FABIS

Faba Bean Information Service

NEWSLETTER

No. 5

OCTOBER 1982

THE INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS

ICARDA

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FABIS

INTRODUCTION

I D R C Grant

We gratefully acknowledge the very generous grant from IDRC (the International Development Research Centre) for the development of FABIS and to enable the more frequent publication of the FABIS Newsletter.

This grant also includes funding for the development of *special* bibliographies, and a question and answer service on all aspects of faba bean research, a facility we hope our subscribers will utilise to the fullest extent.

Twice a year

As mentioned in FABIS Newsletter No. 4, the FABIS Newsletter will now be published twice each year.

Subscription Reminder

We wish to remind our subscribers that the new FABIS subscription rate is now $10 U.S. per year.

Means of payment must be in the form of one of the following:-

- U.S. Dollar draft drawn on a U.K. bank, payable to 'ICARDA'.
- Eurocheque in U.S. Dollars (place must state London), payable to 'ICARDA'.
- International Money Order or Postal Order in U.S. Dollars, payable to 'ICARDA'.
- Direct transfer to ICARDA's bank account at; The Hongkong & Shanghai Banking Corp., P.O. Box 199, 99, Bishopsgate, LONDON, E.C. 2P 2LA England A/C No. 729-195-43

Up-dates to FABIS publications

We are currently in the process of up-dating both the Directory of World Faba Bean Research and Genetic Variation within *Vicia faba*. Would anyone having any changes, additions or suggestions relating to either of these publications, please forward them to;

FABIS,
Documentation Unit,
ICARDA,
P.O. Box 5466,
Aleppo,
SYRIA

Deadlines

We wish to remind our contributors that the deadlines for submission of articles for FABIS Newsletters numbers 6 and 7 are December 31, 1982, and June 30, 1983, respectively.

Would those wishing to contribute please ensure that their articles reach us as soon as possible, to facilitate the production of the Newsletter.

Subjects for General Articles will be Seed Quality and Nutrition in FABIS Newsletter No. 6, and General Faba Bean Research in FABIS Newsletter No. 7. As usual Short Communications may be on any subject relating to faba bean research or production. General Articles should be in the region of 1500 words in length, with form and style following the guidelines set down in FABIS Newsletter No. 4.

Photographs and drawings

It is our intention to set up a library of photographs, slides and drawings relating to faba bean research and production, with an aim to provide this service to our subscribers.

With a view to this end, we would like to hear your views on what you feel will be of most use to yourselves; we would also like to hear from anyone who has, and would be willing to provide us with copies of, good quality black and white photographs, colour slides or drawings which they feel would be of value to such a project.

Farewell . . .

to Dr. Richard Stewart of ICARDA's Communications department, who is leaving us to take up a position as Science Writer in the International Livestock Centre for Africa in Ethiopia.

Dr. Stewart was intimately involved in the development of the FABIS service from its initiation in 1979 until the present, his drive and enthusiasm for the project being invaluable.

We wish him well in his new post, and hope that he will continue to take an interest in the FABIS service.

Welcome . . .

to Dr. Larry D. Robertson, who has recently joined the Food Legume Improvement Program (FLIP) at ICARDA, as faba bean breeder.

Dr. Robertson hails from Knoxville, Tennessee, U.S.A., receiving his Masters degree from the University of Tennessee, before going on to take his Ph.D. from Iowa State University in 1980.

After receiving his Ph.D. Dr. Robertson worked for two years at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) at Hyderabad in India, doing Post-Doctoral research on the inheritance and relationships of yield, growth traits and yield components in African x Indian Pearl Millet crosses.

We welcome Dr. Robertson to ICARDA, and wish him success in his new post.

FABIS
Co-ordinating Committee
Members

LETTERS AND ANNOUNCEMENTS

Letters to the Editors

Dear Sirs,

I read the attached article (See Y.H. Yousif, FABIS Newsletter No. 4, May 1982) while in London to introduce the poultry manure pelleting process and enclose details (of the process), as it would seem to have possible application in your area.

I emphasize the ability of the process to reduce moisture content from 40-50% at cage level to 15% pre-pelleting with zero use of power.

Yours etc.

Philip Gibson
Philip Gibson Pty, Ltd.,
G.P.O. Box 2225,
Sydney NSW 2001,
AUSTRALIA.

Note: Further details of this process and its benefits may be obtained either by writing to:

FABIS
Documentation Unit,
ICARDA,
P.O. Box 5466,
Aleppo,
SYRIA

or direct from Philip Gibson at the above address.

ENGLISH BEAN

'The English bean, which is that which we have now to speak of, has several varieties, the favourite among which, is the broad bean, or Windsor bean. The long-pod is the next best, though there are several others of nearly the same form, size, and quality. But there is one bean which is called the Mazagan, which comes earlier than the rest, and which, on that account is justly esteemed by those who like this sort of vegetable, which, I must confess, I do not. All this tribe of beans thrive best in moist and stiffish ground; but, if we desire to have them early, we must sow them early; and, near a wall facing to the south, they may be sowed in November and even in October; and, if kept earthed up pretty nearly to their tops, and in very sharp weather, covered from the frost, they will stand the winter pretty well; and will be a little earlier than those which were sowed in the latter end of February or beginning of March'.

From 'The English Gardener', by William Cobbett, (1929), reprinted in 1980 by Oxford Univ. Press, p. 67.

REPORT ON DIJON FABA BEAN WORKSHOP, DIJON, JULY 6 TO 8, 1982.

The EEC *Vicia faba* group started meeting and participating in some common experiments six years ago. Since that time the group has expanded with the inclusion of workers from outside the EEC, i.e. from Austria, Sweden, Switzerland, Spain and ICARDA, Syria. At this workshop, the group also welcomed research workers from Canada, Egypt and Sudan.

As is often the case in such meetings time was too short to discuss all the topics arising following short presentations by each speaker. First, members who had participated in the EEC group's activities since its beginning underlined the tremendous amount of knowledge accumulated in the past six years. This was felt to have been due chiefly to the existence of the group, its workshops and seminars, and the links developed between workers and institutes both within and outside the EEC, especially with ICARDA.

Genetic variability was the main subject of the meeting. It was obvious that breeders already have substantial genetic variation at their disposal. This was demonstrated by an exhibition of genetic variation in the field.

Information given at the workshop also demonstrated the possible interest in (a) some mutant genes such as the 'closed-flower gene', (b) some specific research, such as the work at Durham University on flowers with independent vascular supply, which can be very useful to breeders if incorporated in a routine test, (c) new developments concerning control of cytoplasmic male-sterility and (d) trisomics for developing a genetic map of *Vicia faba*.

Less time was devoted to breeding methods and variability in quality traits, but members of the group agreed to pursue two methods of breeding new varieties, i.e. pure line varieties and F_1 hybrids based on cytoplasmic male-sterility, in addition to making the best use of existing methods, such as synthetic varieties and recurrent selection within populations.

Notwithstanding the progress made it was clear that more intensive research efforts were needed in many areas. These include:-

* different aspects of agronomy of the crop and physiology of the plant (e.g. role and importance of water stress in the change from vegetative to reproductive growth, and the plant's internal balance in relation to this change);
* genetics and cytogenetics in relation to obtaining interspecific hybrids;
* resistance to diseases and pests;
* some specific quality traits such as the concentration of vicine and convicine, anti-trypsic factors, lectins and tannins in seeds.

Following a wide-ranging discussion on the above points the group made the following recommendations:

* To ask the authorities which test varieties for Distinctness, Uniformity and Stability to allow more flexibility, especially concerning uniformity, as breeders do not know which type of variety will be ideal for the future (improved populations, synthetics, pure lines, or any kind of hybrid). It was considered that in this partially cross pollinated species where yield is partly dependent on heterozygosity, flexibility is needed in order not to impair the development of improved varieties.
* To maintain genetic variability and especially to conserve old varieties, land races and all other genetic resources. Close cooperation with IBPGR and the European *V. faba* germplasm group was recommended.
* To develop a greater capacity for assessing the value of some new lines of investigation, for example the closed-flower type, and to ask for special financial support, or for priority at the new project level.
* To start new common breeding work; for example, to develop, through recurrent selection, some distinct gene pools which would be available for members of the group to utilise in the formation of hybrid or synthetic varieties and which, because of their contrasting origin or different traits, would be expected to achieve a more rapid genetic progress than the work of breeders in isolation.
* Regarding the proposal of the programme committee to hold a seminar in Brussels in 1983, it was proposed that this meeting be held in the U.K. (Nottingham was suggested) in mid-September 1983, with the possibility of concurrent half-day sessions devoted to small meetings of specialists on breeding methods, screening of genotypes, physiology, etc.
* To request a workshop on cytogenetics and interspecific hybrids; this could include similar topics in other legumes such as lupins and peas.
* To request a small meeting of the participants in the Joint Field Bean Test, together with some additional experts, to develop a new joint project; this meeting to be held in January 1983.
* To request a special workshop on screening techniques for quality traits.

In conclusion, breeders consider that the cumulative effect of certain specific events make the *V. faba* plant ready for a substantial evolution, especially if further innovations should appear (i.e. tissue culture and plant regeneration). This anticipated improvement would also be brought forward if breeders were able, jointly, to test a larger number of selections and crosses, and if this breeding work were to be complemented by information from other scientific disciplines and better interdisciplinary understanding.

Dijon 20 July 1982

Vicieae Experimental Information Service: Trial period Dec. 82 - Aug. 83

This is to announce that our experimental information service is now available and will operate for a trial period of 9 months (December 1982 - August 1983). Enquiries are invited concerning the classification, morphology, chromosome counts, phytochemistry, geographical distribution, seed availability and nomenclature of species in the tribe *Vicieae*. We recognise 302 species in the *Vicieae* comprising 144 spp. of *Lathyrus*, 5 spp. of *LENS*, 2 spp. of *Pisum*, 1 sp. of *Vavilovia* and 150 spp. of *Vicia*. We hold a limited amount of information on subspecies and none on cultivars.

Enquiries should be made to the following address:-

F.A. Bisby,
Vicieae Database Project,
Biology Department, Building 44,
University of Southampton,
Southampton, S09 5NH,
United Kingdom

Telex No.: 47661 Sotonu G.
Telephone: National (0703) 559122 Ext 2444,
International + 44 703 559122 Ext 2444.M.

WANTED

Dr. Barbara Pickersgill will appreciate receiving seeds of different wild species of *Vicia* for her work on interspecific hybridisation. The seeds may be sent to the following address;

Dr. Barbara Pickersgill
Dept. of Agricultural Botany,
Plant Science Laboratories,
University of Reading,
Whiteknights,
Reading, RG6 2AS,
ENGLAND

The E.E.C. Workshop on Diseases of Legumes, Rothamsted, U.K., 17-19 May 1982.

The proceedings of this workshop will not be published. However, limited numbers of copies of abstracts of papers presented are available from;

Drs. J.F. Jenkyn and R.T. Plumb,
Rothamsted Experimental Station,
Harpenden,
Hertfordshire, AL5 2JQ,
ENGLAND

The following reference book on faba beans appeared during 1982 :

FABA BEAN IMPROVEMENT
Proceedings of the International Faba Bean Conference held at Cairo, March 7th to 11th, 1981

Edited by
Geoffrey Hawtin and Colin Webb
The International Center for Agricultural Research in the Dry Areas (ICARDA),
P.O. Box 5466, Aleppo, SYRIA

Published by
MARTINUS-NIJHOFF PUBLISHERS for the
IFAD/ICARDA NILE VALLEY PROJECT

Copies of the book will be distributed free to all who attended the Conference. All other requests for copies should be sent to FABIS or books should be purchased directly from the publishers.

Nile Valley Faba Bean Abstracts. Ed. by E.M. Vincent. *Published by the Commonwealth Agricultural Bureaux (CAB) for the ICARDA/IFAD Nile Valley Project (1982). ISBN 085 198 5033. 131 pp.*

This publication is a compilation of abstracts of research papers and theses on research carried out on faba beans in Egypt and in the Sudan up to and including 1980. Abstracts have been reproduced from CAB journals as well as being prepared at the Documentation Unit, ICARDA, and at the Commonwealth Bureaux of Pasture and Field Crops, Hurley, U.K..

Copies may be obtained from:

FABIS
Documentation Unit
ICARDA
P.O. Box 5466
Aleppo
Syria

Announcement

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

Food Legume Improvement and Development: proceedings of a workshop held at the University of Aleppo, Aleppo, Syria, 2-7 May 1978. Ottawa, Ont., 1979. 216p.:ill.

An IDRC publication. Consists of a compilation of workshop papers on food legume production in the Middle East and North Africa - discusses agroclimatology and cultivation systems, nutritional value and food composition; plant production (particularly of chickpeas, lentils and faba beans), agricultural research, cultivation practices for plant protection; plant diseases, insect pests, disease resistance, weed control problems (use of herbicides in arid zones); plant breeding and genetic improvement.

Copies of this publication are available free of charge from:

FABIS
Documentation Unit
ICARDA
P.O. Box 5466
Aleppo
Syria

Diseases of Pulse Crops in Western Canada
Western Committee on Plant Disease Control, 1981, Agdex 632-1, 98 pp.

This handbook is directed to growers, contracting companies and others concerned with pulse diseases and their control. It describes the most prevalent diseases on the major pulses grown in western Canada and particular emphasis is given to lentils and faba beans. It was prepared to promote the development and adoption of sound control measures for plant diseases of regional concern. It is written in descriptive language and illustrated with colour photographs. An index, reference list and chemical control recommendations for pulse crops in 1981 are also included.

Single copies of this publication can be obtained free from:

Print Media Branch,
Alberta Agriculture,
9718-107 Street,
Edmonton, Alberta,
Canada T5K 3G8

SOIL WATER AND NITROGEN
in Mediterranean-type environments

Ed. by John Monteith and Colin Webb. Martinus Nijhoff Publishers, P.O.Box 566, 2501 CN The Hague, The Netherlands. 1981. 352 pages, ISBN 90-247-2406-6 U.S. $ 66.00.

A number of scientists from all over the world were invited to attend a week long workshop at Aleppo, Syria in January, 1980. The workshop was organized by the 'International Center for Agricultural Research in the Dry Areas' (ICARDA) with the help of the 'United Nations Development Program' (UNDP); in order to further the project for 'increasing the fixation of soil nitrogen and the efficiency of soil water use in rainfed agricultural systems in the countries of North Africa and West Asia'.

Soil Water and Nitrogen is compiled from the review papers presented at this meeting. While of particular interest to the North Africa-West Asia region and other Mediterranean-type areas, which occur in practically every continent, this publication has a much wider application, and will be a very useful reference throughout the world.

LAMB, BROADBEAN AND CHICKPEA CASSEROLE (DIZI) — **IRAN**

2 lb (1 kg) shoulder of lamb (and a few bones) in 1-inch pieces
1 lb (½ kg) lamb shanks in 2-inch pieces
3 onions, quartered
6 oz (150 g) dried faba beans
6 oz (150 g) dried chickpeas } *soaked overnight in cold water*
salt and black pepper
1 x 15 oz tin of tomatoes or 1 lb (½ kg) peeled and chopped tomatoes
1-2 lemons
1 tsp. turmeric & 1 finely chopped onion

Put the lamb in the bottom of a heavy casserole then the quartered onions and top with the drained faba beans and chickpeas. Cover with water and season with salt & freshly ground black pepper.

