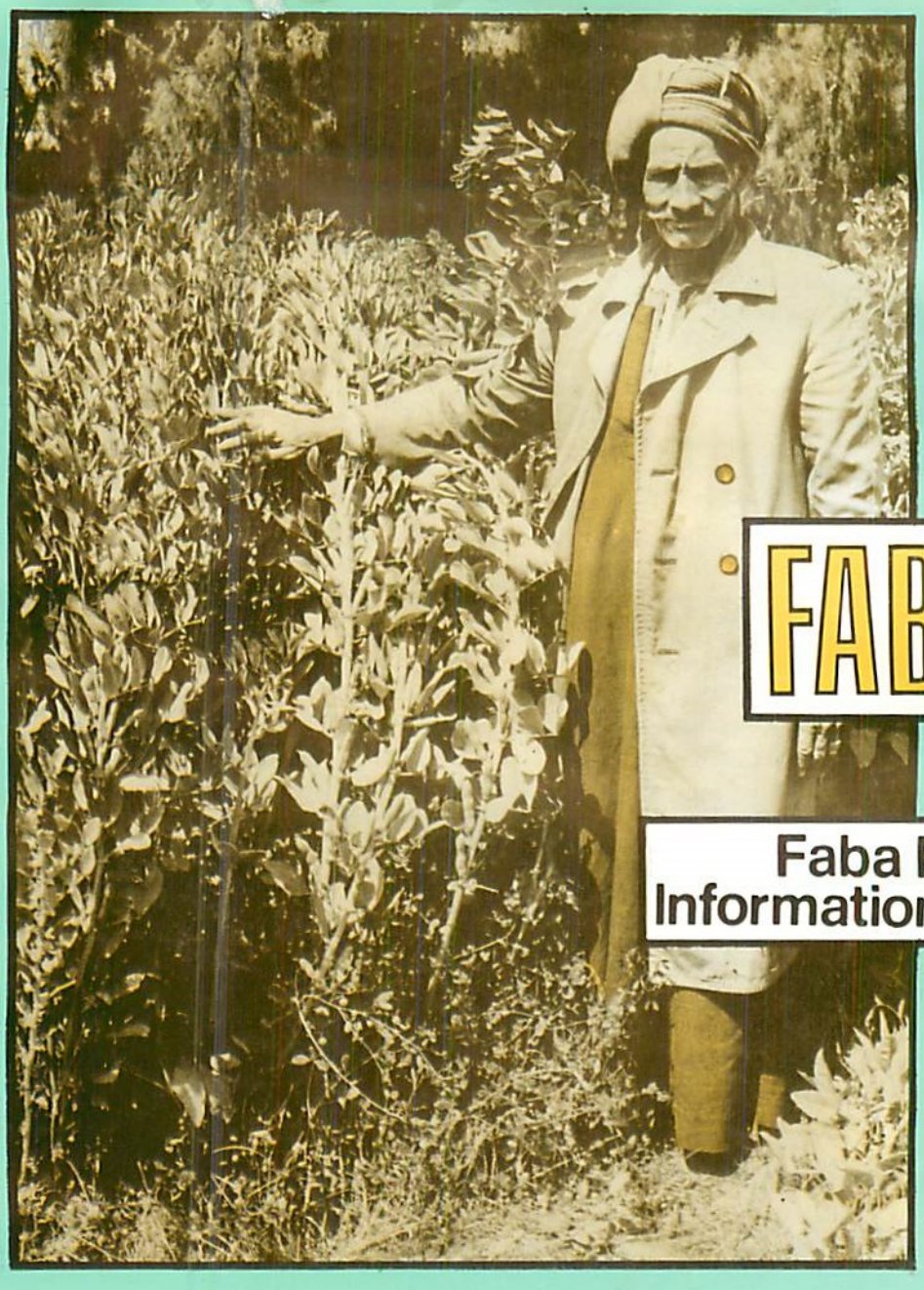

FABIS

Faba Bean Information Service

NEWSLETTER

No. 10
DECEMBER 1984

INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS

(ICARDA)

The Center and its Mission

The International Center for Agricultural Research in the Dry Areas (ICARDA) was established in 1977 to undertake research relevant to the needs of developing countries and specifically for the agricultural systems in West Asia and North Africa. The overall objective of the Center is to contribute towards increased agricultural productivity, thereby increasing the availability of food in both rural and urban areas, and thus improving the economic and social well-being of people.

Though devoted mainly to winter-rainfed agriculture in areas with 200-600 mm rainfall per annum, ICARDA has world responsibility for the improvement of barley, lentil, and faba bean. Where logical, ICARDA's area of concern thus extends into environments with monsoon rainfall or with irrigation. In the winter-rainfed areas, research is also carried out on wheat, kabuli chickpea, and pasture and forage crops. Development of improved farming systems is a major component in the Center's research program. The Center undertakes and supports training.

ICARDA is one of 13 international research centers receiving support from donors through the Consultative Group on International Agricultural Research (CGIAR). Donors to ICARDA have included Australia, the Arab Fund for Social and Economic Development, Belgium, Canada, Denmark, Ford Foundation, France, the Federal Republic of Germany, the World Bank, Italy, International Fund for Agricultural Development, International Development Research Centre, Mexico, the Netherlands, Norway, Organization of Petroleum Exporting Countries, Saudi Arabia, Spain, United Kingdom, Sweden, United Nations Development Programme, and United States Agency for International Development.

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NEWSLETTER No.10

THE INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS
(ICARDA)

CONTENTS

SHORT COMMUNICATIONS

THE SCOPE FOR FABA BEAN PRODUCTION IN INDIA

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Almost 75% of the cropped area in India is rainfed, with consequent low cropping intensity and poor productivity. In spite of a large scale expansion in irrigation in the country, both cropping and irrigation intensity have remained lowest in the larger states, such as Madhya Pradesh, Rajasthan, and Maharashtra. Poor rainfall and its erratic distribution through the season contribute to instability in production in rainfed areas, where drought-resistant cultivars may also fail to perform well.

Agricultural scientists have given high priority to breeding varieties for rainfed areas and to designing cropping systems which make better use of available rainfall, and thus increasing stability of production. However, a large acreage remains fallow after taking a single crop of paddy rice or sorghum in the kharif (post-rainy season). In these systems, *Utera*[1] or *Para*[2] cropping, particularly with Chickling vetch (*Lathyrus sativus*) has been successful. Unfortunately, the presence of a neurotoxin (BOAA) in lathyrus seeds poses a great risk to human health, and consequently its cultivation has been banned in some states.

