koch, thrips and leaf midges were neglected because of the small damage due to these insects.

Damage due to *Sitona* and *Apion* adults was estimated by counting the total number of infested and uninfested leaflets of 10 plants individually, which were selected at random from each plot. Two counts were made; one 18 weeks after sowing, the other 21 weeks after sowing. The mean number of leaflets in the first and second counts were 41.1 and 97.5 leaflets/plant, respectively; accordingly, the leaflet damage percentages decreased in the second count (Table 1).

The results show that damage to faba bean leaflets by *Sitona* and *Apion* was less in plots treated with carbofuran granules. Grain yield and seed weight increased significantly when the crop was treated with carbofuran at the November sowing and again in January, followed by four fenitrothion sprayings from late March to May (Table 1.).

Table 1. Effects of insecticide treatments on damage by *Sitona* and *Apion* adults, 100 seed weight and yield of a local cultivar of faba beans (ILB 1812).

Treatment	No. of replicates	per cent leaflet damage by *Sitona* adults		per cent leaflet damage by *Apion* adults		100 seed weight (g)	grain yield (kg/ha)
		1st count	2nd count	1st count	2nd count		
Carbofuran plus fenitrothion	4	3.7	0.4	5.2	0.5	132	2295
Carbofuran plus methomyl	4	2.2	0.6	4.5	0.4	122	1974
Carbofuran	4	2.8	0.1	2.5	0.1	129	2059
Fenitrothion	4	15.0	4.0	5.2	2.0	128	1858
Methomyl	4	14.5	3.6	9.1	2.5	124	1831
Check (untreated)	4	12.9	4.0	10.0	3.2	124	1781
L.S.D. 5 %		5.1	2.5	4.4	1.9	7.1	362.4
C.V.		39.8	79.6	47.4	88.7	3.7	12.2

Notes :
Sowing was on 19.11.1979. 1st count of leaflet damage was on 23.3.1980, 2nd count of leaflet damage was on 14.4.1980
Furadan (carbofuran) 5 per cent granules was applied at 1500 g a.i./ha in seeding furrows at sowing plus 750 a.i./ha on one side of the row (on 21.1.1980)
Folithion (fenitrothion) 50 per cent E.C. was applied at 500 g a.i./ha in four sprayings from early flowering to maturity. Sprayings were at two week intervals (from 26.3.1980 to 15.5.1980).
Lannate (methomyl) 90 per cent W.P. was applied at 1000 g a.i./ha in four sprayings from flowering to maturity. Sprayings were two week intervals (from 26.3.1980 to 15.5.1980).

Seed Quality and Processing

Breeding faba beans for use as a green vegetable

Geoffrey Hawtin and Mamdouh Omar
Food Legume Improvement Program, ICARDA, P.O. Box 5466, Aleppo, SYRIA

Throughout much of the ICARDA region faba beans *(Vicia faba)* are harvested both dry and as a green vegetable. Although there are no accurate statistics available, it is thought that in the West Asia region (Iraq, Syria, Turkey, Lebanon, Cyprus) at least two-thirds of the total production is consumed green. In North Africa the proportion may be slightly lower, but green production is still a very significant factor. Even in Egypt and Sudan, where the majority of faba beans are harvested dry, green bean consumption is thought to account for about ten per cent of the total production.

In general the large seeded, var. *major*, types are preferred for green consumption. The young pods may be picked and consumed whole or sliced. At a later stage the pods may be picked green but then shelled and only the green seed consumed. Farmers also vary considerably in how they handle the crop. Early in the season, when fresh bean prices are high, many farmers find it economic to harvest the young pods. Later in the season prices usually fall and the high cost of labour for picking, or high transport costs, may make it uneconomic to take later green harvests. The crop may then be left to mature and the seeds harvested dry.

Thus three situations may be envisaged :

- the crop is entirely harvested as a green vegetable
- the early pods are harvested green and the rest of the crop harvested for dry seed, and
- the crop is harvested entirely for dry seed.

In breeding cultivars for this region it is clearly important that green vegetable yields be considered. Dual purpose types, which are suitable for both green pod and dry seed production, would be the most valuable and would allow the farmer to base his decision of whether to harvest or not at a given stage, on the prevailing economic conditions.