Bring to the boil quickly, and skim off any scum or foam. Reduce heat and simmer for 1½ hours. Add the tomato, lemon juice and turmeric cover and simmer for about 1½ hours until the beans and chickpeas are tender but whole. Add more water if necessary; the ingredients should be covered with water throughout the cooking time. Adjust seasoning. Stir in the finely chopped onion before serving.

Serves 4

STYLE AND FORM FOR FABIS CONTRIBUTIONS

Please remember the following guidelines:

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 for June issue and July 1st for December issue.

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.

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* 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.

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 necessarily appear in the next published issue of the Newsletter. This, however, should not result in a long delay in publication, as the frequency of the Newsletter is being increased.

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.

GENERAL ARTICLES

REPORT ON PARTS OF AN EEC WORKSHOP ON DISEASES OF LEGUMES HELD AT ROTHAMSTED EXPERIMENTAL STATION, U.K., 17-19 MAY 1982.

D.A. Bond
Plant Breeding Institute, Cambridge, U.K.

This workshop was organised by Drs. J.F. Jenkyn and R.T. Plumb of Rothamsted and was attended by 42 scientists from eight EEC countries and one from ICARDA. Diseases of both grain and forage legume crops were included. One of the sessions was devoted to the subject of breeding for resistance to diseases of faba beans, while other aspects of some faba bean diseases were the subjects of individual papers in other sessions, of posters, and of field demonstrations. The main faba bean diseases considered by the Workshop were chocolate spot (*Botrytis* spp.), leaf and pod spot (*Ascochyta fabae*) and viruses. Others, such as those caused by *Uromyces*, *Fusarium* and *Orobanche* were briefly mentioned in discussions.

Chocolate spot

The development of the disease in faba bean crops was described in a poster by A. Bainbridge (Rothamsted Experimental Station), emphasis being on dispersal of conidia in humid conditions. The spring of 1981 was particularly favourable for the disease in the UK, and field experiments showed a marked effect of benomyl seed treatment, many seedlings from untreated seed completely succumbing to the disease.

Another poster by J.W. Mansfield (Wye College) showed the ultrastructure of *Botrytis* infection in bean leaves. In resistant reactions, caused by non-pathogenic species of *Botrytis*, 'activated' cells (with numerous groups of Golgi bodies and mitochondria) could be recognised, but these were rare during the development of spreading lesions caused by *B. fabae*.

Madame Rouselle (Rennes) spoke of the need to score the bottom and top regions of plants separately when assessing field trials. Late scores, at the end of the flowering period, were best correlated with yield. Fungicides had doubled yields in some French trials and some genotypes had had their yields increased more than others. However, further work is necessary to establish the extent to which this may be a reflection of differential susceptibility.

Three papers on selection for varietal resistance were presented. That by G.J. Jellis and D.A. Bond (PBI, Cambridge) described similar genotype rankings from polythene tunnel and field tests but non-aggressive scores did not give good predictions of reactions to the aggressive phase of the attack. The main source of resistance being used at PBI is now ILB 938 from the ICARDA collection.

J.W. Mansfield (Wye College) used three methods of assessment; detached leaves, whole-plant inoculation and field trials, and discovered levels of resistance better than that in Maris Bead. *V. faba* subsp. *paucijuga* was a good source of resistance. *V. narbonensis* was highly susceptible to colonisation but showed some resistance in the field.

J. Gondran's (Lusignan) assessment was much more related to rate of defoliation, disease intensity having been positively correlated with loss of diseased leaves and negatively correlated with yield. Artificial infections gave reproducible results when spore suspensions were applied at mid-flowering. Plants were being screened from the French variety 'Survoy' by using this method.

Discussions on chocolate spot centered on (a) the question of the extent to which defoliation should be used as an assessment of susceptibility; (b) the integration of agronomic practices (lower plant density, later sowing) with chemical control and varietal resistance and (c) the importance of international germplasms as material for screening for genetic resistance.

Ascochyta

A poster by G.J. Jellis and G. Lockwood (PBI, Cambridge) showed how inoculated sand-maize meal placed around the base of plants in the field was used to demonstrate the inherent susceptibility of a winter-hardy form of the Svalof *ti* mutant compared to the variety Throws MS. Chlorothalonil, applied during the pod-filling phase was effective in controlling *Ascochyta* on leaves, pods and seeds.

Viruses

A.J. Cockbain (Rothamsted) described the 16 viruses which have been reported on faba beans in western Europe. Some of these can cause substantial yield losses, particularly in seasons when vectors are common. Bean leaf roll virus (aphid - but not seed-borne) is the most common in the UK, but bean yellow mosaic virus (aphid-borne and occasionally seed-borne) is of greater importance in Germany. This was confirmed in a later paper by H. Rohloff. The incidence of broad stain and broad bean true mosaic viruses (weevil-borne and frequently seed-borne) declined steadily in the UK from 1970 to 1977 but they again became common in 1982.

Resistance to BYMV was reported by H. Rohloff (Braunschweig). Screening of the Braunschweig germplasm collection, by sap inoculation in a glass-house, revealed one accession which, by inbreeding, segregated for resistance in a way which suggested the character is controlled by two recessive genes.

Multidisciplinary research on faba beans at Rothamsted

J. McEwen is the leader of a team which has shown that a group of diseases and pests (mainly *Pratylenchus, Acyrthosiphon pisum, Sitona lineatus, Pythium, Fusarium, Botrytis, Uromyces* and viruses) for which control measures are not commonly used in the UK, is responsible for substantial yield losses. The team claims that good control of these diseases and pests should bring yields of the spring bean crop up to 5 t/ha given adequate rainfall. Experiments are continuing in both spring and winter beans with 'standard', 'economic' and 'complete' control of these pests and diseases.

Final discussion
(chaired by E. Lester, Rothamsted Deputy Director, and B.J. Miflin, UK member of EEC protein committee)

In this part of the discussion dealing with faba beans it was reaffirmed that chocolate spot is the major disease of winter beans in NW Europe, whilst *Orobanche* is of equal importance in S. Europe. In Germany, chocolate spot can also be a major problem in spring beans. Chemical control of *Botrytis* is costly and more information is needed on the epidemiology of the disease to improve the efficiency of chemical treatments. Also there was concern about the possible development of pathogen-resistance. Thus the meeting recommended further breeding for resistance, though it was noted that higher levels of resistance are needed by breeders and that there are some difficulties in incorporating resistance into commercial varieties. Integration of genetic resistance, especially if only partial resistance, with improved agronomic practices (later sowing and low plant density) was again stressed.

Prospects for chemical control of *Ascochyta* have recently been improved, but despite high seed certification standards in the UK, the disease is widespread and a third method of approach is required. Breeding for resistance would be facilitated by better screening methods.

Aphid-borne viruses can usually be controlled adequately by insecticides, but weevil control and roguing of the seed - and weevil-borne viruses may have to be intensified.

In general, delegates considered that recent improvements in the breeding and growing of faba beans had reversed the decline in the crop and that an upturn may be occurring. A general limitation, however, is the lack of simple accurate screening techniques for determining resistance, and further work, possibly at the biochemical level, is needed for some diseases.

The value of international cooperation was stressed. Exchanges of germplasm between breeders have been fostered by the EEC coordination programs, but further support is needed to enable the development of common procedures, common control varieties and common terminology. It was especially recommended that the EEC faba bean groups should keep in close contact with work being carried out by ICARDA.

CHILLI CON CARNE

This Mexican dish is normally made with red kidney beans, however faba beans make an interesting substitute.

1 lb (½ kg) ground or minced beef
1 clove garlic, crushed
1 green pepper, de-seeded & chopped
1½ lb (¾ kg) presoaked small faba beans
2½ lb (1 kg) tomatoes, skinned & chopped (or 1 large tin)
½ pt. (250 ml) tomato juice
2 beef stock cubes
½ tsp. each of basil, oregano, cumin & thyme
1 tbsp. chilli powder, salt

Brown the beef in a little oil, add the onion, garlic and green pepper and stir round for a few minutes. Add the rest of the ingredients and simmer, covered, for one hour, stirring occasionally. If dry add a little coffee.

SHORT COMMUNICATIONS

General

AN ECONOMIC ANALYSIS OF SOME ON-FARM TRIALS IN THE SUDAN, 1980-81 CROP SEASON.

Abdul Bari Salkini[1], *M.G. El Saraj*[2] *and David Nygaard*[1]
[1] *Farming Systems Program, ICARDA, P.O.Box 5466, Aleppo, SYRIA.*
[2] *Hudeiba Research Station, P.O.Box 31, Ed-Damer, SUDAN.*

Introduction

The on-farm trials conducted at several sites in Sudan constitute one of the major research components in the Nile Valley Project aimed at improving faba bean production in Egypt and Sudan. The trials were carried out under field conditions with the active involvement of farmers. One of the principal objectives of these trials was to verify, under farmer's conditions, the research findings of experimental workers. The trials may also provide feed-back to research workers, and serve to demonstrate improved technologies to farmers.

The trials analyzed in this article were conducted by El Saraj (1981), in the Zeidab and Aliab schemes in the Nile province. The economic analysis evaluates the different treatment combinations in the trials by measuring the benefits gained and costs incurred from each combination. The best alternative treatment in terms of income, net return and capital use can then be determined.

Materials and Methods

Six production changes were examined in a mini-factorial set of eight treatments (Table 1) in order to identify the gap between the potential and actual yields of the farm, and also to examine production practices that would help close the gap. The variables in production practices were: date of planting, variety, irrigation, weed control, method of planting and pest control. Each of these factors was studied at two levels:

a. the recommended practice.
b. the farmer's practice (Table 2).

The economic analysis was based on partial budgeting which required the calculation of four measures. These were:

1. Gross benefit = yield x farm gate price.
2. Variable cost = field costs for the variable.
3. Net benefit = gross benefit minus variable costs.
4. Benefit cost ratio = increase in net benefit/ increase in variable cost.

Yield and input data were obtained directly from the trials. Output and input prices were obtained from the farm survey conducted by Salkini and Taha

We expected different treatments to produce different physical yields and as a result to give different economic returns. However, this was not always the case.

Economic Results

Various partial budgets of the different treatments at both sites are shown in Table 3.

Table 1. Treatment combinations (from El Sarraj, 1981).

Treatment	Planting date	Variety	Irrigation	Weed control	Planting method	Pest control
1	R[1]	R	R	R	R	F[1]
2	F	F	F	F	F	F
3	R	R	R	R	F	F
4	R	R	R	F	R	F
5	R	R	F	R	R	F
6	R	F	R	R	R	F
7	F	R	R	R	R	F
8	R	R	R	R	R	R

[1] R = recommended practice; F = farmers' practice.

Table 2. Level of inputs given in the on-farm trials.

Input	Zeidab		Aliab	
	R[1]	F[1]	R	F
Seed rate (kg/ha)	67	167	67	167
No. of irrigations	10	5	14	7
No. of weedings	2	1	2	1
No. of insecticide applications	3	Nil	3	Nil
Date of planting	1/11	21/11	1/11	21/11

The recommended method of land preparation and planting included disc plowing, harrowing, levelling and 60 cm ridging followed by hand sowing at 20 cm spacing. The farmer's practice consisted of disc plowing, harrowing, levelling, hand broadcasting of seeds on a flat seed bed or ridging by using local implements.

[1] R = recommended practice; F = farmer's practice.

The significant variations in yield between the treatments (Fig. 1) were reflected in significant variations in gross benefits, net benefits and rates of return. Net benefits ranged from 368 SL/ha for T2 (all inputs at farmer level) to 679 SL/ha for T8 (all inputs at recommended level).

All treatments generated increases in net benefits (over T2) and were relatively inexpensive to apply. Increases of variable costs ranged from 6 to 56 SL/ha, while the increases of net benefit ranged from 125 to 311 SL/ha.

Figs. 1 and 2 compare the physical and economic impact of various treatments. The economic attractiveness of the treatments is not perfectly related to the effect of the treatments on yield. It is apparent from the net benefit curve (Figure 2) that some treatments (T3, T6, T7 and T1) can be excluded since these treatments were dominated by other alternatives. In each case there is another alternative with a higher net benefit and/or a lower variable cost.

The next step in the decision making process is to choose one of the feasible or optimal alternatives (T5, T4, T2 or T8). A farmer would most likely adopt T8 (all factors at recommended level) as it gives the highest net benefit. Differences in costs were not considered to be sufficient to impose a capital scarcity and hence force adoption of another choice with lower variable costs. Risk averse farmers may however prefer to choose something less costly, say T5 (only irrigation and pest control at farmer's level) which has the highest benefit cost ratio (22.7 SL/ha compared with 5.58 SL/ha for T8).

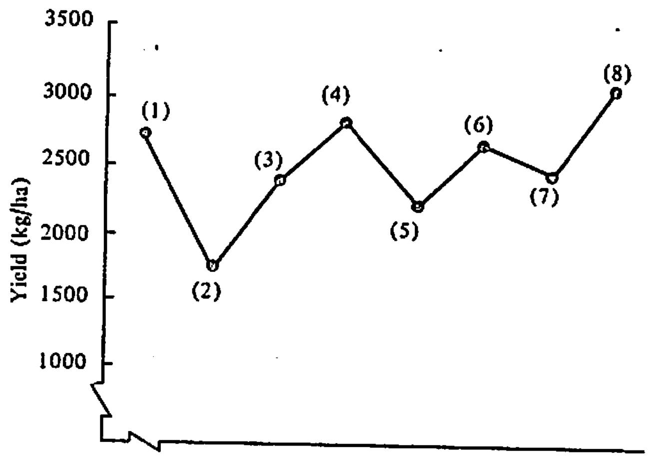

Fig. 1. Yield response to the different treatments (T1 to T8).

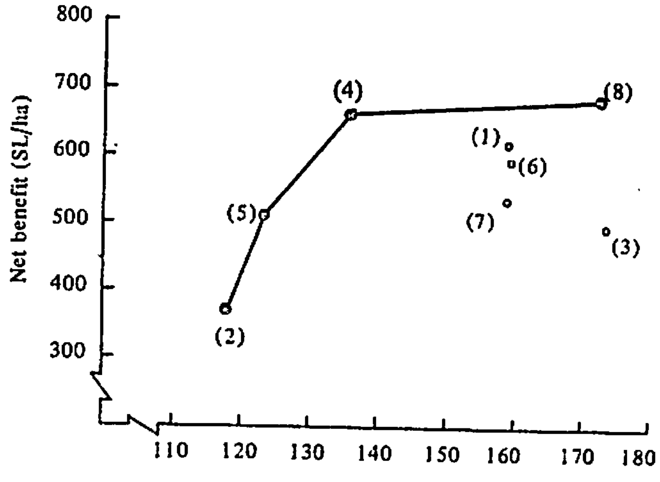

Fig. 2. Net benefit curve of the treatments.

Table 3. Partial budget of the treatments of the on-farm trials (Zeidab and Aliab), SL/ha (except yield, kg/ha).

	T1	T2	T3	T4	T5	T6	T7	T8
Yield (kg/ha)	2755	1750	2403	2867	2262	2685	2485	3070
Gross benefit (SL/ha)	766	487	668	797	629	746	691	853
Variable costs (SL/ha)	160	119	175	137	125	160	160	174
Net benefit (SL/ha)	606	368	493	660	504	586	531	679
Increase in variable cost over T2 (farmer's practice (SL/ha)	41	-	56	18	6	41	41	55
Increase in net benefit over T2 (SL/ha)	238	-	125	292	136	218	163	311
Benefit cost ratio	5.75	-	2.22	15.51	22.72	5.28	3.93	5.58

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El Saraj, M.G. (1981). 'Results of on-farm research in Sudan (1980-81 Crop Season)'. ICARDA/IFAD Nile Valley Project, September 1981.