The question of what to grow following the rice crop is still unanswered, however, and the farmer has no choice other than to grow lathyrus. Several rabi (autumn sown) crops, such as linseed, lentil, chickpea, black gram, and green gram, have been tried; none matches lathyrus in terms of yield and tolerance to drought stress.

Recently, Singh *et al.* (1982) suggested faba bean (*Vicia faba*) as a substitute for lathyrus, as it does not contain the neurotoxin which is present in lathyrus. It has been claimed that the seeds of faba bean are as hard or harder than those of lathyrus, and it can be used in *Utera*[1] or *Superutera*[3] systems. However, faba bean is a new crop to many farmers in India, and will need more research and extension work to convince the farming community of its potential under these conditions.

Faba bean, as a high yielding grain legume and high protein crop has potential as a rabi crop in rainfed agriculture in India. Preliminary studies at the Department of Plant Breeding and Genetics, JNKVV, have indicated a bright scope for faba bean cultivation under rainfed conditions, such as Utera and *Superutera* systems.

1. In the *Utera* system, the seed is broadcasted in the standing paddy rice crop when the field is still moist. The seed germinates before the rice crop is harvested, to make the best use of the residual moisture and fertility.

2. *Para* is a synonym of *Utera*.

3. In the *Superutera* system, the seed of the *Utera* crop is broadcasted at the beginning of the paddy season, and remains dormant until about the end of the paddy season.

Reference

Singh, C.B., Ramgiri, S.B., Singh, S.B. and Khare, D. 1982. Faba bean, a high protein potential pulse crop. Genetic Culture 1:22.

PROSPECTS FOR FABA BEAN (*VICIA FABA* L.) CULTIVATION IN HARYANA

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Traditionally, chickpea has been the major pulse food legume in India, and more so in Haryana, where it used to account for more than 95%of both area and production of food legumes in the state. However, with the increasing irrigation facilities, the cultivation of chickpeas has been pushed out from irrigated areas into the rainfed areas. Now, almost no food legumes are grown in the irrigated areas of the state. The problem of ascochyta blight has given a further setback to chickpea cultivation, which has consequently decreased drastically.

These factors have led scientists from the Haryana Agricultural University to look for an alternative food legume that could be grown in the irrigated areas during the winter season. This paper presents results of preliminary experiments on faba bean at Hissar.

Materials and Methods

An experiment on seed rate, sowing date, and row spacing was conducted in 1981/82 and 1982/83 at Hissar. The cultivar used was a local variety of the *minor* type (24.54 g/100 seeds). Four sowing dates (1, 16 Oct, 1, and 16 Nov), three seed rates (75, 100, and 125 kg/ha), and three row spacings (20, 30, and 40 cm) were laid out in a split plot design, with *sowing dates* as the main plots and seed rates and row spacings as the sub-plots. In addition to a heavy presowing irrigation, three irrigations were applied during the growing season. A basal dose of 15 kg N and 40 kg P_2O_5/ha was applied at sowing. Usual interrow cultivation practices were also followed.

Results

The results (Table 1) suggest that sowing at any time during October is equally suitable. Sowing in November resulted in lower yields, due to poor growth and shorter grain filling and maturity periods. Our experience has shown that flowering in the late-sown crop often coincides with increasing temperatures in March, resulting in a high degree of flower shedding and poor pod development.

A seed rate of 100-125 kg/ha gave the highest yields. With the lower seed rate, although the number of pods and seeds/plant was quite high, the yields were lower due to the lower plant population.

In both seasons the 20 cm row spacing gave the highest yield (Table 1).

The yield of faba bean in these experiments ranged from 2799 to 4638 kg/ha, compared with an average yield of 600 kg/ha for chickpea in Haryana. Thus, it appears that faba bean shows promise for cultivation under irrigated conditions in Haryana.

Table 1. The effects of sowing date, seed rate, and row spacing on faba bean yield, Hissar, 1981-83.

Treatment	Seed yield (kg/ha)		Mean (kg/ha)
	1981/82	1982/83	
Sowing date			
1 Oct	4140	4638	4389
16 Oct	4373	3869	4121
1 Nov	4023	3560	3791
16 Nov	3406	2799	3102
CD (5%)	8.14	5.26	
Seed rate (kg/ha)			
75	3748	3537	3642
100	4006	3768	3887
125	4266	3849	4057
CD (5%)	1.97	1.46	
Row spacing (cm)			
20	4165	3842	4003
30	3856	3642	3749
40	3931	3666	3798
CD (5%)	1.97	1.46	

We plan to conduct faba bean yield trials on selected farmers' fields. Simultaneously, we shall conduct experiments on faba bean products and consumption.

Acknowledgement

The authors are grateful to Dr. V.P. Singh for his interest in this study, and for critically reviewing the manuscript.

NEIGHBORING PLOTS AFFECT FABA BEAN YIELDS

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Introduction of shorter straw and a determinate growth habit are two steps in the domestication of the faba bean (*Vicia faba*). Plants with Sjodin's (1971) *ti*-1 gene have terminal inflorescences on the stems and thus short, stiff straw and absence of postflowering vegetative development. This gene, and others which stop initiation of new nodes at different growth stages (e.g. Nagl 1979; Filippetti *et al.* 1982; Steuckardt *et al.* 1982; and Frauen and Brimo 1983), have all been considered for use in restructuring the plant. The success of architectural remodelling will be decided in yield trials where short-straw determinate material will be compared with longer straw, indeterminate commercial varieties. The effect of interplot competition between remodelled and conventional material in breeders' trials was assessed by Kempton and Lockwood (1984).

Four spring bean varieties were examined. The Sutton is a *major* type homozygous for *dw-1* which confers short internodes and a dwarf appearance. Ticol is a faba bean population developed by D.A. Bond at the Plant Breeding Institute from Sjodin's (1971) *ti-1* mutant and produces terminal inflorescences after about five flowering nodes. Its final plant height is intermediate between that of The Sutton and two conventional spring bean varieties, Maris Bead and Stella Spring.

A competition diallel was planted with 16 treatments representing all possible pairings of the four varieties. Each plot consisted of three subplots, made up of a central subplot and adjacent subplots of the neighboring variety. Each subplot was made up of 4 rows of 35 plants spaced at 8.5 cm between plants and 30 cm between rows, with a blank row between plots. The 16 treatments were arranged as four replicates of a 4 x 4 lattice square and spatial effects were removed by analysis of variance to give adjusted treatment means.