The direct measurement of green-pod yield is inevitably destructive, and thus of limited value in selection. Trials were therefore conducted to study the relationship between dry seed yield and green pod yield.

In the 1978/79 season at the ICARDA site near Aleppo, 25 cultivars were evaluated in 5-row plots in an unreplicated trial. Each of the three central rows was randomly assigned one of the following treatments :

1. green pods were harvested once early in the season, and the late formed pods were harvested dry.
2. green pods were harvested twice in the season (there was almost no residual dry-seed yield) and
3. the whole row was harvested dry.

Dry seed yield (treatment 3) was significantly correlated with green pod yield/one picking (r equals 0.485*), the residual dry seed yield (r equals 0.418*) and the total green pod yield /two pickings (r equals 0.712**). Figure 1 shows the relationship between dry seed and green pod yields.

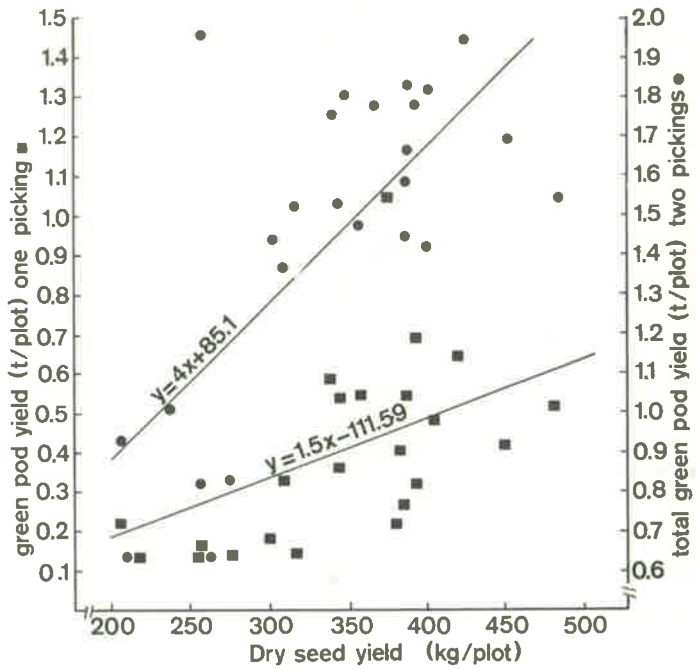


Fig. 1. The relationship between dry seed and green pod yields.

The following season, 68 large-seeded germplasm accessions were evaluated in a similar trial. In this study the green pods were also shelled, and the yield of green seeds alone recorded in addition to the measurements taken in the first season.

The correlations between these various factors are shown in Table 1. Similar results were obtained as for the previous season except that in 1979/80 there was no correlation between the dry seed yield (f) and the yield of the first picking of green pods (a). However the significant correlations between dry seed yield (f) and the total green bean yields (both b and c) following two pickings, indicate that selection based on dry seed yield alone may be effective in identifying types which are suitable for green vegetable use.

Likewise there is an indication that cultivars having a good yield potential for dry seeds might also be good as dual-purpose types.

Table 1. Correlation coefficients between green bean and dry bean yields in 68 accessions of faba bean (Aleppo, 1979/80)

Treatment	(b)	(c)	(d)	(e)	(f)
a) Fresh yield, pods and seeds, one picking.	0.366**	-0.494**	0.981**	0.320**	-0.005^{ns}
b) Fresh yield, pods and seeds, two pickings.	—	0.078^{ns}	0.348**	0.894**	0.508**
c) Residual dry seed yield after one green picking.		—	0.455**	0.227^{ns}	0.397**
d) Fresh yield of seeds, one picking.			—	0.329**	0.033^{ns}
e) Fresh yield of seeds, two pickings.				—	0.622**
f) Dry seed yield; no green bean harvest.					—

** = correlation coefficent significant P ⩽0.01

ns = not significant

Thus in breeding faba beans for the complex situation prevailing in much of the Middle East and North Africa, a strategy based on breeding for dry seed yield *per se* is likely to give rise to types which produce good vegetable yields as well. In considering types for predominantly green use, it may be preferable to select for other desirable characters (e.g. long uniform pods, pod development starting early in the season and continuing through the harvest period, and pods borne high off the ground for easier harvesting) together with high dry seed yield, rather than to select for green pod yield *per se* , which is both time consuming and destructive.