BEAN CULTURE

... it will not be improper to recommend to all farmers the bean culture, for crops, drilled and horse-hoed enough to keep the land perfectly clean, are fully equal to a summer fallow, either for barley or clover.

from 'The Farmer's Kalendar' (1771), by Arthur Young, reprinted in 1973, by E.P. Publishing Ltd., Yorkshire, England.

A FARM SURVEY ON FABA BEAN PRODUCTION IN THE NORTHERN AND NILE PROVINCES IN SUDAN, 1979-80 CROP SEASON.

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The Northern and Nile provinces are the principal faba bean producing areas in the Sudan, contributing up to 98 per cent of the national production. A survey of farmers in these provinces was carried out in the Nile Valley Project. The survey aimed to:

a. describe the socio-economic characteristics of the farm and farmers, and also production practices of faba bean,
b. identify constraints to measure the potential for increasing productivity, and
c. provide a base line data that would help in determining future research priorities and production policies.

The survey included a sample of 53 farmers of varying age, education, land tenure, farm size, production relations, resource availability and cultural practices. The most important findings of the survey are mentioned below:

Yields, yield gap and constraints

Wide yield variability was found among the farmers in the sample. Yields ranged from 0 to 3.7 t/ha and averaged 1.8 t/ha. The average was 0.960 t/ha for the Nile province and 2.567 t/ha for the Northern province. Estimates of a possible yield gap between potential and actual yields could be 25 to 42 per cent of the current average yields.

Major yield constraints reported by the sample farmers were:

1. Irrigation problems, due to the shortage of fuel and spare parts for water pumps. This was reported by more than 75 per cent of farmers. Despite the consensus that seven to eight waterings is the optimal requirement, only 16 per cent of the farmers gave this amount, obtaining a yield increase of 42 per cent over those who gave only four and five irrigations. Researchers recommend 13 to 15 waterings for faba bean.

2. Insect pests and diseases were recognized by 71 per cent of farmers as a severe production problem which reduced yields by about 56 per cent.

3. Other constraints identified by the farmers were: seed quality (24 per cent), shortages of

tractors, accessories, and the complete absence of seeders, harvesters and/or threshers (27 per cent). Machinery shortage indirectly affected yields, as it delayed sowing which in turn drastically affected crop performance.

Importance and profitability

Despite farmers' complaints about the increasing costs of production, they still rank faba bean, in terms of generating cash flow and profitability, above other winter crops. More than 46 per cent of the total farm area was allotted to this crop, which produced more than 57% of the total farm income. The Agricultural Bank of Sudan estimates profitability of faba beans in Northern Region as 462 LS/ha compared to 160, 98 and 276 LS/ha from lentil, wheat and fenugreek respectively. Other studies estimated the gross revenue of faba beans to range between 268 and 550 LS/ha, production costs between 177 and 265 LS/ha and net revenues between 91 and 307 LS/ha.

Major differences between the two provinces

The study showed dramatic differences between the provinces, with the Northern province being the best faba bean producing area. The Northern province has

a. better climatic conditions and fewer problem soils,
b. less incidence of weeds, insects and diseases,
c. higher seed quality with reference to consumer preference and germination, and
d. less problems with respect to input supplies (labour, machinery, water, finance and credit).

All the farmers sampled sowed their crop within optimum sowing date in this province as against only 54% of farmers in the Nile province. As a result, the Northern province farmers obtained significantly higher yields. This, accompanied by higher prices, enabled the Northern province farmers to earn higher net profits. Minor differences were related to farm size, age, education, seeding rate, chemical use, weeding and harvesting methods.

Higher profitability could explain the larger proportion of land allotted to faba bean production (60% compared to 36% for the Nile province).

Conclusions

Research efforts should focus on several of the environmental factors that limit yields in the Nile province, especially pests and diseases, and on a more economical management of the irrigation system. Although the Northern province has a better environment and higher yields, there may still be an even higher potential to increase yields in this region by using agronomic practices with chemical and/or mechanical inputs.

Intensive research on breeding to evolve and develop new varieties with higher potential undoubtedly has a high priority; and the support of the seed farm in Hudeiba may be used to increase its production of improved seeds.

Developing credit systems, agricultural extension services, transportation and other infrastructure will also help improve faba bean production in the two provinces studied.

FABA BEAN SOUP

1 lb (½ kg) faba beans (pods included)
1 onion, chopped
½ oz (15 g) margerine
1 pt. (500 ml) stock
1 tsp. mixed herbs
salt and pepper
thickening :
¼ (250 ml) pint milk
½ oz (15 g) flour, cornflour or rice flour

Slice the faba beans thinly. Melt the margerine and add the beans & onions, cover the saucepan and shake it frequently over a gentle heat for 10 minutes.

Boil the stock and add it to the beans along with the mixed herbs.

Simmer the soup for ½ to 2 hours until the vegetables are quite soft. Liquidize or pass through a sieve and return the soup to the saucepan.

Blend the flour or cornflour with the milk and add it to the soup, bring to the boil and stir for a few minutes. Taste and season before serving.

BROAD BEAN (*Vicia faba*)

One of the most ancient of all Old World cultivated vegetables, broad beans have been found associated with Iron-Age relics in various parts of Europe, including the British Isles. Prehistoric specimens are all small seeded forms-even smaller than the 'Horse bean' or 'Tick bean' varieties grown as food for livestock in modern times.

The bean was regarded as harmful by upper class Greeks and Romans, who believed that eating it would cloud their vision. In recent times it has been shown that a haemolytic disorder called favism, common amongst Mediterranean peoples but rare elsewhere, may be caused by eating broad beans.

From 'the Oxford Book of Food Plants' by S.G. Harrison, G.B. Masefield and Michael Wallis. Illustrated by B.E. Nicholson.

Oxford University Press 1969.

Breeding and Genetics

GENETIC CONTROL OF ELECTROPHORETIC VARIATION FOR GLUTAMATE - OXALOACETATE-TRANSAMINASE (G.O.T.) IN *VICIA FABA* L.

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The interest in pulses around the world has raised studies on their variability in morphological and biochemical characters. Gates and Boulter (1979) have described the isoenzymatic variation in *V. faba* for *several* enzymes (G.O.T., EST, etc.) and suggested the use of this knowledge in plant breeding studies. These enzymes are also excellent genetic chromosomic markers which we are trying to use to build up the chromosomic map of *V. faba.*

This short communication describes the inheritance of two isoenzymatic variants of Glutamate-oxaloacetate-transaminase (G.O.T.).

Materials and Methods

Two inbred lines of *Vicia faba* differing in an electrophoretic pattern (VF 171 and VF 172) were crossed with each other in both directions. The hybrid (F_1) and the F_3 (to determine the F_2 genotypes) were analysed for G.O.T.. The method was described by Gates (1978).

Results and Discussion

Fig. 1 shows the electrophoresis pattern for G.O.T. in *Vicia faba*. We did not observe any variation in Zone A, but were able to identify some inbred lines showing variation in Zone B; those variants will be mentioned here as FF, FS and SS respectively. Rf for the two zones are, approximately: 0.35 - 0.38 for zone A, and 0.43 - 0.49 for zone B. It can be observed that the hybrid shows three bands, indicating that the enzyme is at least a dimer. The F_1 pattern was not dependent on the direction of the cross.

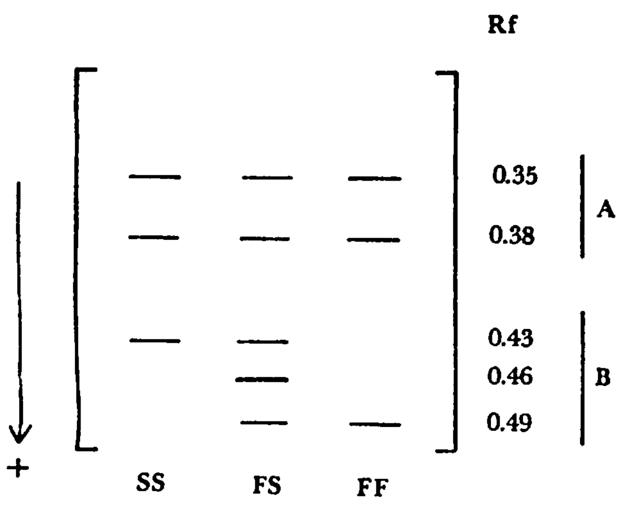

Fig. 1. G.O.T. Electrophoretic variants in *V. faba.*

Fifty F_2 plants were analysed with the following results: 14 FF, 21 FS, 15 SS, which fits the requirements of a locus with two alleles to control this B-variant of *V. faba* G.O.T.. ($X^2 = 1.32$, $0.7 < P > 0.5$). The ease of its analysis makes G.O.T. a very suitable genetic marker.

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Gates, P. (1978). 'The use of isoenzymes as an aid to the breeding of field beans (*Vicia faba* L.)'. Ph.D. Thesis, University of Durham.

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FURTHER EVIDENCE ON THE AMOUNT OF OUT-CROSSING IN *VICIA FABA* GROWN IN SOUTHERN ITALIAN ENVIRONMENTS.

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It is well known that the breeding system in *V. faba* is intermediate between autogamy and allogamy. This is because bumble bees visiting flowers for collecting nectar cause cross pollination. Such insect activity changes according to environmental conditions (Table 1), and is measured in terms of percentage of outcrossing, i.e. percent of plants showing the dominant allele in progeny collected from plants showing the recessive phenotype.

Several authors (Sirks, 1923; Fyfe and Bayley, 1951; Rowlands, 1958; Holden and Bond, 1960) have reported that 60 to 70 % of the seeds in a crop are derived from selfing, while 30 to 40 % are derived from out-crossing.

These are experimentally determined values, and in non-standard conditions lower or higher percentages of outcrossing are observed. In fact, the percentage of outcrossing increases as plant density increases, and the lower inflorescences allow more effective bee pollination (Porceddu *et al.*, 1980). Hawtin and Omar (1980) Omar and Hawtin (1981) showed the outcrossing rate decreased as the distance between plots and plot size increased.

V. faba major types showed in general a lower outcrossing rate than the *minor* types (Holden and Bond, 1960).

Plants resulting from outcrossing showed high self-fertility and heterosis: both positively affected the grain yield. Thus verification of the outcrossing rate in a specific environment is a better way to improve management practices and breeding strategies.

In this short communication, the results of the estimated outcrossing rate in Bari during the 1979 growing season have been reported. For this study, two *V. faba* lines (LP 46 and LP 386) homozygous for light hilum color were randomly distributed in a field of faba bean having dark hilum color.

In 1980, the progeny from plants homozygous for the light hilum colour allele were examined in order to estimate the outcrossing rate during 1979. Table 2 shows the number of plants homozygous for the light hilum color planted in 1979 and the frequency of plants with dark hilum colour appearing in the 1980 progeny derived from 1979 plants. These dark hilum progeny are supposed to be the results of an outcrossing event in the 1979 growing season. Both LP 46 and LP 386 lines show almost the same outcrossing rate: 19.1% for LP 46 and 17.4% for LP 386 (supposing that all pods produced an equal number of seeds).

In 1981 all the progeny from the plants showing dark hilum color in 1980 were observed in order to verify the segregation ratio for the hilum color alleles. Fifty-five lines analyzed in 1980 containing plants with dark hilum seeds gave a sufficient number of seeds for a statistical analysis of the segregation observed. The progeny gave in total 1518 plants, 1111 plants showing dark hilum seeds and 407 plants showing light hilum seeds, thus giving a 3:1 segregation ratio (X^2 0.05 = 2.66).

Table 1. Outcrossing rates estimated in *V. faba* under different environmental conditions.

Country	Reported by	Outcrossing rate (%)	Note
Denmark	Poulsen (1975)	40-60	In a 3 ha area grown with cv. Franks Ackerperle.
France	Picard (1953)	19	Seed stock from west France
		70	Seed stock from east France
U.K.	Bond and Pope (1974)	17	Foreign pollen source at 0.9 m.
	Fyfe and Bailey (1951)	31-48	In *V. faba minor*
	Holden and Bond (1960)	29-35	In *V. faba minor*
		69.8	In winter beans
		60.0	In spring beans
		32-41	In broad bean
Italy	Monti *et al.* (1979)	20-25	In *V. fabe minor*
	Porceddu *et al.* (1980)	23-45	In *V. faba minor* and *major*
Netherlands	Sirks (1923)	25-40	In *V. faba minor*
Sweden	Sjodin (1977)	31-39	Foreign pollen source at 15 cm
		21-24	Foreign pollen source at 120 cm
Syria	Hawtin and Omar (1980)	1.6-6.8	Faba bean plots 200 and 10-40m distant respectively.
		8.9-14.2	Faba bean plots of 7.8 m x 4 m and 3.9 m x 4 m size respectively
	Omar and Hawtin (1981)	17.8	In faba bean

References:

Bond, D.A., and Pope, M. (1974) J. Agric. Sci. Camb. 83, 343-351.

Fyfe, S.L., and Bailey, N.T.J. (1951) J. Agric. Sci. Camb. 45, 141-147.

Hawtin, G., and Omar, M. (1980) FABIS Newsletter 2, 28-29.

Holden, J.H.W., and Bond, D.A. (1960) Heredity 15, 175-192.

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Porceddu, E., Monti, L.M., Frusciante, L.; and Volpe, N. (1980) Z. Pflanzenzuchtung 84, 313-322.

Poulsen, M.H. (1975) Z. Pflanzenzuchtung 74, 97-118.

Rowlands, D.G. (1958) Heredity 12, 113-126

Sirks, M.J. (1923) Meded. Landb. Hoogesch., Wageningen, 26.

Table 2. Outcrossing rate for two *V. faba major* lines homozygous for the light hilum allele (aa), randomly grown in a field of plants with dark hilum seed (AA).

Line	1979	1980		Outcrossing rate %
	No. of aa plants analyzed	Progeny size derived from the 1979 plants	No. of plants yielding dark hilum seeds	(dark/light hilum)
LP 46	100	1280	244	19.1
LP 386	100	1050	183	17.4
Total	200	2330	427	18.3

Agronomy and Mechanisation

INFLUENCE OF IRRIGATION PRACTICES ON FABA BEANS IN EGYPT.

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The present investigation was carried out to study the effect of soil moisture stress on the yield of faba beans. The effect of withholding irrigation at different growth stages was also studied. Experiments were conducted at four agricultural research stations, which were representative of a considerable portion of the cultivated area in Egypt. The main results of this study can be summarised as follows:

In Upper Egypt, it was found that the highest yield was obtained when irrigation was applied at 80% available water depletion until flowering; and thereafter at 40% depletion.

Two irrigations applied before the annual closure of the irrigation canals (in January) resulted in a yield increase of 0.42 t of seeds/ha over the treatment receiving just one irrigation before the closure. Irrigation during the annual closure yielded 0.38 t/ha more than non-irrigated treatments.

Watering three times after the opening of canals resulted in 0.74 t/ha more than the treatments receiving only two irrigations in the same period.

In Middle Egypt, the best results were produced from giving two irrigations before the annual closure and three after the opening of the canals.