Table 1 gives the mean yield and height of each variety when grown adjacent to itself, and the difference in its performance, i.e. its response, when grown adjacent to the other three varieties. The shorter varieties, The Sutton and Ticol, showed a decrease in yield of 10-20% when grown alongside the taller Maris Bead and Stella Spring, while Stella Spring showed a complementary increase in yield when associated with The Sutton and Ticol. Plant height was also significantly affected by the associate variety: in particular, Maris Bead was considerably shorter when grown between The Sutton and Ticol than when grown in pure stand or adjacent to Stella Spring. The neighbor effects were thus related to length of straw, taller neighbors inducing longer straw and lower yields and shorter neighbors having the converse effect. The effect on yield was stronger in the outer rows than in the inner ones, although it was significant in both.

Table 1. Effect of neighboring variety on whole plot yield and mean plant height in a competition diallel field trial.

	Neighbor			
Variety	The Sutton	Ticol	Maris Bead	Stella Spring
	Yield			
The Sutton	1829	+18	−323	−359
Ticol	+10	1252	−261	−107
				SE 90
Maris Bead	+13	+84	1674	−60
Stella Spring	+387	+175	+92	1858
	Height			
The Sutton	25.3	+2.1	+0.2	+1.9
Ticol	−2.3	56.5	−4.9	+1.1
				SE 3.3
Maris Bead	−8.5	−8.8	106.1	−1.0
Stella Spring	−5.5	+3.0	+5.9	104.0

Diagonal terms indicate the performance (yield in g/plot and height in cm) of a variety with itself as neighbor, off-diagonals the response to other neighbors with appropriate standard error.

The four varieties, together with Minica (height similar to Ticol) and Metissa (height intermediate between Ticol and The Sutton) were investigated in two further trials, one with single-row plots and the other with four rows (Kempton and Lockwood 1984). The experimental layouts were variants of Finney and Outhwaite's (1956) balanced designs in which every variety occurs as both a left- and a right-hand neighbor to all varieties, including itself. The results for yield and height from these two trials confirmed those from the competition diallel; furthermore, in the single-row trial the ratio of grain yield to total dry matter at harvest was negatively correlated with excess height of the neighboring plot. In another trial, using a balanced design and four-row plots, six commercial varieties which differed in height by less than 15 cm showed no differential effect of intervarietal competition on yield.

In the trial with single-row plots, each cm of height difference was associated with a yield change of 0.4%, compared with 0.25% in the outer rows of the four-row plots. This suggests that in trials using the plot layout of the competition diallel, buffer plots are needed when height differences exceed 20 cm, and that a minimum of two rows of the short variety and two rows of the tall are required as buffers. When this is not practicable in the early stages of selection, height difference with neighbors may be used as the basis for covariance adjustment of yields following Kempton and Lockwood (1984).

References

Filippetti, A., De Pace, C. and Scarascia-Mugnozza, G.T. 1982. Induction of genetic variability in *Vicia faba* L. FABIS 4: 19-21.

Finney, D.J. and Outhwaite, A.D. 1956. Serially balanced sequences in bioassay. Proceedings of the Royal Society of London B. 145: 493-507.

Frauen, M. and Brimo, M. 1983. The inheritance of semi-determinate growth in *Vicia faba* (L). Zeitschrift fur Pflanzenzuchtung 91: 261-263.

Kempton, R.A. and Lockwood, G. 1984. Inter-plot competition in variety trials of field beans (*Vicia faba* L.). Journal of Agricultural Science, Camb. 75.

Nagl, K. 1979. Results of mutation and breeding work on *Vicia faba* in Austria. Pages 355-369 *in* Some Current Research on *Vicia faba* in Western Europe (Bond, D.A., Scarascia-Mugnozza, G.T. and Poulsen, M.H., eds.). Commission of the European Communities EUR 6244 En.

Sjodin, J. 1971. Induced morphological variation in *Vicia faba* L. Hereditas 67: 155-180.

Steuckardt, R., Dietrich, M. and Griem, H. 1982. Ergebnisse von Kreuzungsanalysen mit terminalinfloreszenten (*ti*) Mutanten und daraus entwickelten Zuchtstammen bei *Vicia faba* L. Archiv fur Zuchtungforschung 12: 33-42.

FABA BEAN CULTIVARS IN EGYPT

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Cultivar: Giza 1

Origin: An individual plant selection from a cross between two landraces (Line 17 and Line 24).

The cultivar was released to farmers in 1957 and was replaced by Giza 3 in 1978.

Agronomic characters:

Flowering: 55-60 days after sowing

Plant height: 90-110 cm at harvest

No. of stems/plant: 3-4

Maturity: 150-160 days after sowing

Seed size: Medium seeded type (100-seed weight = 65 g)

Seed color: Light brown, with black hilum

Seeds/pod: 3-4

Protein content: 28%

Reaction to orobanche: Susceptible

Region of cultivation: North Delta Region.

Cultivar: Giza 2

Origin: An individual plant selection (F.148) in landraces, It was released in 1957.

Agronomic characters:

Flowering: 45-50 days after sowing

Plant height: 80-100 cm

No. of stems/plant: 3-4

Maturity: 140-150 days after sowing

Seed size: Medium-seeded type (100-seed weight 60 g)

Seed color: Light brown, with black hilum

Seeds/pod: 3-4

Protein content: 28%

Disease reaction: Susceptible to chocolate spot and rust

Reaction to orobanche: Susceptible

Region of cultivation: South Delta region and Middle Egypt (50,000 ha); will be replaced by Giza 402.

Cultivar: Giza 3

Origin: An individual plant selection from a cross between Giza 1 and Dutch introduction (NA 29). It was released in 1978.

Agronomic characters:

Flowering: 55-60 days after sowing

Plant height: 100-110 cm at harvest

No. of stems/plant: 3-4

Maturity: 150-160 days after sowing

Seed size: Medium-seeded type (100-seed weight 60 g)

Seed color: Light brown, with black hilum

Seeds/pod: 3-4

Protein content: 28%

Disease reaction: Tolerant to chocolate spot and rust diseases

Reaction to orobanche: Highly susceptible

Region of cultivation: North Delta Region (35,000 ha).

Cultivar: Giza 4

Origin: An individual plant selection from a cross between Giza 1 and Dutch introduction (NA 29). It was released in 1978, and is now being replaced by Giza 402.