Preliminary attempt to enrich 'zabadi' with faba bean extract.

Samir A. Abou-Donia and Ahmed E. Salam
Department of Agricultural Industries, Faculty of Agriculture, Alexandria University, Alexandria, EGYPT

Zabadi is the national type of yoghurt in Egypt. The starter for this yoghurt consists mainly of *Streptococcus thermophilus* and *Lactobacillus bulgaricus*. In Egypt, the cow and buffalo milk shortage is so serious that every possible means of supplementing this shortage must be investigated. In the present study the effect of adding faba bean extract to cow's milk in zabadi making and its effect on the yoghurt's chemical or organoleptic properties was studied for the first time.

Materials and Methods

Preparation of faba bean extract : Faba beans were soaked for seven days at 2-4°C, minced after seed coat removal, then extracted at 40-60°C with water (1:2). The resultant faba bean extract was sterilized at 120°C for 15 min. The high quality of carbohydrates in faba bean, especially starch, gave the faba bean extract a thick body.

Preparation of zabadi : Eleven samples of zabadi were prepared as described by Abou-Donia, El-Donia and Mashaly (1980). Zabadi samples were made from cow's milk after adjusting the fat percentage to 2.5. The milk was heated to 90°C for 30 minutes, then 200 ml were transferred to a closed container. Faba bean extract was added to 10 similar containers in concentrations of 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 per cent (w/v), made up to 200 ml with milk and mixed thoroughly. Active zabadi starter was obtained from Chr. Hansen (Copenhagen, Denmark) and consisted of a mixed culture of *Streptococcus thermophilus* and *Lactobacillus bulagaricus*. The starter was then added at a level of 3 per cent and the milk incubated at 45°C until completely coagulated, which took 4-5 hours.

Chemical analysis : In both milk and zabadi the titratable acidity, fat content, total N(TN) and volatile acids were determined as described by Lees (1975).

Organoleptic scoring : Zabadi was judged by the usual scoring system (flavour 45 points, body and texture 30, appearance 15 and acidity 10) as described by Abou-Donia, El-Soda and Mashaly (1980).

Results and Discussion

After 5 hours incubation, only the control and the 10, 20, 30, 40, 50, 60, 70 per cent added faba bean samples coagulated. The chemical composition of zabadi samples with and without faba bean extract are summarised in Table 1. In the resultant zabadi, the chemical composition was greatly affected by the addition of the faba bean extract. Titratable acidity decreased gradually with increasing levels of faba bean extract; this may be due to a decrease in lactose and other fermentable sugars and an increase in starch and non fermentable sugars with the higher faba bean extract levels. The fat content and volatile acidity gradually decreased with increasing levels of added faba bean extract. The TN increased gradually with increasing faba bean levels. Results with the control differed to some extent from those of other workers (Naguib and Negum, 1972; Abou-Donia, El-Soda and Mashaly, 1980). This could be due to variations in chemical composition of the milk, differences in level of heat treatment, or type of starter added.

Table 1 Chemical analysis of zabadi with and without added faba bean extract

Level of faba bean extract added (%)	Titratable acidity (%)	Fat content (%)	Total N (%)	Volatile acids (as ml of 0.05 M NaOH/100g zabady)
Control	0.96	2.5	0.336	7.26
10	0.93	2.5	0.448	7.26
20	0.86	2.3	0.560	6.93
30	0.82	2.3	0.672	6.60
40	0.75	2.2	0.840	5.94
50	0.73	2.0	0.895	4.95
60	0.68	2.0	1.064	4.95
70	0.59	1.9	1.232	4.29

Each result is an average of 3 samples examined.
In the control, no faba bean extract was added.