Seasonal water use (evapotranspiration, ET) ranged from 25.8 to 48.5 cm. The average daily use was between 0.17 to 0.30 cm for the different treatments and locations. The highest water use efficiency was found when irrigation was applied after 80% depletion in available soil moisture in the Northern Delta. In comparing the different locations, it was found that the highest values of water use efficiency were 39, 47 and 83 kg seeds/cm E_t/ha respectively for Northern Delta, Upper Egypt and Middle Egypt. It can be concluded that Middle Egypt was the most economical region for growing faba beans, in terms of water use efficiency.

It was noticed that most of the water consumed was removed from the upper soil surface layer and less water was extracted from successive depths. The upper 30 cm of the soil profile was the most important layer, since it contained about 70% of the active roots.

WATER REQUIREMENTS OF IRRIGATED FABA BEANS (*VICIA FABA*) ON THE VERTISOLS OF GEZIRA (SUDAN)

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The published work on irrigation of faba beans in the Sudan has to date treated the subject qualitatively because most of the relevant trials included predetermined and fixed watering intervals. However, data on water use of crops is a pre-requisite to planning and evaluating their cost of production. Such a quantitative approach is important especially under irrigation by pumps since in the Sudan this is the method under which most of the commercial faba beans are now produced. Recently, however, trials under gravity fed irrigation have been conducted in the Gezira where canal management and adequate discharges rely on daily indenting.

This paper is the first report on the evapotranspiration (ET) of faba beans and its relation to the prevailing evaporative conditions in the Sudan. Nuclear techniques were used to take measurements in a trial on sowing dates and watering intervals conducted at the Gezira Agricultural Research Station, Wad Medani by Ageeb (1981).

The faba bean cultivar BF 2/2 was sown on November 7, 1979 at a spacing of 60cm between ridges, 20cm between holes and three plants per hole. Two replicates from each of the irrigation intervals, namely 7 and 14 days, were selected, and aluminium access tubes were placed among plants in the centre of the subplots. Moisture profiles were regularly monitored down to a 160cm depth with a Troxler's neutron probe and scaler. Water use was calculated from moisture depletion data between waterings. Following planting, all subplots received two weekly irrigations and thereafter the different irrigation treatments were started. The first treatment was irrigated every 7 days and the second every 14 days until harvest. The plant population in this trial did not effectively change to the end of the season (Ageeb, 1981).

Although evapotranspiration (ET) of faba bean was calculated for November to February in 10 day periods, the daily mean for each month is reported in this paper. The results for both the weekly and the fortnightly irrigated crops are given in Table 1.

For a prediction of crop water requirement from data of evaporation from a free water surface, the crop factor is needed. The crop factor (CF) is given by the relationship CF = ET/Eo where Eo is Penman's evaporation. The CF of the weekly and the fortnightly irrigated crops followed similar trends to the mean daily ET (Table 1). Thus under the standard 14 day intervals the mean daily ET increased from 1.8mm at planting to a peak of 6.3mm in January. Concomitantly the CF increased from 0.3 to 0.99. The high CF values during January are not unusual for the arid environment of Gezira in view of the high advective energy and the development of extra surfaces for evaporation, with cracking of soil rich in montmorillonite.

Table 1. Mean daily evapotranspiration (ET) in mm and crop factor (CF) of irrigated faba beans as affected by interval of irrigation.

Month	Interval of irrigation			
	14 days		7 days	
	ET	CF	ET	CF
November, 1979	1.8	0.30	1.3	0.21
December, 1979	3.4	0.57	3.5	0.66
January, 1980	6.3	0.99	10.3	1.63
February, 1980	3.1	0.43	4.5	0.63

It was evident that under the experimental conditions the vigorous crop growth, indicated by the height of the canopy in January, was accompanied by a rapid increase in ET. This period coincided with the appearance and rapid development of pods. Long irrigation intervals hastened ripening and shortened the duration of the crop. It is noteworthy that irrigation was effected in one day in the small plots of the experiment and therefore it was possible to attain the strict intervals required. This is in contrast to the large plots prepared by Gezira tenants to avoid costly labour.

For agronomic and economic considerations Table 2 gives the total water requirements and the grain yields. Water utilisation efficiency of the crop receiving irrigation at 14 day intervals was 1.5 kg/ha/mm compared to 2.2 kg/ha/mm for the crop irrigated weekly.

Table 2. Total water requirement and grain yield of faba beans as affected by irrigation interval.

Interval of irrigation	Water requirement (mm)	Yield (kg/ha)
14 days	424	659
7 days	596	1342

Obviously the data obtained and reported above are from small plots. Tenants do not use small plots because of labour costs and the time needed to irrigate them. An extrapolation of the above results to actual field conditions would, therefore, call for great caution.

Acknowledgement:

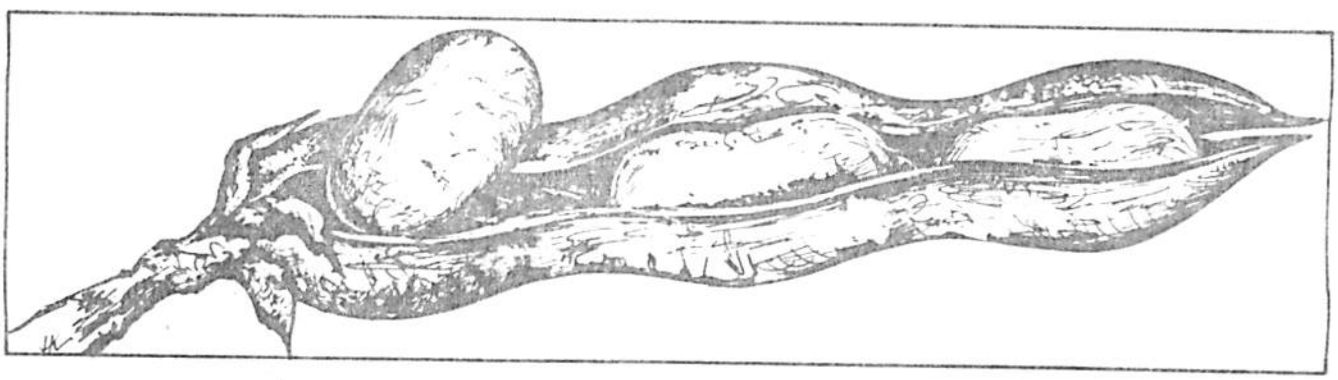
I would like to thank Dr. Osman A. A. Ageeb, Agronomy Section, GARS, for allowing me to take measurements from his trial.

References:

Ageeb, O.A.A. (1981). 'Agronomy of faba beans'. Gezira Research Station Ann. Rept. (1979-80).

SAY IT WITH BEANS

'Full of beans' - having a surfit of energy
'hasn't got a bean' - having no money
'old bean' - old British greeting
'Not worth a bean' - of no account
'beanery' - an unpretentious restaurant
'Beano' - a treat



INFLUENCE OF SOWING DATE ON THE PERFORMANCE OF FOUR FABA BEAN VARIETIES AT DIFFERENT LOCATIONS IN SUDAN.

Farouk A. Salih[1] *and Ali Khalafalla*[2]

[1] *Shambat Research Station, P.O.Box 30, Khartoum, North SUDAN.*

[2] *Shendi Research Station, P.O.Box 31, Shendi, SUDAN.*

Introduction

The faba bean growing season in Sudan is short because of high temperature and disease stress at both the beginning and end of the season. The high day-time temperatures that occur during the season tend to set an upper limit to potential maximum yields. Under such conditions, timely sowing of the crop is of paramount importance in achieving good yields. Planting time is a critical production factor and the harmful effects of diseases could be avoided by sowing at the optimum time. Repeated experiments on the effect of sowing date on grain yield at Shendi and Shambat in the 1980/ 81 season showed that the highest grain yields were obtained from planting dates between the end of October and the first of November.

Material and Methods

Trials were conducted at Shambat and Shendi to assess the performance of three varieties selected at Hudeiba Research Station when compared with the local cultivar of the site. Sowing was done on five dates, at 10 day intervals between October 10 and November 20. The treatments were replicated four times in a split plot design with sowing dates in the main plots and varieties in the sub plots. A basal dressing of 20 kg N/ha and 50 kg P_2O_5/ha, in the form of urea and triple super phosphate respectively, was applied at sowing. The seeds were planted on ridges 60 cm apart with 10 cm between holes and one seed per hole. The experiments were watered by furrow irrigation every week. Irrigation was applied at intervals of 10 to 14 days after the onset of cool weather.

At both locations, insect infestation (*Laphygma*, thrips and aphids) was kept under control by spraying with 50% folimat and 57% malathion.

Results and Discussion

Data on the yield response to sowing date for Shambat and Shendi are shown in Tables 1 and 2. The effect of sowing date on grain yield and its components (except number of seeds/pod at Shendi and number of seeds/pod and 1000-seed weight at Shambat) was highly significant ($P < 0.1$ and 0.01). At Shambat, the highest grain yield was obtained from the November 10 sowing, which significantly ($P < 0.01$) out-yielded other sowing dates. The yield of November 10 surpassed the yields of October 30 and November 20 by 14 and 27 per cent, respectively. Sowing on October 30 out-yielded November 20 and October 20 by 16 and 54 per cent, respectively. At Shendi, October 30 and November 10 sowings produced the highest grain yield. The lowest grain yield was obtained from the October 10 sowing date, followed by the October 20 and November 20 sowings. Sowing the crop 10 days later than the November 10 date or 10 days earlier than the October 30 date reduced grain yield by 18 and 21 per cent, respectively.

Table 1. The mean effect of sowing date and variety on grain yield (kg/ha) at Shambat and Shendi locations.

Treatment	Location: Shambat	Location: Shendi
Sowing date		
October 10	399	1100
October 20	973	1317
October 30	1814	1662
November 10	2108	1600
November 20	1530	1310
S.E ±	64	89
Level of sig.	***	**
LSD 0.05	197	274
Variety		
H.72	1379	1505
BF 2/2	1461	1324
BM 9/2	1432	1448
Local	1187	1314
S.E ±	162	45
Level of sig.	N.S.	**
LSD 0.05	–	128

Level of significance *5% , **1% , ***0.1% probability level.
N.S = not significant.

The lower yields obtained at the two earlier sowing dates for both locations, was probably due to reduced plant stand. Most likely the main variable affecting early planting, which caused reduction in plant stand and subsequently low yield, was the prevailing high temperature during seed germination and seedling growth (mean max. and minimum temperature in October were respectively 39.5 and 25.5°C at Shambat and 39.9 and 24.8°C at Shendi). These high temperatures predisposed the plants to wilt and root-rot diseases.

It appeared that the production of a significantly greater number of pods/plant did not compensate for the reduced plant stand (Table 2).

Plant stand from late sowings (November 10 and 20) were similar at each site, but higher at Shambat than at Shendi, even though both experiments were planted in soils which had not been under leguminous crops for the past three years. It is likely that the low yield obtained from the latest sowing (November 20), was due to the reduced number of pods produced and the significantly lighter seeds, especially at Shendi.

Grain yield difference between varieties was highly significant ($P < 0.01$) at Shendi but was not significant at Shambat. However, the local cultivar at both sites produced the lowest yield (Table 1). At Shendi, the yields of H.72 and BM 9/3 were significantly higher than BF 2/2 and the local cultivar. BM 9/3 produced heavier seeds than the other varieties at Shendi. However, at Shambat the local cultivar produced significantly heavier seeds than other varieties (Table 2).

At both locations the interactions between sowing date and variety were non-significant for all characters studied, but for grain yield it was observed that all four cultivars gave their best yields at the October 30 and November 10 sowing dates.

This trial, and that of the previous season, strongly indicates that the optimum time to plant faba bean in the area of Shendi and Shambat is between the end of October and the first week of November.

BROAD BEAN AND LENTIL PATE

8 oz (250 g) dried broad beans
2 tbsp. red lentils
2½ pints (1¼ l) water
2 tbsps fresh lemon juice
salt
4 tbsps olive oil
1 clove garlic crushed
To garnish: a spring of parsley (or coriander) & paprika.

Soak the broad beans and lentils overnight in the water. Cook under 15 lbs pressure for 20 mins - the beans should be soft and the water absorbed. Mash with a fork and add salt, garlic, lemon juice and olive oil to taste (2 tbsps lemon juice and 3 tbsps oil is about right).

Put into a dish & pour over about one tablespoon of olive oil, sprinkle with a little paprika and place a sprig of parsley (or coriander on top). Serve as you would pate with bread, rusks or cheese biscuits.

Table 2. Effect of sowing date and variety on yield components of faba bean.

Treatment	Plant stand (1000 plants/ha)		No. of pods/plant		No. of seeds/pod		1000-seeds weight (g)		Plant height (cm)	
Sowing dates	Shambat	Shendi	Shambat	Shendi	Shambat	Shendi	Shambat	Shendi	Shambat	Shendi
October 10	33.8	28.3	19.5	49.0	2.24	2.54	440	440	63.4	86.4
October 20	60.1	48.3	23.0	48.0	2.21	2.80	432	473	72.8	93.0
October 30	89.2	62.5	22.7	34.9	2.14	2.93	432	467	76.5	106.4
November 10	108.4	81.7	19.8	27.3	2.27	2.96	430	440	75.6	105.3
November 20	105.3	81.7	18.6	23.2	2.28	2.82	426	417	74.0	97.0
S.E. ±	6.30	4.91	0.62	3.7	0.09	0.15	6.9	9.3	1.18	2.48
Level of Sig.	***	***	**	**	NS	NS	NS	**	**	**
LSD 0.05	19.4	15.1	1.91	11.4	-	-	-	28.6	3.65	7.64
Variety										
H.72	73.5	65.5	24.0	35.0	2.13	2.65	412	444	70.5	96.1
BF 2/2	77.4	57.7	22.1	39.5	2.26	2.91	407	435	71.8	95.5
BM 9/3	86.5	59.9	20.9	37.0	2.40	2.85	391	461	71.8	97.8
Local	80.0	60.6	15.3	34.4	2.12	2.84	518	449	75.7	98.5
S.E. ±	2.77	2.28	0.53	1.89	0.08	0.13	4.13	6.52	0.99	1.54
Level of Sig.	NS	NS	***	NS	NS	NS	***	*	**	NS
LSD 0.05	-	-	1.51	-	-	-	11.76	18.57	2.82	4.39

Level of significance *5%, **1%, ***0.1% probability level N.S. = Not significant

FIELD CHEMICAL CONTROL OF *BRUCHUS DENTIPES* BAUDI (COLEOPTERA: BRUCHIDAE) INFESTING FABA BEAN SEEDS

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Bruchus dentipes Baudi is the main bruchid infesting faba bean seeds at Tel Hadya, ICARDA's experimental site. Field experiments were conducted during the 1980-81 growing season to investigate means of controlling this pest.

Materials and Methods

Seeds of local large faba bean (ILB - 1814) cultivar were planted on November 16, 1980 in field plots of 11 m x 11 m each with a distance from row to row of 50 cm. Three treatments, consisting of one untreated control and two chemical treatments, were evaluated in a randomised block design with four replications. The chemical treatments were (i) four sprays of 'Decis' (deltamethrin) at 38 g a.i./ha in each spray, (ii) four sprays of 'Thiodan' (endosulfan) at 700 g a.i./ha in each spray and a check. The spraying dates were March 31, April 13 and May 12, 1981.

Thirty plants from each plot were selected along a diagonal and marked for counting: pods per plant, eggs per pod and eggs per plant on April 8, 12, 26 and May, 2, 1981.