Agronomic characters:

Flowering: 50-55 days after sowing

Plant height: 100-110 cm

No. of stems/plants: 3-4

Maturity: 130-140 days after sowing

Seed size: Medium-seeded type (100 seed weight 60 g)

Seed color: Light brown, with black hilum

Seeds/pod: 3-4

Protein content: 24%

Disease reaction: Moderately susceptible to chocolate spot and rust

Reaction to orobanche: Highly susceptible

Region of cultivation: Upper Egypt (20,000 ha).

Cultivar: Rebaya 40

Origin: An individual plant selection in landraces. It was released in 1957, and will now be replaced by Giza 402.

Agronomic characters:

Flowering: 45-50 days after sowing

Plant height: 90-110 cm at harvest

No. of stems/plant: 2-3

Maturity: 120-130 days after sowing

Seed size: Medium-seeded type (100 seed weight 55 g)

Seed color: Light brown, with black hilum

Seeds/pod: 2-3

Protein content: 25%

Disease reaction: Highly susceptible to chocolate spot and rust

Reaction to orobanche: Susceptible

Region of cultivation: Upper Egypt (5,000 ha).

Cultivar: Giza 402

Origin: An individual plant selection in natural cross involving two selections in landraces (Rebaya 40 and F.216) on one hand and unknown *major*-type parents on the other hand. It was released 1983 and will replace Giza 2 in Middle Egypt and Rebaya 40 and Giza 4 in Upper Egypt.

Agronomic characters:

Flowering: 55-60 days after sowing

Plant height: 110-120 cm at harvest

No. of stems/plant: 2-3

Maturity: 130-140 days after sowing

Seed size: Medium-seeded type (100-seed weight 75 g)

Seeds/pod: 3-4

Protein content: 28%

Disease reaction: Highly susceptible to chocolate spot and rust

Reaction to orobanche: Tolerant

Region of cultivation: Middle and Upper Egypt (75,000 ha) by 1989.

Physiology and Microbiology

EFFECT OF USING SOME CHEMICALS AS BIO–STIMULANTS ON THE GROWTH AND YIELD OF FABA BEAN

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Faba bean (*Vicia faba* L.) is the most important leguminous crop cultivated in Egypt, and its seeds provide a cheap source of protein. Improvement in the yield and nutritional value of faba bean seeds is needed. A new tool in agriculture is the use of chemical growth regulators to modify growth pattern and thus affect yielding capacity of plants.

The present work studied the effect of foliar application of three chemicals (a growth retardant, Pix (1,1-dimethyl piperidinium chloride), a selective postemergence herbicide, Basagran (3-isopropyl-(1H)-2,1,3-benzothiodiazin 4 (3 H) - one 2,2 - dioxide (Bentazon)), and a special trace-elements fertilizer Fetrilon, (containing Mg, Mn, Fe, Cu, Zn, B, Mo, and Co in chelating form) on the growth, yield, and biochemical components of faba bean under the environmental conditions of Egypt, and also to determine their stimulant or inhibitory action in plant metabolism. These chemicals are manufactured by BASF Aktiengesellschaft, West Germany. The study was carried out at Giza (a pot experiment) and Sids (a field experiment) Experimental Stations in 1982/83 and 1983/84 seasons, respectively.

The pot experiment

An outdoor pot experiment (10 kg of clay loam soil and three plants per pot) was conducted using faba bean cv Giza 2. Pix and Basagran were applied at two concentrations (1250 ppm or 2500 ppm) and the spraying was done only one time at two application dates, 30 days or 60 days after planting. The biochemical determinations were done either on the drymatter of vegetative growth of plants randomly selected 10,40,70, and 100 days after spraying or on the seeds at harvest. Statistical analysis indicated that only plants selected 10 days after the early application (30 days after planting) revealed significant differences in their content of crude protein, total carbohydrate, and P, while K and Ca concentration did not alter significantly.

A detectable alteration in certain biochemical components of the seeds was shown with both treatments. Pix treatments significantly increased crude protein and P percentages (in the plant dry matter), globulin, prolamine, and non-soluble protein fractions (in the seeds). Only one treatment (2500 ppm of Pix) significantly increased the crude protein concentration in the seeds. The increases shown in these components could be attributed to the favorable effect of Pix on some physiological aspects such as CO_2 fixation (Cothren *et al.* 1977), chlorophyll concentration and chlorophyll a/b ratio (Namken & Gausman 1978), and photosynthesis capacity (Walter *et al.* 1978). Basagran also effected similar changes in these compounds but the magnitude was different. In addition, it significantly enhanced total carbohydrate percentage

Table 1. Yield components of faba bean (cv Giza 2) as affected by foliar application of Pix and Basagran (mean/pot), Giza, 1982/83.

Treatments	No. of pods		Weight of pods (g)		Seed yield (g)	
	A[1]	B[2]	A	B	A	B
Control	21.3		57.9		46.5	
Pix 1250 ppm	29.0	25.5	77.5	73.2	63.6	59.2
Pix 2500 ppm	28.0	25.0	72.3	71.7	57.6	55.1
Basagran 1250 ppm	29.1	23.8	76.7	68.8	60.8	52.1
Basagran 2500 ppm	28.8	21.8	72.2	63.3	56.8	49.5
L.S.D. at 5%	2.6		4.9		5.1	

[1] A = First application date, 30 days after planting.
[2] B = Second application date, 60 days after planting.

in drymatter, and gluteline and total soluble protein fractions in the seeds. These results were as expected and agree with the findings of Moreland (1967).

Generally, the early-application treatments exhibited a significant increase in the number of pods over the corresponding late applied treatments. However, all chemical sprays showed a significant increase in the weight of pods per pot over the control. Seed yield per pot showed a similar trend to that observed in pod weight, except in the case of Basagran 2500 ppm treatment at 60 days after planting (Table 1). Date of application significantly affected both weight of pods and seed yield in Basagran-treated plants, early application giving larger values. Conversely, date of application did not significantly affect yield components of Pix treatments excepting the pod number per plant, which showed significant increase with the early spray.

The field experiment

Twelve treatments were arranged in a randomized complete block design with five replications. Cultivar Giza 402 was planted in a clay loam soil and the normal cultural procedures for growing this crop were practised. Chemical concentrations used in this study were 1250 ppm for each of Pix and Basagran and 2000 ppm for Fetrilon. Each chemical was sprayed alone or in combination with others. Spraying was done either once (30 days after planting) or twice (30 and 60 days after planting) using 200 l/feddan (one feddan = 0.24 ha) for each chemical solution.