The average organoleptic scoring of zabadi samples with and without the added faba bean extract (Table 2) showed that the control samples and the 10 and 20 per cent added faba bean extract gave the best results (95 points). Zabadi prepared with additions of 30, 40, 50, and 60 faba bean extract gave 82 points. Zabadi prepared with addition of different levels of faba bean extract was very acceptable to the tasting panel. In other work by Abou-Donia, El-Soda and Mashaly (1980), zabadi samples made from milk plus 10 per cent soy extract had a lower score, while zabadi prepared with addition of more than 10 per cent of soy extract was almost always refused by the tasting panel. This could be attributed to the dominating effect of the beany flavours of the soy bean extract. On the other hand, the zabadi samples made from milk plus up to 70 per cent faba bean extract were highly acceptable to the tasting panel. This could be attributed to the fact that in Egypt, faba beans are eaten in the stewed form for breakfast as well as in sandwiches at any time of day. They are eaten on their own or mixed with zabadi or crude soft white cheese. The faba bean flavour is much favoured in Egypt.

Table 2 Average tasting panel scoring of zabadi samples with or without added faba bean extract

Level of faba bean extract added	flavour	body and texture	Appearance score	acidity score	total
Control	10	15	30	40	95
10	10	15	30	40	95
20	10	15	30	40	95
30	8	15	25	35	83
40	8	15	25	35	83
50	8	14	25	35	82
60	8	14	25	35	82
70	7	12	20	35	74

References :

Abou-Donia, S.A., Hassan, N. and Nofal, A.A.(1975). Res. Bull. Fac. Agric. Tanta Univ. 11, 1-14.

Abou-Donia, S., El-Soda, M. and Mashaly, R. (1980). J. Dairy Ras. 47, 151-153.

El-Sadek, M.G., Naguib, K.H., and Negm, A. (1972). Milchwissenschaft 27, 570-572.

Lees, R. (1975). 'Food Analysis: Analytical and quality control Methods for the Food Manufacturer and buyer'. 3rd Ed. Leonard Hill, London

Purification and identification of an egg size and fertility depressing factor (vicine) in faba beans.

R.R. Marquardt, L.D. Campbell and W. Guenter
Department of Animal science, University of Manitoba, Winnipeg, Manitoba, CANADA R3T 2N2

Initial studies in our laboratory demonstrated that when diets adequately supplemented with methionine were used, egg production rates and mortality of hens fed on faba beans were similar to those fed on the control soybean-wheat based diet. Hens fed on faba beans consistently laid eggs of a smaller size than those fed on the control, and the extent of egg size depression was related to the level of faba beans in the diet. The egg size depressing effect of faba beans was not related to dietary levels of protein or energy and was not influenced by heat treatment or removal of hulls from faba beans (Campbell *et al* , 1980).

In a second series of studies a short term bioassay test using laying hens was developed to determine the location of the egg weight depressing factor (EWDF) in various fractions of faba beans and to facilitate studies on its identity and mode of action. The 14-day test period proved useful in confirming that EWDF activity was concentrated in the cotyledon portion of faba bean seeds and was associated with the protein rather than the starch component. Ethanol-water extraction was effective in concentrating the factor (Olaboro *et al.,* 1980a).

In the third study, two experiments were conducted to study the egg-weight-depressing effect of autoclaved faba bean protein concentrate. Acetone fractionation of the extract produced four fractions, one of which (fraction H) significantly depressed egg weight. Further fractionation of fraction-H produced two fractions: a highly water soluble supernatant fraction and a fraction with low solubility which was harvested as a white precipitate. Both the supernatant and the white precipitate, when added to diets in proportion to their relative yields, caused similar depression in egg weight. The observation that there was a direct relationship between amounts of vicine-reactive material in the different fractions and the magnitude of egg weight depression indicates that the principal EWDF in faba beans is vicine and/or a related compound, convicine (Olaboro *et al.,* 1980b).

In a fourth study, the EWDF in faba beans was isolated in a pure form and was shown to have physical and chemical properties identical to those of vicine. A procedure using cation exchange chromatography was also developed to determine the amount of vicine and convicine in faba beans and tissue samples (Olaboro *et al.,* 1980c).