A sample of one hundred seeds from each harvested plot was examined in late June 1981 for larval penetration dots on the seed coat. The number of larvae per *100* infested seeds was recorded. In early September 1981, 100 stored seeds from each harvested plot were dissected in order to record larval infestation.

The percentage of seed infestation of dead and live larvae was determined. In mid-December 1981, a third sample of 100 stored seeds from each harvested plot was examined for adult exit windows in the seed coat. The number of seeds infested by adults and number of adults per 100 infested seeds were also counted.

Results and Discussion

Eggs started to appear on green pods in the field in early April 1981, with a peak in number of eggs per plant and per pod by the middle of April of 6.4 eggs/plant and 1.8 eggs/pod respectively (Figure 1). The percentage of pods infested by eggs reached 64% in mid-April and early May (Figure 2).

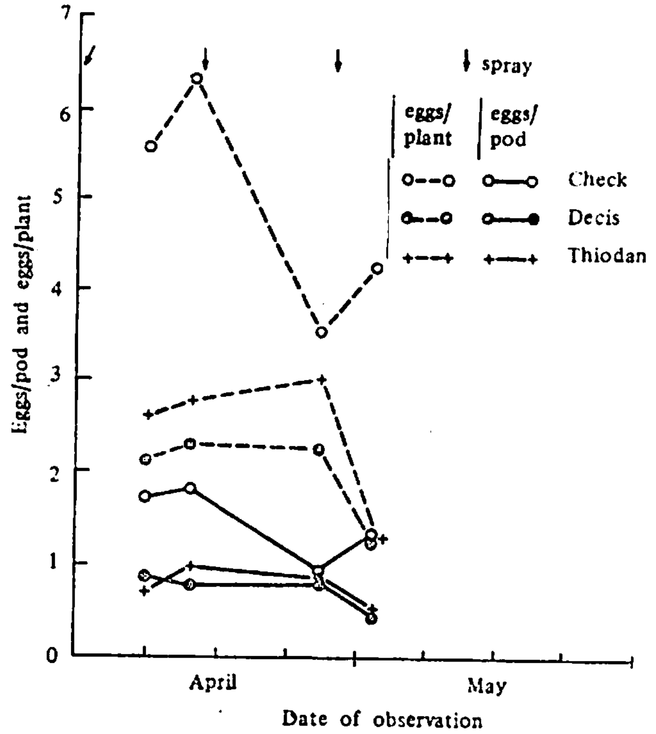

Fig. 1. *Bruchus dentipes* eggs per pod and per plant in Thiodan and Decis treated and untreated plots at Tel Hadya in 1981. (Vertical arrows indicate the dates of spraying).

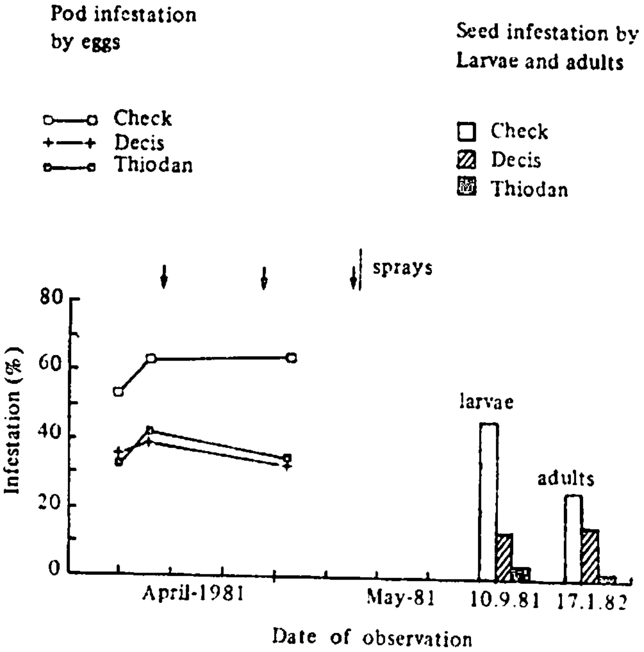

Fig. 2. Infestation of faba bean pods and seeds by eggs, larvae and adults of *Bruchus dentipes* in insecticide treated and untreated plots at Tel Hadya.

On average, the numbers of eggs per pod and eggs per plant were 1.9 and 2.2 times greater in untreated plots. Nearly 60% and 34% of the pods were infested by eggs in untreated and treated plots, respectively (Figures 1 and 2).

There was a highly significant correlation between the percentage of pods infested by eggs and the number of eggs per pod and per plant; therefore for scoring eggs in the field, it was easier to count the number of pods infested with eggs and the total number of pods per plant.

Seed infestation by larvae was 46.5% in untreated plots, whereas in Thiodan and Decis-treated plots the infestation declined significantly to 4.5 and 13.3% respectively (Figure 2, Table 1).

Infested seeds of Thiodan-treated plots had significantly less live larvae, pupae and adults than the Decis-treated and check plots (Tables 1 and 2). Subsequently, the seeds of Thiodan-treated plots had less adult infestation than Decis-treated and check plots. Seed infestations according to adult exit windows in the seed coat were 1.6, 14.4 and 25.5% in the Thiodan, Decis and check plots respectively (Figure 2).

A previous study indicated that spraying of dimethoate, methidathion, methomyl and fenitrothion did not give control of larval infestation (Tahhan and Hariri 1981). This study has proved that Thiodan significantly decreased the adult infestation to 1.6% (Figure 2). A similar result has been reported from France where endosulfan, when applied in sprays at 800 g/ha, reduced infestation of faba bean by *B. rufimanus* Boheman. This work also suggested spraying of endosulfan with a wetting agent in order to increase its activity (Meirleire and Rouzet, 1979).

Table 1. *Bruchus dentipes* infestation of stored faba bean seeds harvested from insecticide treated and untreated plots at Tel Hadya (dissection of seeds done on September 10, 1982).

Treatment	Infested seeds (%)	Number per 100 infested seeds			
		larvae		pupae	adults
		live	dead		
Decis	13.2	3.2	1.2	5.7	4.7
Thiodan	4.5	3.5	0.0	0.5	0.7
Check	46.5	31.2	9.2	7.5	12.2
L.S.D. 5%	13.98	19.31	5.76	3.54	1.91

Table 2. Number of *Bruchus dentipes* larvae in infested faba bean seeds of treated and untreated plots (June 25, 1981).

Treatment	Number per 100 infested seeds		
	Penetration dots	Larvae	
		live	dead
Decis	128.7	81.4[1]	47.3[1]
Thiodan	133.8	24.6[2]	109.2[2]
Check	179.4	118.9	60.5

[1] Significant at 5% level.
[2] Significant at 1% level.

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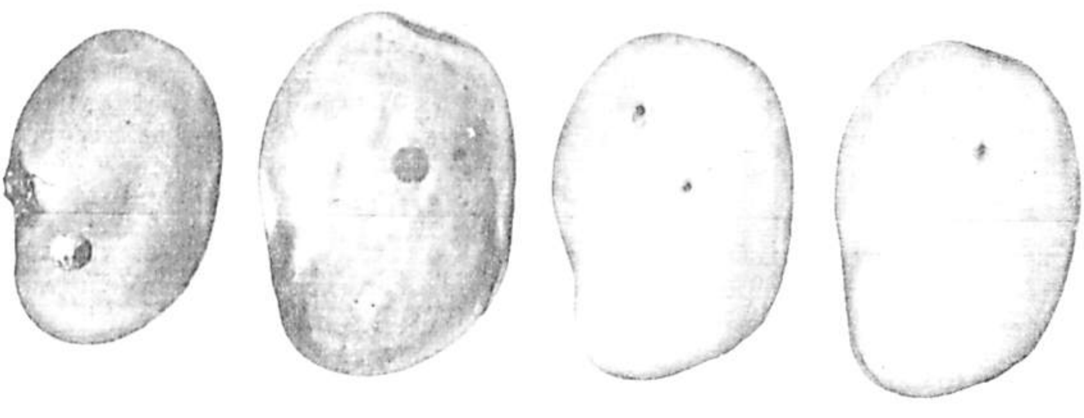

BRUCHUS DENTIPES BAUDI (COLEOPTERA: BRUCHIDAE) INFESTATION AS AFFECTED BY GENOTYPES, PLANTING DATE AND PLANT POPULATIONS OF FABA BEANS

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Introduction

Studies during the past few seasons have revealed that the seeds of faba beans at ICARDA's Tel Hadya site were heavily infested by *Bruchus dentipes* Baudi. Infestation reached as high as 76% of all seeds (Tahhan and Hariri, 1981). In order to get more information on the factors affecting the magnitude of infestation, studies were carried out to investigate the effects of planting date and plant population on the infestation of *B. dentipes* in a series of promising faba bean genotypes during 1980/81, at the ICARDA farm in Tel Hadya.

Materials and Methods

Two experiments were carried out. Experiment 1 dealt with the interaction between planting date and genotype. The second dealt with the interaction between planting date and plant population in one genotype.

Experiment 1.

Twelve faba bean genotypes were planted at four different planting dates - October 29 (D_1), November 29 (D_2), December 9, 1980 (D_3) and January 1, 1981 (D_4). The design was a single split plot with planting dates in the main plots and genotypes in the sub-plots, with four replicates. The sub-plot size was 3m x 5m with 6 rows of 5m each, with a plant population of 20 plants/m^2.

Experiment 2.

ILB-1814 (Syrian local large) was planted at four different planting dates and five plant populations in a single split plot design with dates of planting in the main plots and plant populations in the sub-plots, with three replications. The planting dates were October 29(D_1), November 29 (D_2), December 8, 1980 (D_3) and January 1, 1981 (D_4), while the plant populations were 33.3 (P_1), 25.0 (P_2), 20.0 (P_3), 16.7 (P_4) and 14.2 (P_5) plants/m^2; sub-plot size was 5.5m x 5.0m.

In both experiments, the number of days from complete emergence to 100% flowering of plants in each sub-plot was recorded. In late April and early May 1981, three faba bean plants from each sub-plot were randomly selected in order to count the total number of pods and pods infested with *Bruchus* eggs. Eggs per plant and per pod were also counted.

In late July and early August 1981, 200 seeds from each harvested sub-plot were examined for larval infestation according to larval penetration dots in the seed coat. The same seeds were kept up to December 1981 under normal storage conditions in order to record adult emergence and seed infestation by adults.

Results and Discussion

Three techniques were used for evaluating *B. dentipes* infestation. These were screening for adult oviposition on pods, seed inspection for larval penetration dots and lastly seed inspection for adult infestation according to emergence windows in the seed coat. The third proved to be the best method for screening in terms of efficiency and convenience.

Of 12 varieties tested, V_6 (Reina Blanca), V_7 (New Mammoth), V_3 (Syrian local medium) and V_{10} (Express) were significantly more affected by adult infestations (a mean of 36.5%), whereas V_{12} (ILB 277), V_4 (Determinate Mutant population), V_2 (Syrian local large), V_9 (Hudeiba 72), V_{11} (Lattakia local large), V_5 (Giza-2), V_8 (Giza-3) and V_1 (Aquadulce) showed the lowest damage (a mean of 32.4%) (Table 1). Further screening of faba bean genotypes tolerant to *B.dentipes* is in progress. Preliminary results have indicated that size and colour of seeds may affect the degree of infestation. Small and dark seeds were attacked less by *Bruchus* than large and light-coloured seeds.

Seeds from the late planting date, D_4 (1 January 1981), had the lowest adult infestation, followed by the early planting date, D_1 (October 29, 1980), whereas D_2 (November 29, 1980) and D_3 (December 8, 1980) planting dates resulted in the highest infestation (Table 1 and 2).

There were positive correlations at the 5% level between number of pods per plant (x) and eggs deposited on the plant ($y=0.356+0.529x$), and between eggs per pod (x) and percentage seed infestation (y) by larvae ($y=35.700+11.088x$).

Seeds from plant population P_1 (33.3 plants/m^2) and P_4 (16.7 plants/m^2) were significantly less infested than those with intermediate (25 and 20 plants/m^2) and very low (14.2 plant/m^2) population levels (Table 2).

Reference:

Tahhan, O. and Hariri, G. (1981). 'Infestation of faba bean seeds by *Bruchus dentipes* Baudi (Coleoptera: Bruchidae)'. FABIS Newsletter No. 3, 58-59.

Table 1. Pod and seed infestation by *B. dentipes* as affected by faba bean genotypes and planting dates.

Treatment	Days from emergence to flowering	Pods/3 plants	Eggs/ plant	Eggs/ pod	% Pods infested with eggs	% Seed infested with larvae	% Seed infested with adults	Larvae dots/100 infested seeds	Adult exit windows/100 infested seeds
Genotypes									
V1	78.5	9.9	5.3	1.6	68.1	51.8	33.8	154.5	124.1
V2	74.0	12.8	7.5	1.7	74.4	52.9	31.9	167.7	128.4
V3	75.3	11.2	6.6	1.7	73.6	58.3	36.5	174.1	129.4
V4	76.0	10.8	5.7	1.5	69.3	53.1	31.8	178.2	109.4
V5	70.8	12.4	6.4	1.5	68.5	53.2	33.2	181.1	113.9
V6	74.3	7.5	4.5	1.5	64.4	55.2	37.4	177.1	122.5
V7	77.0	10.2	6.4	2.0	74.1	56.4	36.9	185.9	122.9
V8	72.0	15.9	8.1	1.5	65.5	50.2	33.9	160.0	113.2
V9	72.3	12.7	7.2	1.4	69.7	53.0	31.9	169.0	110.5
V10	72.5	10.4	5.3	1.4	68.3	49.2	35.1	171.8	114.3
V11	73 8	13.4	8.9	1.8	72.6	58.5	33.1	177.5	130.1
V12	71.8	11.1	5.5	1.6	69.1	49.5	29.7	162.5	114.4
Date of planting									
D1	101.1	20.4	11.4	1.7	65.6	41.8	30.4	154.8	117.5
D2	77.7	10.6	6.7	1.9	75.8	61.2	41.8	180.7	121.3
D3	65.7	7.7	4.8	1.7	73.3	57.2	39.6	179.6	120.7
D4	51.4	7.3	2.8	1.1	64.5	53.5	23.1	171.3	118.3

Table 2. The effect of planting dates and plant population levels on infestations from *B. dentipes* eggs, larvae, and adults in local large faba bean (ILB 1814).

Treatment	Pods/3 Plants	Eggs/ Plant	Eggs/ Pod	% Pod infested with eggs	% Seed infested with larvae	% Seed infested with adults	Adults/100 infested seeds
Planting date							
D1	13.8	5.4	1.1	55.9	67.4	33.0	133.8
D2	11.7	6.7	1.8	75.0	78.4	38.6	137.5
D3	12.7	6.5	1.6	72.8	74.3	39.2	137.5
D4	8.7	4.4	1.6	72.2	70.8	30.4	131.3
Population level							
P1	11.7	4.6	1.2	60.1	66.0	29.6	126.1
P2	10.0	5.2	1.4	60.2	72.6	38.0	139.7
P3	12.3	5.4	1.5	73.0	75.0	37.2	136.3
P4	12.1	6.9	1.9	75.6	74.8	32.3	137.3
P5	12.4	6.5	1.5	75.8	75.2	39.4	135.6

RESISTANCE IN FABA BEAN TO CHOCOLATE SPOT.