Pix at 1250 ppm applied either once or twice signficantly increased seed yield by 31.2 and 28.0%, respectively, over the control, while yield did not differ signficantly between the two sprayed treatments. Similar results were also obtained when these treatments were combined with Fetrilon (Table 2), while the remaining treatments did not significantly affect the yield. Fetrilon itself had no favorable effect on seed yield either sprayed alone or in combination with other chemicals. This lack of response

Table 2. Seed yield of Giza 402 as affected by foliar application of Pix (1250 ppm) and Fetrilon (2000 ppm), Sids, 1983/84.

Treatments		[1]Ardab/Feddan
Control		16.65
Pix	(A)[2]	21.84
Pix	(B)[3]	21.31
Fetrilon	(A)	15.99
Fetrilon	(B)	17.07
Pix + Fetrilon	(A)	19.03
Pix + Fetrilon	(B)	19.66
L.S.D. at 5%		2.33

[1] One Ardab = 155 kg.
[2] A = Sprayed once (30 days after planting).
[3] B = Sprayed twice (30 and 60 days after planting).

may be because of the abundance of essential trace elements in the soil of the experiment site and hence plants were not deficient in these nutrients. Also, since faba bean plants did not reveal any susceptibility when sprayed with each of Basagran and Pix, Fetrilon did not perform its expected function (as a source of certain heavy metal ions) to *reverse* or correct the toxicity of these chemicals if present. Crude *protein of seeds* was not significantly affected by any treatment.

From these results, it can be concluded that foliar application of Pix significantly enhanced the seed yield of both Giza 2 and Giza 402 cultivars grown at two locations (Giza and Sids) with different environmental conditions, whilst its significant favorable effect on the crude protein concentration in seeds was only noticed in cv Giza 2. These results are in agreement with those obtained in cotton plants by Willard *et al.* (1977) and Makram *et al.* (1981). Follin (1979) reported that Pix seems to have an effect in reducing abscission of cotton flowers, probably through an anti-auxin action. The seed yield response of the two cultivars to Basagran application may be due to genetic differences in their tolerance to this herbicide (El-Hyatemy *et al.* 1981).

References

Cothren, J.T., Nester, P.R. and Stutte, C.V. 1977. Some physiological responses of cotton to 1, 1-dimethyl-piperidinium chloride. Proceedings of the Fourth Annual Meeting, Aug 9-11, 1977, Plant Growth Regulator Working Group, Hot Springs, Arkansas, USA

El-Hyatemy, Y.Y., Rammah, A.M., Abou El-Leil, G.A., and El-Rays, F.M. 1981. Effect of foliar application of 2, 4-DB on the growth of alfalfa. Ain Shams University, Cairo, Bulletin No. 1497.

Follin, J.C. 1979. Action des reducteurs de croiss ance sur le cottonnier en afrique de L'ouest et en afrique centrals. Presentation an 10 conference du Columa, Paris (with English summary, cited from Pix pamphlet, crop protection division, BASF, Jan., 1980; p. 30-36).

Makram, E.A., El-Ghandour, M.A., and Ali, S.A. 1981. Effect of growth retardant 1, 1-dimethyl piperidinium chloride on growth, flowering and yield of Egyptian cotton. Ain Shams University, Cairo, Bulletin No. 1626.

Moreland, D.E. 1967. Mechanisms of action of herbicides. Annual Review of Physiology 18: 365-386.

Namken, L.N. and Gausman, H.W. 1978. Practical aspects of chemical regulation of cotton plant growth and fruiting. Pages 23-25 *in* Beltwide cotton Production-Mechanization Conference Proceedings, Dallas, Texas, USA.

Walter, H., Gausman, H.W., Namken, L.N., and Rodriguez R.R. 1978. Effect of 1, 1-dimethyl-piperidinium chloride on growth and CO_2 assimilation of cotton. American Society of Agronomy Abstracts. p. 171.

Willard, J.I., Kupelian, R.H., and Schott, P.E. 1977. Effect of 1, 1-dimethyl-piperidinium chloride on cotton yield and development. Page 69 *in* Beltwide Cotton Production Research Conference Proceedings, Atlanta, GA.

EFFECT OF PLANT GROWTH REGULATOR COMBINATIONS ON FRUIT ABSCISSION IN *VICIA FABA* L.

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Abscission — the natural process by which cell-to-cell adhesion is lost at specific points in plants — plays an important role in affecting the productivity of many crops (Osborne 1984). In *Vicia faba*, the high abscission rates of reproductive organs often greatly reduce the yield potential to an uneconomically low level. Keller (1974) and Gates *et al.* (1983) observed losses of reproductive organs during reproductive development in faba bean which ranged from 36 to 87% depending on the variety. Studies on fruit abscission in *Vicia faba* have shown two main reasons for this phenomenon: firstly, the competition for assimilates between apex and reproductive organs and between reproductive organs themselves (Jaquiery and Keller 1978), and secondly, limitations caused by the vascular architecture (Gates *et al.* 1983). Both the competition for assimilates and the induction of the vascular tissue are probably influenced by phytohormones.

Bellucci *et al.* (1983), using gibberellic acid (GA_3), succeeded in increasing the fruit-set in *Vicia faba* under certain circumstances. By using growth-regulator combinations which may be compatible with the endogenous hormonal balance, we obtained the results reported in this paper.

According to the concept of hormonal balance, growth and development depend upon a quantitative relationship between the levels of interacting growth substances (Wareing 1978). Based on this concept, we considered time of application, concentration, and different growth substances when combining them.

Materials and Methods

The experiments consisted of field trials in 1981-1983 with the faba bean cv Herz Freya. In 1981, a field screening test was conducted with 70 different treatments of single or combined growth substances such as GA_3, $GA_{4/7}$ (gibberellic acid), BA (N6-benzyladenine), NAA (1-Naphthylaceticacid), ABA (abscissic acid), Atrinal (dikegulaksodium), and Alar (daminozide). The most promising treatments were slightly modified and tested in more detail at two different locations in 1982. In 1983, our research focused on three growth-regulator combinations which also included the new growth retardants, Paclobutrazol and Tetcyclacis. The aim was to approach a faba bean ideotype for middle Europe as postulated by Dantuma *et al.* (1983), i.e. a semi-dwarf small-seeded type. Results of the 1983 study are reported here.