The effect of vicine on the performance of laying hens was established in the final study (Muduuli *et al.,* 1981). The number of developing ova, egg and yolk weights, and the fertility and hatchability of eggs were reduced when laying hens were fed on a diet containing vicine. Elevated levels of plasma lipid and lipid peroxides, an increased level of erythrocyte heamolysis, and a depressed vitamin E/ lipid level was apparent in the vicine-fed birds. In addition, these birds had heavier livers with higher lipid peroxides and glutathione levels than controls. Yolks from the vicine-fed birds had a low yolk index (height/width), highly fragile membranes and increased incidence of blood spots. A summary of these effects is presented in Table 1.

Table 1. Effect of vicine on the laying hen.

Factor studied	Diet[1]	
	Control	Control plus 1.0 per cent vicine
Egg weight (g)	55.8b	48.1a
Egg production rate[2]	102 b	90 a
Total egg mass[2]	104 b	80 a
Yolk weight (g)	13.8b	11.8a
Yolk index[3]	0.48b	0.42a
Relative frequency of blood spotting	1.0 a	4.1 b
Egg fertility (per cent)	93 b	47 a
Hatchability (per cent)	90 b	33 a
Plasma lipid levels (mg/100 ml)	490 a	1551 b
Plasma lipid peroxides[4]	1.7 a	8.0 b
Ratio vitamin E/lipids (mg X 104/mg)	6.5 b	3.1 a
Haemolysis score	1.6 a	2.5 b

[1]Means with different subscripts are significantly different at P 0.05.
[2]Values in test period are expressed as a per cent of the control period.
[3]Ratio of yolk height : width.
[4]n moles malondialdehyde per ml.

It is concluded that vicine, which can be isolated from faba beans, has a marked influence on the metabolism of the laying hen. Vicine produces pro-oxidants that cause lipid peroxidation, erythrocyte haemolysis and vicine interferes with normal lipid metabolism in the hen. The laying hen appears to be an ideal animal to use as a model for studying the mode of action of vicine. It should be possible to relate results from studies with laying hens to favism, a metabolic disease in humans.

References:

Campbell, L.D., Olaboro, G., Marquardt, R.R. and Waddell, D. (1980). 'Use of faba beans in diets for laying hens'. Can. J. Animal Sci. **60**, 395-405.

Muduuli, D., Marquardt, R.R. and Guenter, W. (1981). 'Effect of dietary vicine on the performance of growing and laying chickens.' Can J. Anim. Sci. **61**. (In press).

Olaboro, G., Campbell, L.D. and Marquardt, R.R. (1980a). 'Influence of faba bean fractions on egg weight among laying hens fed test diets for a short time period'. Can. J. Anim. Sci. **61**. (In press).

Olaboro, G., Marquardt, R.R. and Campbell, L.D. (1980b). 'Isolation of the egg weight depressing factor in faba beans (*Vicia faba* L.).' J. Sci. Food Agric. (In press).

Olaboro, G., Marquardt, R.R. and Campbell, L.D. (1980c). 'Purification, identification and quantitation of an egg weight depressing factor (vicine) in faba beans (*Vicia faba* L.).' J. Sci. Food Agric. (In press).

Studies on the energy and protein values of faba beans for poultry rations

Koji Totsuka, Masahide Tajima, Tadatsuga Saito and Keigo Shoji.
Nihon Nosan Kogyo Co., Ltd., Research Center, Yokohama-city, 226, JAPAN.

Faba beans are at present not usually included in commercial poultry diets in Japan. This is partly due to a lack of information on their nutritive value and partly because they are not available in quantities which would make their commercial use attractive. The acreage of faba beans grown in Canada is increasing rapidly and it is likely that in the near future faba beans will be available in commercially worthwhile quantities. Faba beans if used in poultry diet formulations would probably replace corn-soybean meal mixture of equivalent protein content.

In the experiments described here the metabolisable energy contents, protein digestibility and the value of including various levels of faba beans in rations for young chicks were determined for two varieties of faba bean.

Experiment 1 was designed to determine the effects of different disintegrator screen sizes of 1 mm and 3.5 mm on the metabolisable energy value (ME) of faba beans (Table 1.). The ME value of the faba beans increased significantly at the 1 per cent level of probability as the particle size of the beans decreased. The difference in the ME value of the two varieties of faba beans was significant at the 5 per cent level of probability.