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Chocolate spot, caused by *Botrytis fabae* Sard., is one of the most devastating diseases of faba bean (*Vicia faba* L.) in many parts of the world (Deverall and Wood 1961; Kaiser *et al*, 1967 and Hanounik, 1981). Chocolate spot can reduce faba bean yields by 67% (Hanounik, 1981). Extended periods of cool, wet weather have also been found to cause severe losses due to the disease (Sundhiem, 1973).

Disease management today is based mainly on the use of expensive fungicides and modified cultural practices, which provide partial protection only. Effective disease control strategies therefore should include resistance as a major component. Reports concerning the detection of resistance to chocolate spot are fragmentary. In the USSR two cultivars, 'Purple pod' and 'Hmelnikie', were reported as being relatively resistant (Sestiperova and Timofeev, 1965).

In Egypt, in a field evaluation of over 4000 lines (Ibrahim and Nassib, 1979), 30 were moderately resistant with less than 10% infection, compared to 92% infection in the local susceptible cultivar, Rebaya-40. In a potted test however, the germplasm accession NEB 938 was highly resistant with less than 1% infection compared to 60% in the local susceptible cultivar Rebaya-40.

The objective of this study was to detect durable sources of chocolate spot resistance in the germplasm collection available at the International Center for Agricultural Research in the Dry Areas (ICARDA).

Materials and Methods

A mixture of *B. fabae* was obtained from a wide range of naturally infected faba bean leaves collected from major faba bean growing regions of Lattakia and Homs in Syria. These leaves were surface sterilized in a 10% clorox solution for 2 minutes, plated on FDA (faba bean-dextrose-agar), incubated at room temperature (16-24° C) for 10 days, and then subcultured until pure cultures of *B. fabae* were obtained. These cultures were incubated at 22°C for 48 hrs., exposed to three cycles of 12 hrs. darkness and 12 hrs. ultra-violet light to induce sporulation, then propagated at room temperature. After 12 days of growth, all cultures were blended together, passed through a cheese cloth and diluted with water until 600,000 spores/ml were obtained. This inoculum was applied in the evening (6 to 8 p.m.) to the foliage of 8-week-old plants by a knapsack sprayer employing 20 ml of spore suspension per plant. Inoculated plants were then covered with a polyethylene sheet supported by 2 x 0.9 x 6 m metal frames. After 12 hrs., plants were uncovered and sprinkled twice a day with water (at 9 a.m. and 6 p.m.), then covered again in the evening. Uncovering, sprinkling and covering procedures were continued until the aggressive stage of chocolate spot was observed on susceptible lines (normally about 15 days later).

Screening was made at the Lattakia sub-site of ICARDA, in the coastal region of Syria. Sowing was done during October of every year, using 20 seeds per entry in single rows, 2 m long and 50 cm apart. A Lattakia local cultivar (ILB 1815) was planted as a standard check every 10 test entries. Disease scoring was made on a 1-9 rating scale where 1=No disease symptoms, or very small brown nonsporulating specks (highly resistant), 3=few small discrete lesions (resistant); 5= lesions common, some coalesced with some defoliation (moderately resistant); 7=large coalesced sporulating lesions with more than 50% of leaves defoliated, some plants dead (susceptible); 9=extensive lesions on leaves, stems, flower parts and pods, severe defoliation, heavy sporulation, stem girdling and blackening, and death of more than 80% of the plants (highly susceptible).

In order to identify durable sources of resistance, a two cycle screening technique was adopted. During the first cycle, in the 1979-1980 season, 1730 lines were screened using a mixed inoculum consisting of a wide range of isolates of *B. fabae* obtained from various lesions of naturally infected faba bean leaves. Resistant and highly resistant selections, made in the 1979-80 season, developed few scattered lesions, which were believed to have been induced by more virulent pathotypes present in the original mixed inoculum. *B. fabae* isolated from such lesions was then inoculated back, in a second-screening-cycle in the 1980-1981 season, to the progenies of the resistant and highly resistant selections made the previous season. Seeds of certain highly resistant genotypes selected from the second screening-cycle were provided for testing at Giza Research Station in Egypt and also at the Plant Breeding Institute of Cambridge in the U.K.

Results and Discussion

Chocolate spot lesions were first observed 5 to 7 days after inoculation. The aggressive stage of the disease, however, was noted about 10 to 12 days later. Classification of various genotypes into different disease reaction-categories is presented in Table 1. Of the 1730 lines tested in the first screening cycle during the 1979-1980 season, 529 lines were rated between 1 and 3, with the remaining 1201 entries rated between 5 and 7, indicating appreciable disease pressure and variation among different entries. Disease reaction was rated at 3 on 82% and 5 on 18% of the local standard check rows, indicating a uniform disease distribution throughout this test.

Table 1. Host status of different faba bean germplasm lines in relation to chocolate spot.

Host status[1]	Number and percentage of germplasm			
	1979-1980[2]		1980-1981[3]	
	Number	%	Number	%
Highly resistant	27	1.56	16	3.03
Resistant	502	29.01	148	28.03
Moderately resistant	756	43.69	189	35.79
Susceptible	445	25.72	152	28.78
Highly susceptible	0	0	24	4.54
Total	1730	.	529	.

[1] = 1-9 rating scale.
[2] = Inoculated with a mixture of *B. fabae* obtained from a wide range of naturally infected faba bean leaves in Lattakia and Homs regions in Syria.
[3] = Inoculated with *B. fabae* isolated from lesions on resistant selections only.

Of the 529 entries selected in 1979/80 and retested in the second screening cycle during the 1980-81 season, 16 were rated 1, 148 were rated 3 and 189 were rated 5. The remaining 176 entries were rated 7 and 9 (Table 1). Average scoring for the local standard check was 7.4, with 80% and 20% of these rows rated 7 and 9 respectively. Representative selections, rated 1 and 3 in the 1980-81 season are shown in Table 2. Highly resistant selections of BPL 710 (ILB 438) and BPL 1179 (ILB 938) made during the second screening cycle and provided for testing in Egypt and the U.K., were rated highly resistant and resistant compared to local susceptible genotypes, at both locations (A.M. Nassib and D.A. Bond, personal communication).

Identification of resistance to chocolate spot is extremely important to stabilize faba bean yield in areas where chocolate spot is an important problem. The confirmation of resistance in BPL 710 and BPL 1179 in Egypt, the U.K. and Syria, is of considerable importance, since such multilocational chocolate spot-resistance was lacking in the past.

This technique did not only help the detection of genetic material with resistance for normally predominant populations of *B. fabae*, but also contributed, through the second-screening-cycle, to the identification of selections which were also resistant to certain pathotypes of *B. fabae* that seemed to differ in their virulence (Hutson *et al*, 1980). Resistant sources listed in Table 2 are believed to be more likely to be durable due to the use of physiologically different populations of *B. fabae* in the two-cycle-screening technique adopted in this study. Incorporation of such resistance into well adapted local cultivars should help stabilize faba bean yields.

The two-cycle-screening technique adopted in this study provided means by which faba bean germplasm were screened for apparently physiologically different populations of *B. fabae*. To confirm this, five faba bean genotypes (Table 3) were inoculated separately in 1980-81, in moist chambers, with the first- and the second screening-cycle inocula of *B. fabae*, employing the same procedures mentioned earlier. Data presented in Table 3 indicate that the mixed inoculum of *B. fabae* used for the first screening cycle was less virulent on ILB 1815, BPL 6, 13, 20 and 296 compared to that used for the second-screening-cycle.

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Table 2. Representative faba bean germplasm lines rated 1 and 3 for chocolate spot in the 1980-81 season at Lattakia Disease Nursery Station.

Entry BPL No.	Origin	Entry BPL No.	Origin	Entry BPL No.	Origin	Entry BPL No.	Origin
710*	Colombia	259	Greece	1054	Turkey	1535	Unknown
1179*	Colombia	260	Greece	1055	Turkey	1539	"
112*	England	262	Greece	1056	Turkey	1540	"
261*	Greece	263	Greece	1058	Turkey	1544	"
274*	Holland	265	Greece	1061	Turkey	1545	"
460*	Lebanon	266	Greece	1107	Spain	1546	"
461*	Lebanon	268	England	1108	Spain	1547	"
1538*	Unknown	276	Holland	1109	Spain	1548	"
1541*	Unknown	278	Holland	1118	Lebanon	1549	"
1543*	Unknown	279	Holland	1154	Algeria	1550	"
1774*	Ethiopia	284	Holland	1155	Algeria	1552	"
1776*	Ethiopia	285	Holland	1156	Algeria	1554	"
1784*	Ethiopia	310	Turkey	1177	Colombia	1555	"
1785*	Ethiopia	331	Turkey	1179	Colombia	1556	"
1786*	Ethiopia	336	Turkey	1189	Afghanistan	1557	"
1787*	Ethiopia	338	Turkey	1196	Spain	1558	"
4	Jordan	361	Turkey	1198	Spain	1559	"
7	Jordan	362	Turkey	1199	Spain	1560	"
18	Syria	369	Turkey	1200	Switzerland	1561	"
19	Syria	388	Turkey	1278	Syria	1562	"
93	Iraq	389	Turkey	1390	Turkey	1563	"
109	England	410	Spain	1398	Turkey	1564	"
110	England	467	Lebanon	1407	Turkey	1565	"
133	England	470	Lebanon	1409	Turkey	1569	"
207	Yugoslavia	471	Lebanon	1416	Turkey	1570	"
212	Ethiopia	472	Lebanon	1423	Turkey	1571	"
215	Morocco	657	Tunisia	1517	Unknown	1573	"
258	Greece	658	Tunisia	1532	Unknown	1596	"

* Rated 1 on a 1-9 scoring scale.

Table 3. Physiological variation between the two inocula of *B. fabae* used in the first and the second-screening-cycles.

Inoculum	Disease reaction[1]				
	ILB 1815[2]	BPL 6	BPL 3	BPL 20	BPL 296
A[3]	5.0 a	3.5 a	5.5 a	5.0 a	4.5 a
B[4]	8.5 b	6.0 b	7.5 b	7.5 b	7.0 b
Water only	1.0 c	1.0 c	1.0 c	1.0 c	1.0 c

[1] Disease reaction was recorded on a 1-9 rating scale as shown in the text.
[2] Ratings followed by different letters are statistically different at the P = 0.05 level for each genotype.
[3] Mixed inoculum used in the first screening cycle.
[4] Selected inoculum from lesions on resistant genotypes used in the second screening cycle.

FABA BEAN SALAD — **SYRIA & LEBANON**

1 lb (½ kg) faba beans, dry
1 onion, chopped
1 clove garlic, crushed
2 tomatoes quartered
1 tsp. mint chopped, fresh or dry
2 tbspns. lemon juice

Soak beans overnight in cold water. The following day drain and rinse, cover with cold water and boil for 1 hour. Cool, then add onion, garlic, tomatoes, mint and lemon juice. Serve cold.

Serves 4

FARMER AND CONSUMER PERSPECTIVES ON INSECT PESTS OF FABA BEANS: SURVEY RESULTS IN SUDAN.

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Introduction

Pest problems in faba beans (*Vicia faba*) were briefly researched as part of three surveys of farmers and consumers in Sudan. This report provides a summary of the survey results on the subjects of pest incidence and its effect on faba bean yield in the Nile and Northern provinces, faba bean pest observations by consumers in the cities of Khartoum and Atbara and also in the producing areas of Zeidab and Aliab.

Faba bean pest incidence and associated yields

Two agro-economic farm surveys were conducted in the principal faba bean producing areas in Sudan as part of the ICARDA/IFAD Nile Valley Project (Salkini, *et al.*, 1981a; 1981b). The 1979-80 survey included producers from both Nile and Northern provinces while farmers from only two irrigation schemes (Zeidab and Aliab) in the Nile province were included in the 1980-81 survey.

More than 75% of the 1979-80 sample farmers considered pests to be one of the major constraints to faba bean production. The main pests were aphids, cutworms and bruchids. Pest infestation was less severe for sample farmers in the Northern province than in the Nile province.

Light infestations were reported by 63% of the farmers in the Northern province sample. The infested plots had average yields of 2.42 t/ha, only 15% less than the average of 2.83 t/ha for the uninfested plots.

Severe infestations by aphids, cutworms and, to some extent, locusts were identified by many of the Nile province sample farmers as major factors responsible for the low yields realised in the 1979-80 crop season (0.96 t/ha compared to normal yields of about 1.5 t). Most sample farmers' plots in the province were infested. Other damaging factors mentioned were irrigation system failures (due to shortages of fuel and spare parts for pumps), the presence of disease and, to some extent, weeds.

The survey in the 1980-81 season for the Nile province revealed above average yields (1.7 t/ha), though about 90% of the sample farmers again reported insect infestations. However, infestation severity was far less than in the previous year. Farmers reporting insect problems estimated average losses of about 20% due to these pests. Minimum and maximum estimates of losses ranged from zero to 50% . The differences between average uninfested and infested plot yields were 26 and 8% for Aliab and Zeidab sample farmers, respectively. The apparent contradiction with the earlier statement of farmers' evaluations of 20% losses may be resolved by considering the site differences within both Zeidab and Aliab Schemes. Each sample farmer was answering for his own plot, not for the farming region as a whole.

Consistent with the previous years' opinions, about 77% of the sample farmers in the Nile province considered pests to be a major yield constraint in 1980-81.

Sixty per cent of the Northern province sample, and nearly all farmers in the Nile province sample of the 1979-80 survey, reported aphids in their faba bean plots. Aphids infested 78% of the Nile province survey plots again in 1980-81. They are considered by both farmers and scientists as the insect pest most damaging to faba beans in the field. Losses caused by them are estimated at 30% on the government schemes and may be total on some individual plots (Watson, 1981).

The Lesser Army Worm, *Spodoptera exigua* was reported by about half the Nile province sample farmers in both seasons, but by only 7% of the Northern province sample farmers in 1979-80.

Bruchids were reported to be present in the fields of about 30% of the Nile province sample farmers. A larger percentage reported these insects in their own stocks of seed. Some farmers in both provinces claimed that infestation of seeds by bruchids has no effect on germination but that it does affect consumption qualities and, consequently, sales prices.

Locust damage was identified by 5 out of 26 farmers in the 1979-80 Nile province sample. Of these, two plots were completely destroyed, but the farmers were able to resow them later in the season. Locust damage was not reported by any of the farmers sampled in the 1980-81 survey.

Grey cotton leaf thrips (*Caliothrips sudanensis*) may have been responsible for crumpled leaf and flower shedding symptoms reported in the crops of 25% of the 1979-80 Nile province samples. Siddig (1981) identified these insects in the neighbourhood of the survey farmers.

Faba bean pest control: farmer surveys

Chemical control of faba bean pests is uncommon in Sudan. Only 7 and 23% of the Northern and Nile province sample farmers, respectively, applied pesticides in the 1979-80 season. However, other methods of control were practiced by a few farmers. These included smoke-fumigation by burning different materials of local origin and overflooding infested plots.

All methods of pest control (chemical use included) were ineffective. The ineffectiveness could have been due to the application of only one spray, as more sprayings may be required for good control. Another factor contributing to ineffective control could be the presence of infested neighbouring plots.

The main reasons given by farmers for not applying pesticides were: high costs, non-availability at proper time, difficulties in contacting government plant protection offices, and lack of knowledge of pesticides. When farmers were questioned on whether any help in plant protection was available, 43% mentioned the Department of Plant Protection as a possible source of help, but complained of limited facilities and activities, 34% identified no source, and 23% did not respond. More than 70% expressed interest in cooperating with any source of help in this respect if the services can be performed effectively and at low cost.