Results and Discussion

A markedly improved fruit-set in the zone affected by treatments with BA was found in all the trials. According to Aufhammer and Solansky (1976), cytokinins are supposed to increase the sink-activity of treated organs. The improved fruit-set due to BA treatment was always found only on a few reproductive nodes. Other parts of the fruit-bearing zone most often had reduced pod-set as compared with untreated plants.

In 1983, BA was applied in combination with Paclobutrazol and NAA (Fig. 1). Fig. 2 shows the effect of this treatment on the abscission of reproductive organs at three different developmental stages. Application of the growth-regulator combination markedly reduced flower production, especially on higher reproductive nodes (Fig. 2). This reduced formation of reproductive organs on higher nodes was compensated for by a signficantly increased setting of young pods on lower nodes as compared with the control. At the final harvest, this surplus of reproductive structures had disappeared almost completely. The reason was a delayed, but ultimately not reduced, drop of pods. Most of the dropped pods were underdeveloped with few or no seeds.

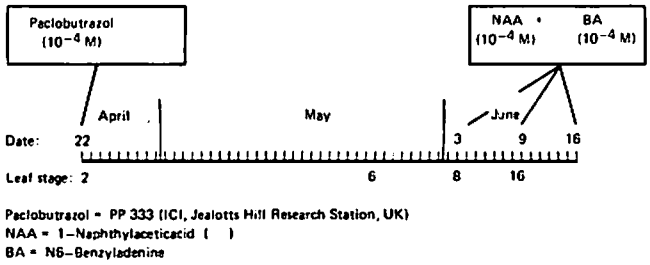

Fig. 1. Growth regulator combination applied in the field trial 1983.

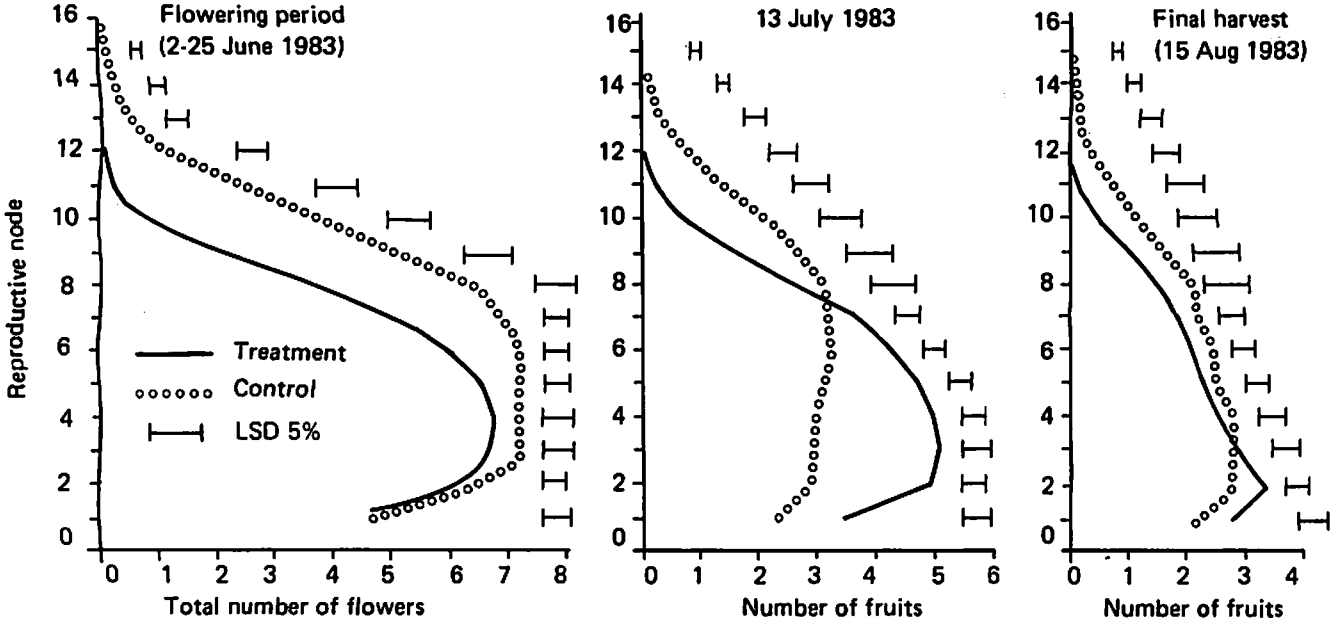

Fig. 1. Effect of the growth regulator combination (treatment) on the abscission of reproductive organs at three different developmental stages as compared to the untreated control (means of 48 plants).

Table 1 shows the effect of the same treatment on the number of reproductive nodes, the length of the fertile-stem zone, and the height of the lowest and highest reproductive nodes as compared with the untreated control. All these characters were markedly reduced by the treatment.

Table 1. Effect of the growth regulator combination on the number of reproductive nodes, the dimension of the fertile stem zone, and the height of the lowest and highest reproductive nodes in faba bean cv Herz Freya at final harvest (mean of 48 plants).

	Treated	Control	LSD 5%
Number of reproductive nodes	8.4	10.5	0.68
Length of the fertile-stem zone (cm)	43.0	66.6	4.36
Height of the lowest reproductive node (cm)	42.0	50.3	3.03
Height of the highest reproductive node (cm)	85.0	117.0	4.63

The treated plants showed a much more compact growth habit, with fewer and shorter internodes than plants treated with Paclobutrazol only. The observed effects can therefore be mainly attributed to BA and NAA. This is true also for the effect of the growth-regulator combination on lodging resistance, which was significantly improved due to the repeated applications of NAA and BA.

In conclusion, endogenous BA and IAA seem to play important roles in the abscission of reproductive organs in *Vicia faba*. According to the auxin-gradient theory, its gradient across the abscission zone regulates the onset and rate of abscission (Smith 1982). A second theory states that the primary action of auxin is directly on the abscission zone, with low concentration accelerating, and high concentration inhibiting, abscission.

Our results clearly showed the involvement of growth substances in the regulation of abscission in *Vicia faba*. Until now we have no evidence as to whether abscission is directly influenced by changes in the hormonal balance or indirectly by an altered sink activity of the reproductive organs.

The success of growth substance applications seems to depend to a great extent on tissue sensitivity. According to Trewavas (1982), plant tissues are not sensitive to growth substances at all stages of development.