Table 1. The effects of particle size on metabolizable energy in two cultivars of faba beans.

cultivar	screen (mm)	kcal/kg dry matter
Herz freya	1.0	2,494
	3.5	2,217
Diana	1.0	2,341
	3.5	2,133

Experiment 2. The digestibility coefficients of crude protein of 'Herz freya' and 'Diana' were, on average, 87.3 and 87.9 per cent respectively. The difference in crude protein coefficients of two cultivars was not significant. The effect of particle size on per cent digestion was not significant.

Experiment 3. The amino acid composition of the two cultivars studied matches the requirements (NRC, 1971) of chicks well, except for the sulphur-containing amino acids and glycine. The content of critical amino acids of faba beans were compared with soybean meal. Methionine content was only 70 per cent of that of the soybean meal.

Experiment 4. One-day-old male 'White Leghorn' chicks were housed in tier brooders and reared for one week on a chick mash of standard composition. They were then weighed individually and allocated to thirty groups of similar mean weight, each of 10 chicks. Three groups were fed on one of 10 experimental mash diets for a further three weeks.

The pancreas from each was immediately excised, dissected free from fat and other material and weighed wet. Faba bean was fed as the replacement for 25 per cent, 12.5 per cent, 6.25 per cent and 3.125 per cent of corn-soybean protein in the ration. The experiments also attempted to assess the value of heat treatment and methionine supplementation in improving the nutritive value of faba beans.

There was an indication of improved body weight gain with faba beans groups compared with corn-soybean meal groups when methionine was supplemented. Heat treated beans as compared with raw faba beans in chick diets resulted in non-significant differences in weight gain, feed conversion and pancreas weight.

Faba beans were used successfully as a replacement for 25 per cent of corn-soybean protein in the ration, which was supplemented with methionine.

(Taken from Japan. Poultry Sci. (1977), 14, 109-114).

Crossing in *Vicia faba*

In-Press Abstracts

Translocation of labelled assimilates following photosynthesis of $^{14}CO_2$ by faba bean.

Hilary J. Crompton, C.P. Lloyd-Jones and D.G. Hill-Cottingham
Long Ashton Research Station, Long Ashton, Bristol BS18 9AF, ENGLAND.

Abstract of a paper accepted for publication in Physiologia Plantarum, 51, (1981).

When whole plants were exposed to $^{14}CO_2$ almost the same amount of radioactivity was taken up initially by each leaf regardless of its position on the stem and of the presence of beans at that node. Thus, although developing beans are a powerful sink for assimilated carbon, they do not increase the CO_2 uptake by adjoining leaves.

The distribution of labelled assimilates six hours after feeding $^{14}CO_2$ to a single leaf for one hour varied with both the position of the treated leaf and the stage of development of the plant. Before any flowers were set most of the radioactivity from all expanded leaves moved downwards to the roots and the stem below the treated leaf (lower stem). Later, during pod-fill, the upper leaves maintained this supply to the roots and lower stem, whilst most of the carbon translocated from the lower and mid-stem leaves went to the beans. However, we found no exclusive relationship between a leaf and the supply to beans developing on the same node.

The amount of radioactivity moving out of a source leaf at a fruiting node increased over successive samplings up to 48 hours; the pattern of distribution of the $^{14}CO_2$ however remained virtually unchanged.

FUL NABED SOUP **EGYPT**

Recommended for sick and convalescing people to regain their health.

1 lb (1/2 kg) dried skinned faba beans	3 tsp parsley chopped finely
2 tsp olive oil	juice of 1 lemon
salt and pepper	

Soak the beans for 48 hours. Drain them and put into a large saucepan with 3-4 pints (about 2 litres) water. Bring to a boil and simmer covered for 1 hour, or until the beans are soft. Press the beans and liquid through a sieve, blend in an electric blender or mash with a fork or potato masher.

Return the soup to the saucepan, add the oil, and season to taste with salt and pepper. Bring to the boil and simmer for a few minutes, adding more water if the soup is too thick.

Garnish with chopped parsley and a squeeze of lemon juice. Serve with bread.

The Faba Bean Information Service (FABIS) is provided by the International Center for Agricultural Research in the Dry Areas (ICARDA). This Newsletter appears in ICARDA's Scientific Newsletter publication series. For details of other ICARDA publications, please write to:

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