Some sample farmers in the 1979-80 survey used 'Agrocide' in attempts to control seed store pests. However, in most cases this practice seemed ineffective since the chemical does not penetrate the seed. Other more effective chemicals (methyl bromide, phostoxin) were available at the Plant Protection offices but demand for them was low, due perhaps to (i) farmers being unaware of their availability and (ii) difficult access to the offices.

Consumers and faba bean pests

A survey of 212 faba bean consumers has been recently carried out in urban Khartoum and Atbara, and in the Aliab and Zeidab farming schemes (El Mubarak, 1982). In addition to many other questions, consumers were asked about the incidence of bruchids in faba beans found in local markets and whether bruchid infestation lowered bean prices. Table 1 summarises their answers.

In the urban areas, the majority of consumers reported bruchid infested beans in their markets. In contrast, a definite minority of consumers interviewed in the faba bean producing areas reported bruchids in their markets. Consistent with this picture, consumers in the producing areas indicated a stronger opinion than their urban counterparts that bruchid infestation does reduce the sale price of beans. One may presume that those from the producing areas should be more familiar with the marketability of infested versus clean faba bean.

While fewer findings from the producing areas provided estimates of infestation levels, there was a remarkable uniformity of sample area mean estimates at around the 20% level. However, within sampling areas, estimates typically ranged from 5 to 50%.

Conclusions

Insect pests are damaging factors at every stage of the faba bean economy in Sudan, though the severity of damage varies considerably from site to site and year to year.

Very few faba bean growers seem to use pesticides, and fewer have used them properly. The Plant Protection Department apparently has sufficient trained personnel to make a much larger contribution to faba bean pest control. Severe shortages of transport facilities, equipment and materials, however, limit the Department's effectiveness considerably.

Of course, the resources required to better equip the Plant Protection Department do have competing uses in Sudan. Information allowing confident anticipation of the resources required to achieve different levels of pest control benefits would permit the best allocation decisions by policy makers. Well designed on-farm trials, under conditions faced by the ultimate pesticide users could provide such information.

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POETICAL BEAN

I will arise and go now, and go to Innisfree
And a small cabin build there, of clay and wattles made
Nine bean rows will I have there, a hive for the honey bee
And live in the bee-loud glade.

William Butler Yeats, 'The Lake Isle of Innisfree'

Table 1. Consumer estimates of bruchid infestation in Sudanese markets.

Questions	% of consumers interviewed who answered 'Yes' Producing areas			Urban areas			Total
	Zeidab	Aliab	(Ze + Al)	Atbara	Khartoum	(At + Kh)	
Are there infested beans in the market?	42	34	38	87	90	89	65
Does bruchid infestation reduce bean prices?	100	88	94	79	77	77	85
No. of consumers interviewed	50	50	100	23	89	112	212
No. who provided estimates of the % of beans infested	13	14	27	16	65	81	108
Average of their estimates (%)	20.5	22.5	21.5	22.0	19.8	20.2	20.5

Source: Abdalla El Mubarak (1982).

SPREAD OF *ASCOCHYTA* IN WINTER-SOWN FABA BEANS.

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The seedborne pathogen *Ascochyta fabae* Speg. produces only pycniospores, which require moisture for release and dispersal. A range of less than 0.5 m seems usual for splash-dispersed spores (Griffiths and Ao, 1976). Studies in England found that the seasonal spread of *A. fabae* was limited to a few meters (Dodd, 1971; Hewett, 1973). Thus attacks can be restricted by the use of 'clean' seed, i.e. with minimal infection (Hewett, 1981), and screening for *A. fabae* is used in several countries. Seed schemes require crops to be isolated from sources of foreign pollen and this also gives a measure of protection from infection in neighbouring crops. However, occasional outbreaks in winter beans have been extensive and Bond and Pope (1980) described two cases in which *Ascochyta* spread at least 120 meters. Additional observations on plots and evidence from crops entered for certification are presented here.

A trial of seven *equina* cultivars at Sutton Bonington, Nottinghamshire, was observed to harvest. The plots were 60 cm apart; each plot contained 10 rows 16 cm apart and 30 m in length; the plots were randomised in four adjacent blocks. The seeds were sown on October 22, 1979 and 5-7.5 plants established per m row resulting in almost equidistant spacing. A parallel trial at Cambridge was also observed. Faba beans had not been grown the previous year in these areas. Opportunities for spore dispersal within and between plots were reduced by making observations only when conditions were dry and by minimizing cultivations. The level of initial seedborne inoculum was established by examining 1000 seeds per sample by an agar plate method (Hewett, 1966). Primary foci of infection were recorded at both centers in each replicate sown with the heavily infected cv. 'Throws MS' (1.7% seed infection, see Table 1). For the other varieties, with lower initial seed infection, primary foci were limited to one or two per plot. The transmission rate of *Ascochyta* from infected seeds to emerged seedlings was estimated as 14% at Cambridge and 30% at Sutton Bonington, somewhat higher than found earlier (Hewett 1973). By the end of March the foci were mostly of more than one plant and there was an obvious spread of up to 25 cm. Leaf lesions continued to increase in number, reaching half-way up the plants toward the end of May. Crop growth then made accurate observation difficult but the disease appeared to remain limited in extent.

Seed from each plot at Sutton Bonington was harvested and 400 seeds were examined. *Ascochyta* was found in seed from ten of twelve plots sown with seed known to bear *Ascochyta*. The two exceptions had the lowest initial seed infection. The fungus appeared to have spread into only three other plots, all immediate neighbours to those sown with infected seed. An additional 400 seeds were examined from plots 2-12 and *Ascochyta* was then detected from plot 7 but there was no further evidence of between plot spread (Table 1).

Table 1. Per cent *A. fabae* on initial seed sown and on seed harvested, Sutton Bonington, 1979/80.

Block No.	Plot No.	Cultivar	% *A. fabae* on seeds		
			Initial	Harvested	
			1000 seeds	400 seeds	800 seeds
I	1	Bulldog	0	0	-
	2	Banner	0	0	0
	3.	Beagle	0	0	0
	4	Throws MS	1.7	4.5	5.6
	5	Buccaneer	0.2	0.8	0.8
	6	Daffa	0	0	0
	7	Beever	0.1	0	0.1
II	8	B	1.7	4.0	3.9
	9	B	0.2	1.8	1.3
	10	B	0	0	0
	11	T	0	0	0
	12	B	0	0	0
	13	D	0.1	0.3	-
	14	B	0	0	-
III	15	B	0	0	-
	16	B	0	0.3	-
	17	B	1.7	1.0	-
	18	T	0.1	3.5	-
	19	B	0	0.3	-
	20	D	0.2	0.3	-
	21	B	0	0.5	-
IV	22	B	0.2	0.3	-
	23	B	0.1	0	-
	24	B	1.7	1.5	-
	25	T	0	0	-
	26	B	0	0	-
	27	D	0	0	-
	28	B	0	0	-

Bond and Pope (1980) found infection 150 m from a disease source by April 15, 1976 and concluded that this was an example of a large source of inoculum flattening and extending the disease gradient. If that outbreak and the case in 1974-75 had been particularly favoured by weather conditions, a corresponding increase in infection might have been expected in seed crops. A total of 1548 ha of winter beans was certified during these two seasons, approximately 80% being of the cvs. 'Throws MS' and 'Maris Beagle'. These cultivars had a history of acting as occasional recurrent infection foci in crops or having 1 in 1000 seeds tested infected. *Ascochyta* had also been detected in relatively fewer lots of the other cultivars. There was no indication of any general increase in infection, which continued to be reported occasionally, at low levels.

Human activity can also spread disease. Attempts to remove *Ascochyta* - diseased plants from seed crops have been followed by continued disease development (R.A. Newman, pers. comm.). This rogueing was followed by fungicide applications but was not restricted to periods when crops were dry. Increased disease severity was observed in certain spray treatments (Gaunt *et al.*, 1978) and attributed to enhanced dispersal by the spraying. The reduction of seedborne inoculum is valuable in certain conditions but other precautions are also required.

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NEMATODES ON FABA BEANS IN EGYPT.

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Root-knot nematode (*Meloidogyne* spp.) is the most widespread of all the nematodes affecting the faba bean crop in Egypt. Samples were taken from different locations in the Delta and Upper Egypt in April 1981. There was severe infection in the roots with the root-knot nematodes, especially in the samples taken from Shandaweel island (Sohag province) in Upper Egypt. Faba bean appears to be a favourite host for this genus (*Meloidogyne*). Biological studies are being carried out to determine the species of *Meloidogyine* which attack faba bean in Egypt.

EFFECT OF *VICIA FABA* ON THE RATE OF MUSCLE PROTEOLYTIC ACTIVITY IN MALE CHICKENS.

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Previous studies from this laboratory (Santidrian *et al.*, 1980; 1981) have shown that chickens grown on diets containing raw *Vicia faba* as the major source of protein suffered a significant reduction in growth rate, accompanied by several changes in the skeletal musculature composition. These latter changes are basically reflected in a marked reduction in the sarcoplasmic fraction and an increase in the non-protein nitrogenous fraction in the skeletal musculature of experimental animals. Furthermore, we have pointed out (Lasheras *et al.*, 1980; Santidrian *et al.*, 1981) that legume-fed chickens suffered a significant reduction in the ability of intestinal tissue to transport sugars and amino acids. Similar results have been reported by Davidson (1977).

The purpose of this study was to investigate further the effect of *Vicia faba* on the rate of muscle protein catabolism in chickens by determining the activities of two proteolytic enzymes, Catepsin A and D, in the skeletal musculature.

Thirty one-day old *Arbor accres* chickens were randomly divided into three dietary groups of ten each as follows: two groups containing *Vicia faba* as the major source of protein, with or without the addition of methionine (Sigma, 250 mg/100 g diet), and one group as control. Both standard and legume diets were isocaloric and contained 20-22% protein. The composition of diets was as previously described by Santidrian *et al.* (1981). Animals were fed *ad libitum* for 60 days. Body weight changes were recorded every ten days. At the end of the experiment, all birds were killed and the pectoral muscle was excised immediately. Activities of muscle Catepsins A and D, both free and total (non-lysosomal and lysosomal plus non-lysosomal, respectively), were determined following the methodology established by Gianetto and De Duve (1955). Muscle protein was assessed by the method of Lowry *et al.* (1951). Statistical evaluations were carried out by the conventional two-way analysis of variance.

Results are summarised in Table 1. As compared to well-fed chickens, those fed the raw legume diet showed a significant ($P < 0.1$) reduction in growth rate, in agreement with published evidence (Santidrian *et al.*, 1980 and 1981). This effect was accompanied by a significant increase ($P < 0.05$) in free and total Catepsin A and D activity in skeletal muscle. This finding correlated with a reduction in the sarcoplasmic nitrogenous fraction and an increase in the non-protein nitrogenous fraction of the skeletal musculature found in legume-fed chickens (Bello *et al.*, 1972; Santidrian *et al.*, 1980). Enhanced proteolytic activity would explain the reduced sarcoplasmic protein content in the muscle. Furthermore, chickens fed the legume-diet with added methionine showed a significant improvement ($P < 0.05$) in growth rate, although they could not reach the rate demons-

Table 1. Body weight gain and muscle proteolytic activity of growing male chickens (one-day old at the beginning of the experiment) fed *ad libitum* for 60 days either a standard diet or a diet containing raw *Vicia faba* with or without added methionine (250 mg/100 g diet). Entries are mean values ± SEM for ten chickens/group.

Diet	Body weight gain (g/day)	Units[1] / mg protein: Catepsin A Total	Catepsin A Free	Catepsin D Total	Catepsin D Free
Control	28.7 ± 4.2	0.11 ± 0.01	0.07 ± 0.01	0.22 ± 0.01	0.19 ± 0.01
Vicia faba	16.3 ± 3.7a[2]	0.19 ± 0.02a	0.13 ± 0.01a	0.28 ± 0.01a	0.23 ± 0.01a
V.faba+ methionine	21.3 ± 4.1a	0.10 ± 0.01	0.08 ± 0.01	0.22 ± 0.01	0.18 ± 0.01

[1] One unit is defined as the amount of enzyme that catalyzes the liberation of 1 μ mol of tyrosine from haemoglobin (substrate) during the incubation time (30 min) at 27° C.

[2] a indicates a significant difference at the 5 % level (2-way ANOVA), as compared to the control animals.

trated by control chickens. However, birds fed the methionine-added diet showed that muscle proteolytic activity was almost identical to that of the control, well-fed birds.

In conclusion, the catabolic effect caused by feeding chickens with raw *Vicia faba* is associated with an increase in the rate of muscle proteolytic activity. This effect seems to be closely related to the sulphur amino acid deficiency which is characteristic of legume proteins. Supplementation with methionine restored the normal proteolytic activity, although it did not completely restore the rate of growth.

It is possible that the antinutritive factors (Marquardt *et al.*,1977) contained in raw legumes, along with a sulphur aminoacid deficiency, were responsible for the antinutritive effect caused by raw *Vicia faba*.

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NUTRITIVE VALUE AND EFFECT OF TANNIN CONTENT OF *VICIA FABA EQUINA* AND *MINOR* SEEDS ON THE RATE OF GROWTH IN GROWING RATS

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The anti-nutritive effect of raw faba bean seeds (*Vicia faba*) on the growth rate and protein metabolism in experimental animals is well established (Liener, 1980). Several investigators have associated this catabolic effect with either the tannin content of the legume seed (Ford and Hewitt, 1979) or the sulphur-aminoacid deficiency characteristic of legume proteins (Marquardt *et al.*, 1975) or both (Bello *et al.*, 1972). The aim of this study was to report data on the effect of two varieties of *Vicia faba* commonly harvested in Spain (var. *equina* and *minor*) on the growth rate and nitrogen balance in growing male rats. The results have been correlated with both the tannin content and the amount of sulphur-amino acids in these two varieties.

Intact young Wistar male rats (90 g initial weight) were randomly assigned into three dietary groups of ten animals each. One group was fed a purified control diet (12% casein), and the others were fed diets containing *Vicia faba equina* or *minor* seed as the only source of protein (resulting in a total protein of 12%). All diets were isocaloric. Diet composition is given in Table 1. Animals received food and water *ad libitum* for two weeks.

Food intake and body weight changes were recorded daily. Urine and faeces were collected every 24 hrs. at 9.00 a.m. Nitrogen balance parameters (True Digestibility Ratio, Biological Value and Protein Efficiency Ratio) were calculated according to the methodology established by Mitchel *et al.* (1945).

Randomised seed samples of *Vicia faba equina* and *Vicia faba minor* were taken in order to determine tannin content (both leucoanthocyanidins and catechins) and aminoacid composition of the legume proteins. Tannin determinations were made following the spectrophotometric method given by Dadic (1976). Previously, the nature of *Vicia faba* tannins was determined using two-dimensional paper chromatography with two different solvents:- butanol:acetic acid:water (4:1:5), and acetic acid (15%). Once the tannins were separated, they were identified by spraying two types of dye, vainilline-HCl and p-toluensulfonic acid, on the chromatography paper (Marquardt *et al.*, 1977). The amino acid profile was determined as described by Muruyaba and Shindo (1977). Statistical evaluations were carried out by the conventional two-way analysis of variance.