Following the theory of growth substance sensitivity, combined or repeated applications seem to be more effective than single-growth regulator treatments. To increase the certainty in growth substance application it is necessary to better understand tissue sensitivity and the impact of changes in the hormonal balance on plant growth and development.

References

Aufhammer, W. and Solansky, S. 1976. Beeinflussung der assimilatspeicherungsprozesse in der sommergerstenahre durch kinetinbehandlungen. Zeitschrift fur Pflanzenernahrung und Bodenkunde 4: 503-515.

Bellucci, S., Keller, E.R. and Schwendimann, F. 1982. Einfluss von wachstumsregulatoren auf die entwicklung und den ertragsaufbau der ackerbohne (*Vicia faba* L.). Teil I: Wirkung von Gibberellinsaure (GA_3) auf die ertragskomponenten und die versorgung der jungen fruchte mit ^{14}C. Teil II: Wirkung von Gibberellinsaure (GA_3) auf die vegetative entwicklung. Angewandte Botanik 56:35-71.

Dantuma, G., von Kittlitz, E., Frauen, M. and Bond, D.A. 1983. Yield, yield stability and measurements of morphological and phenological characters of faba bean (*Vicia faba* L.) varieties grown in a wide range of environments in western Europe. Zeitschrift fur Pflanzenzuchtung 90: 85-105.

Gates, P., Smith, M.L. and Boulter, D. 1983. Reproductive physiology of *Vicia faba* L. Pages 133-142 *in* The Faba Bean (Hebblethwaite, P.D., ed.) Butterworth, London, U.K.

Jaquiery, R. and Keller, E.R. 1978. Beeinflussung des fruchtansatzes bei der ackerbohne (*Vicia faba* L.) durch die verteilung der assimilate. Teil I. Angewandte Botanik 52: 261-276.

Keller, E.R. 1974. Die ackerbohne (*Vicia faba* L.) eine vergessene kulturpflanze mit zukunftsaussichten? Schweizerische Landwirtschaftliche Forschung 13: 287-300.

Osborne, D.J. 1984. Abscission in agriculture. Outlook on Agriculture 13: 97-103.

Smith, M.L. 1982. Factors affecting flower abscission in field beans (*Vicia faba* L. *minor*). Ph.D. Thesis, Durham University.

Trewavas, A.J. 1982. Growth substance sensitivity: The limiting factor in plant development. Plant Physiology 55: 60-72.

Wareing, P.F. 1978. Some general aspects of growth substance interaction. British Plant Growth Regulator Group Monograph 2: 1-9.

Agronomy and Mechanization

EFFECT OF VARIETY, CHEMICAL CONTROL, SOWING DATE, AND TILLAGE ON *OROBANCHE* SPP. INFESTATION AND FABA BEAN YIELD

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Introduction

Orobanche spp. parasitism is one of the main constraints to faba bean production in Egypt. Heavy orobanche infestations cause drastic reduction in seed and straw yields. Plant breeders developed line F 402 (later released as variety Giza 402) which has resistance to orobanche, and allows fewer orobanche spikes to grow, resulting in more parasite-free faba bean plants (Nassib *et al.* 1979; Nassib *et al.* 1982). Other control methods include applying glyphosate (Schmitt *et al.* 1979; Schluter and Aber 1980; Zahran 1982) and delaying sowing (Zahran 1982; Mesa-Garcia and Garcia-Torres 1982). The objective of this study was to investigate the effect of integrating variety, chemical control, and cultural practices on orobanche infestation and faba bean yield.

Materials and Methods

The experiments were carried out on farmers' fields naturally infested with orobanche at El-Tawfekia and Saft El-Khamar sites in Minia Governorate, Egypt, during the winter season 1981/82.

The four factors studied were:

- Variety: Giza 2 (susceptible) and Giza 402 (resistant)
- Glyphosate application: control (not sprayed) and two and three sprays
- Sowing date: mid-October and mid-November
- Tillage system: regular tillage and zero-tillage

A split-split plot design with four replications was used. The two tillage systems were allotted to main plots, the two sowing dates to sub-plots, and the six factorial combinations of the two varieties and three chemical treatments to sub-sub plots. The plot size was 24 m^2. The tilled plots were plowed twice and then ridged. In non-tilled plots, planting took place on the old ridges after the previous summer crop (corn at El-Tawfekia and cotton at Saft El-Khamar) had been harvested. The first chemical spray was applied at the start of flowering, and the second and third at three-week intervals thereafter. Glyphosate (Lancer) was applied with a manual knapsack sprayer at 64 g a.i./ha in 500 l of water /ha.

The soil at El-Tawfekia was a silty loam, and at Saft El-Khamar was a sandy clay. Seed was planted by hand in single-seeded hills, 15 cm apart, with three rows per ridge. Ridges were 60 cm apart. Plant population was 33 plants/m^2. Statistical combined analysis was applied to the data of the two experiments.

Results and Discussion

The orobanche infestation was high, as indicated by the orobanche spike number (36,500 spikes/ha) and the air dry weight (98 kg/ha) at crop harvest (average of the two sites, Fig. 1). The results are presented as the combined data of the two sites.

Variety x glyphosate

For both varieties, orobanche infestation was significantly reduced by glyphosate application. The third spray did not greatly reduce the number and weight of orobanche spikes as compared with the two spray regime (Fig. 1).

In the control and two-spray treatment the resistant variety Giza 402 seemed to have been less infested by orobanche than Giza 2 (Fig. 1).

The average weight of individual spikes of orobanche was increased by glyphosate application in both varieties. The effect of the three-spray regime was more conspicuous (Fig. 1). This is due to less intraspecific competition. Abdalla (1982) observed that where there were fewer orobanche spikes present, they were generally taller, thicker, and heavier.