Table 1. Diet composition. Entries are expressed as g per 100 g of dry diet.

Diet[1]	Control	*Vicia faba equina*	*Vicia faba minor*
Casein	13.2	--	-
Vicia faba[2]	--	54.1	47.8
Olive oil	4.9	4.0	4.1
Mineral mx[3]	4.6	3.2	3.5
Vitamin mx[3]	1.6	1.6	1.6
Cellulose	5.0	0.5	1.3
Sucrose	23.6	12.2	13.9
Starch	47.1	24.4	27.8

[1] Diets were prepared according to the A.O.A.C. (1970) recommendations

[2] *Vicia faba* composition. Var. *equina*: moisture, 10.2%; total protein, 22.2%; ether extract, 1.8%; ash, 3.3%; crude fiber, 6.4% and carbohydrates, 56.1%. Var. *minor*: moisture, 9.4%; total protein, 25.1%; ether extract, 1.8%; ash, 3.0%; crude fiber, 5.7% and carbohydrates, 55.0%.

[3] Vitamin and mineral mixtures were prepared as described elsewhere (Cenarruzabeitia *et al.*, (1979).

The analytical quantification of the two varieties showed that both had two different types of tannins (Table 2), which were identified as leucoanthocyanidins (flavan-3-ols) and catechins (flavan-3,4-diols). This finding correlates with the investigations of Marquardt *et al.* (1977) and Martin-Tanguy *et al.* (1977), and the quantities found in this study are in agreement with the data reported by these workers. However, *Vicia faba equina* contained an amount of tannins (leucoanthocyanidins, catechins and total) significantly higher (P< 0.001) than that found in *Vicia faba minor*.

It is well known that legume proteins are deficient in sulphur-amino acid, and this has been attributed, in part, to the antinutritive effect caused by raw legumes (Bello *et al.*, 1972; Marquardt and Campbell, 1974). Table 2 also shows that no major differences were found in the amino acid profile of the two varieties of *Vicia faba* investigated in this study, both of them being deficient in methionine.

As compared with casein-fed rats (Table 3), a significant reduction (P< 0.05) in growth rate was found in legume-fed rats, in agreement with published evidence (Santidrian, 1981a and b). This characteristic growth inhibition caused by raw faba beans was significantly greater (P< 0.05) in the rats fed *V. faba equina* than in those fed *V. faba minor*. Since *V. faba minor* contained a tannin concentration lesser than the *V. faba equina*, it can be assumed that the different tannin content was responsible for the different growth inhibition effect caused by raw *Vicia faba*. These results agree with the investigations of Marquardt and Campbell (1974) and Marquardt *et al.* (1977), who attributed the growth inhibitory effect to the tannin fraction of *Vicia faba*.

Table 2. Amino acid profiles and seed tannin content of two varieties of *Vicia faba* used in this study. Entries are expressed as mg of amino acid per 100 g of legume protein (N x 6.25). Tannin content is expressed as mg/100 g seed.

Constituent	*Vicia faba equina*	*Vicia faba minor*
Amino acids		
Aspartic acid	10.4	9.1
Threonine	2.6	3.1
Serine	5.4	4.5
Glutamic acid	12.0	10.3
Proline	2.9	2.9
Glycine	1.2	3.0
Alanine	2.6	2.8
Valine	4.8	4.4
Methionine	0.7	0.7
Isoleucine	2.9	3.0
Leucine	8.7	8.4
Tyrosine	2.6	2.5
Phenylalanine	4.1	6.0
Histidine	1.9	2.2
Lysine	6.0	6.9
Arginine	6.9	8.3
Cystine	1.1	1.1
Tryptophan	2.1	2.2
Tannin content		
Leucoanthocyanidins	0.39+0.01	0.29+0.01a
Catechins	0.16+0.01	0.11+0.01a
Total	0.55+0.01	0.40+0.01a

a = statistically significant at the 1% level.

Finally, a parallel pattern was observed in the nitrogen balance parameters calculated in the experimental groups. Rats fed either variety exhibited a significant reduction (P< 0.01) in the True Digestibility Ratio (absorbed N/ingested N), Biological Value (retained N/absorbed N) and Protein Efficiency Ratio (body weight gain/protein intake) when compared to control animals, in agreement with previously reported data from this laboratory (Bello *et al.*, 1972; Santidrian, 1981b) and others (Palmer and Thompson, 1975; Darwish *et al.*, 1976; Ford and Hewitt, 1979a and b). However the reduction in nitrogen balance displayed by legume-fed rats was significantly greater (P < 0.05) in the animals fed *V. faba equina*, which had a higher tannin content, and lower protein content.

Table 3. Body weight gain and nitrogen balance parameters (True Digestibility Ratio, Biological Value and Protein Efficiency Ratio) in growing male rats fed *ad libitum* on diets containing either casein (12% total protein) or *Vicia faba* varieties *equina* and *minor* (12% total protein) for two weeks. Entries are mean values (± SEM) for six rats in each group. For nitrogen balance, values are percentages refered to casein control diet (control = 100).

Group	Body weight gain (g/day)	Nitrogen balance		
		TDR	BV	PER
Casein	5.6±0.7	100.0	100.0	100.0
Vicia faba equina	3.5±0.5a	84.0±0.8a	67.3±3.1a	55.2±5.0a
Vicia faba minor	4.0±0.4ab	86.7±0.4ab	79.8±3.6ab	80.1±5.1ab

a = Significant at the 1% level as compared to casein-fed rats (ANOVA).
b = Significant at the 5% level as compared to *Vicia faba equina* fed rats (ANOVA).

In conclusion, the study showed that rats fed on diets containing *Vicia faba equina* as the only source of protein suffered a more pronounced anti-nutritive effect (as measured by the growth rate and nitrogen balance) than animals fed *Vicia faba minor*. Furthermore, since the variety *equina* had a higher tannin concentration than the variety *minor*, and both had similar sulphur-amino acid concentrations in their proteins, it could be concluded that the differential anti-nutritive effect of these *Vicia faba* varieties was due to their respective tannin content. Nevertheless, tannins are not the only anti-nutritive factors contained in *Vicia faba* seeds. Substances such as haemagglutinins, saponins, glucosides, trypsin inhibitory factors, etc., which are present in legume seeds, also have toxic effects. These substances as well as tannins, therefore, appear to contribute to the anti-nutritive effects of raw *Vicia faba*.

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OLD BEAN

The earliest cultivated Horse Beans yet found are those reported from the prepottery Neolithic 'B' levels at Jericho (circa 6500 B.C.). Their cultivation spread during the Neolithic period into Spain . . . subsequently they occur in the Aegean at Troy II . . . and many bronze age lake-side dwellings in Switzerland.

From 'Paleoethnobotany' by Jane M. Renfrew, Columbia University Press, New York 1973; 248 pp.

FROM THE DIVINE TO THE DEVIOUS

Faba bean meal was used to make a porridge, in sacrifice to the gods, and was esteemed as a delicacy, by some members of the Roman society.

However, a less open use was also made of this versatile bean. 'Lomentum', a bean meal, was also used as an addition to wheat or Italian millet flour to increase the weight of loaves for sale.

From information derived from 'Paleoethnobotany', by Jane M. Renfrew, Columbia University Press, New York, 1973.

DIGESTIBILITY OF LOW TANNIN FABA BEANS.

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A low tannin population (LT) was created by transferring the gene for white flower and low tannin content from cv. 'Compacta White' to cv. 'Francks Ackerperle'. Two cycles of backcrossing, selfing and selection for white flower, normal growth habit and small seed size were performed. Offspring plants, after selection and selfing, were pooled and the population was multiplied by bee pollination in 1977 and 1978.

Samples from this LT material and the normal Francks Ackerperle, both harvested on the same farm in 1978, were evaluated for metabolizable energy content and digestibility of the amino acids. Adult White Leghorn males were used as test animals to evaluate digestibility according to the method of Petersen and Thomson (1981).

Apart from a much lower tannin content and a reduced fiber content in the LT sample, the chemical composition was similar to the control (Table 1). The total energy content was the same in the two samples but the digestible energy of the LT material was seven per cent higher than the control.

Table 1. Chemical composition and energy content of normal and low tannin faba beans.

	Normal	Low tannin
	Composition, % DM	
Tannin	2.51	1.20
Crude Protein	29.8	28.5
Fat	2.3	2.1
Fibre	8.8	7.9
Soluble carb.	55.2	57.2
Ash	3.9	4.3
	Energy, MJ/kg DM	
Total	18.32	18.00
Metabolisable	9.52	10.22

The digestibility of the protein was 75% in Francks Ackerperle (control) as against 86% in the low tannin population. Thus, despite the fact that the LT material was 1.3% lower in protein content, the digestible protein content was increased by 1.2% compared to the control.

The digestibility of the individual amino acids was in all cases higher in the LT material than in the control (Table 2). It is especially interesting to note that the digestibility of the sulphur containing amino acids (SCAA) was more than doubled in the LT sample leading to a content of 1.27 g digestible SCAA per 16 g of nitrogen against only 0.62 g in the control.

Table 2. Aminoacid composition and digestibility of normal and low tannin (LT) faba bean.

Amino acid	g/16 gN		% digestible	
	Control	LT	Control	LT
Alanine	4.09	4.01	64	76
Arginine	9.10	8.31	86	90
Asparagine	10.67	10.54	82	87
Cystine	1.19	1.15	22	59
Phenylalanine	4.03	4.03	81	91
Glutamine	16.66	16.19	80	90
Glycine	4.19	4.10	-	-
Histidine	2.53	2.49	72	91
Isoleucine	3.86	3.87	75	84
Leucine	7.16	7.06	73	87
Lysine	6.09	5.83	81	84
Methionine	0.81	0.80	45	73
Proline	4.23	3.94	50	80
Serine	4.75	4.60	74	83
Threonine	3.43	3.32	69	79
Tyrosine	3.35	3.24	71	85
Valine	4.28	4.27	72	85

The present results support earlier reports of higher digestibility in low tannin or tannin-free faba beans. Bond (1976) showed that white flowered tannin-free cultivars had a 5% higher *in vitro* digestibility than a set of normal tannin containing control cultivars. The difference was accounted for by a significantly higher digestibility of the tannin-free tests.

From an experiment with rats, Mendes-Pereira and Pion (1977) reported that the apparent digestibility of organic matter as well as of proteins was higher in the white flowered cv. 'Bianka' than in two cultivars with higher tannin content. Also, steam cooking increased the apparent digestibility of the tannin containing cultivar 'S 45' but not of the tannin-free cultivar. Similar results were found with chickens (Guilloume, 1977). Martin-Tanquy *et al.*, (1977) found a significant negative correlation between apparent nitrogen digestibility and tannin content and as a result, growth depression in ducklings was significantly related to faba bean tannin content in the diet.

The wide variation in digestibility, especially of the sulphur containing amino acids (as demonstrated in the present experiment), is of considerable interest as it may be a source for increasing the biological value of faba bean protein. If this variation, or part of it, is related to the white flower, low tannin character, as supported by data obtained with *Streptococcus zymogenes* and chickens fed on sorghum and faba beans (Ford and Hewitt, 1979 a and b), then there is further support for breeding faba beans for low or zero tannin content.

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DISTRIBUTION OF PROTEIN CONTENT IN THE WORLD COLLECTION OF FABA BEAN (*VICIA FABA* L.)

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The international collection of pure faba bean lines maintained at the Tel Hadya research station of ICARDA currently contains 2280 entries. The purity of these lines is carefully preserved, and the collection represents an excellent series for the study of distribution of protein content in the faba bean. The seeds of all entries harvested during 1981 were tested for protein (Nx6.25) using a Neotec food quality analyzer, model 51 A, which uses the principle of near-infrared reflectance spectroscopy (NIRS). Every day 10 to 12 samples were also tested by a macro Kjeldahl procedure, using 0.5 g of the sample. These tests verified the accuracy of the NIRS analysis. All samples were prepared for analysis by grinding (20 g) in a U - D cyclone sample mill, fitted with a 1.0 mm screen, after preliminary crushing in a mortar. Results were recorded on an 'as is' basis, with respect to moisture.

The moisture content of the ground beans was 9.0% plus or minus 0.5%. The mean protein content of the series was 25.8% (28.4% dry basis), with a standard deviation of 2.4. The range in protein extended from 6.9 to 34.4% (8.6 to 37.8% dry basis). The Gaussian distribution showed a fairly sharp peak about the mean, with 92% of the entries lying between 22 and 29% (24 to 32% dry basis). Accuracy of testing as assessed by the standard deviation of differences between Kjeldahl and NIRS results was plus or minus 0.27%, for a coefficient of variability of 1.04%. The overall coefficient of correlation between Kjeldahl and NIRS results (69 comparisons) was 0.984. Distribution of results is summarised in Table 1. Table 2 illustrates the 25 entries which were highest and lowest in protein respectively.

These results showed that there are several entries which possess a very high protein level in the present world collection of faba bean. Therefore, it should be possible to increase protein percentage in existing cultivars for feed purposes if the need should arise. There is a general feeling among faba bean breeders that the present level of protein percentage in most of the existing cultivars is satisfactory. However, protein percentage increases in faba bean for feed purposes must be considered if faba bean is to compete with other feed crops.

Table 1. Distribution of faba bean pure lines as related to protein percentage in the present world collection.

Protein %	% of population
34	0.05
33	0.16
32	0.22
31	0.54
30	2.27
29	3.73
28	9.54
27	14.17
26	17.76
25	17.79
24	13.95
23	9.19
22	5.79
21	2.70
20	1.51
19	0.49
18	0.10
17	0.00
16	0.05

Mean = 25.8%

Standard deviation = 2.4

Table 2. List of entries for the highest and lowest protein percentage in the faba bean world collection and their country of origin.

Order	BPL No.	Protein % (dry)	Country of Origin	BPL No.	Protein % (dry)	Country Origin
1	331	37.8	Turkey	1872	18.6	U.K.
2	1587	36.6	Unknown	1417	19.9	Turkey
3	717	36.6	Cyprus	1744	20.8	Ethiopia
4	521	36.3	U.K.	367	21.1	Turkey
5	1520	36.0	Unknown	871	21.2	Unknown
6	896	35.8	Unknown	361	21.4	Turkey
7	563	35.7	Egypt	161	21.5	Afghanistan
8	1691	35.4	Ethiopia	360	21.7	Turkey
9	189	34.9	Ethiopia	763	21.7	Afghanistan
10	1159	34.9	Tunisia	860	21.7	Afghanistan
11	1141	34.8	Egypt	784	21.8	Afghanistan
12	1693	34.8	Ethiopia	1165	21.9	Tunisia
13	1766	34.7	Ethiopia	1090	22.0	Turkey
14	494	34.4	Spain	1854	22.1	Finland
15	303	34.3	Holland	791	22.2	Afghanistan
16	667	34.3	Tunisia	168	22.3	Australia
17	171	34.2	Iran	207	22.4	Yugoslavia
18	650	34.0	Tunisia	1974	22.4	Ethiopia
19	373	33.8	Turkey	1596	22.4	Unknown
20	1481	33.7	Unknown	315	22.4	Turkey
21	1387	33.7	Turkey	109	22.5	U.K.
22	1525	33.6	Unknown	2207	22.6	Ethiopia
23	2222	33.6	Ethiopia	2	22.8	Jordan
24	2241	33.6	Ethiopia	345	22.8	Turkey
25	861	33.6	Afghanistan	749	22.9	Ethiopia

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