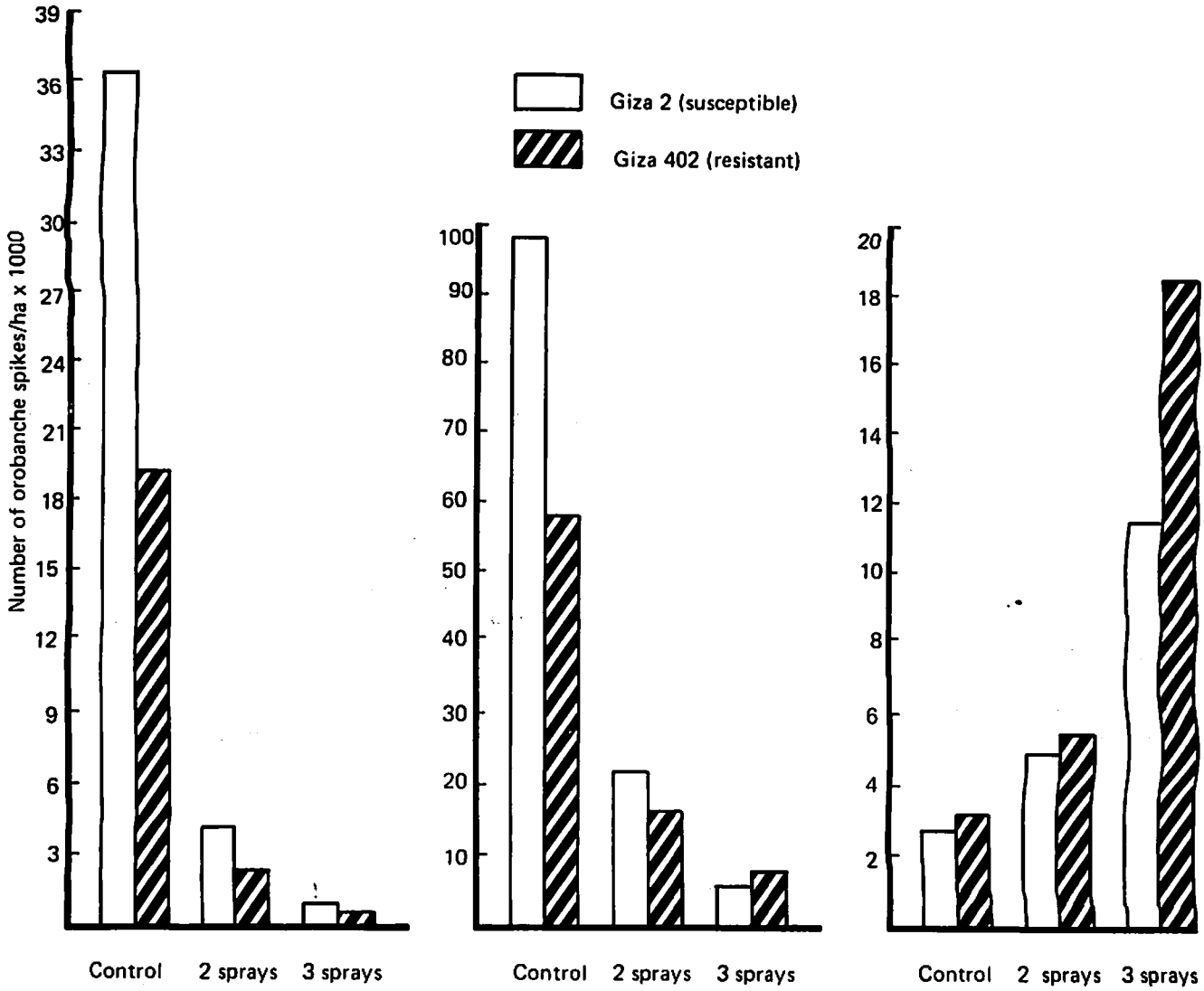

Fig. 1. Effect of variety and glyphosate spray on *Orobanche* infestation of faba beans.

Orobanche spikes on Giza 402 were heavier than those on Giza 2 when chemical control was maximized by applying three sprays of glyphosate (Fig. 1). Nassib *et al.* (1979) ascribed the resistance of Giza 402 to less production of lateral roots and more compact root mass than Giza 2. The difference in nature of root growth results in less contact between parasite seeds and the root mass of the resistant variety late in the season. The difference in the susceptibility of the two genotypes is also probably associated with mechanical hinderance offered by host root tissue to penetrating parasite haustoria (unpublished data) which ultimately shortens the infection period of Giza 402 compared with that of Giza 2. When the third chemical spray was applied six weeks after flowering it destroyed most of the few parasite tubercules which were present on the root mass of Giza 402. The combined effect of resistance and chemical control during the late infection period resulted in emergence of only a few orobanche spikes with heavier dry weight per spike.

Giza 402 showed no significant increase in seed or straw yield with chemical control. However, the seed and straw yields of Giza 2 were increased by 1.0 t/ha (27.8%) and 1.18 t/ha (20.9%), respectively, when two sprays of glyphosate were applied (Table 1). Seed and straw yields of Giza 402 without chemical control were similar to those of Giza 2 when sprayed twice. Thus, at the level of orobanche infestation of the two sites, the inherent resistance of Giza 402 could combat orobanche attack without chemical control.

Table 1. Effect of variety and glyphosate spray on faba bean seed and straw yields and harvest index across two sites in Minia Governorate, 1982.

Variety x spray	Seed yield t/ha	Straw yield t/ha	Harvest index
Giza 2 - no spray	3.60	5.65	0.39
- two sprays	4.60	6.83	0.40
- three sprays	3.84	5.59	0.41
Giza 402 - no spray	4.22	6.79	0.38
- two sprays	4.62	7.50	0.39
- three sprays	4.61	7.19	0.40
LSD (5%)	0.69	1.12	ns

The third glyphosate spray was detrimental to Giza 2, as indicated by the significant reduction in seed and straw yields. This was not observed in Giza 402. Varietal differences in sensitivity to the chemical may be the reason.

Sowing date x tillage

Sowing on 15 October and the zero-tillage treatment increased the number and dry weight of orobanche spikes/ha over those of the 15 November sowing and regular tillage treatments, respectively (Fig. 2). Increased intra-specific competition resulted in lower average weight of orobanche spikes in the early-planted and regular tillage treatments (Fig. 2). Broomrape attachment and emergence was reported by Mesa-Garcia and Garcia-Torres (1982) to occur more intensively and at an earlier stage of growth of faba beans in the early than in the late-sown crop. A positive effect of deep tillage on orobanche control was reported by Aleksiev (1967), Frater (1975), and Saghir and Dastgheib (1978), while Kukula and Masri (1984) found no difference between deep- and zero-tillage treatments. The discrepancy between the results of these studies could be attributed to differences in soil moisture content/porosity/tillage interactions during the infection period.

With zero-tillage, the seed yield was increased, on an average of the two varieties, by 1.38 t/ha (37.6%) by delaying planting from 15 October to 15 November (Table 2). Over both tillage systems, straw yield was decreased by 2.15 t/ha (28.0%) when planting took place on the later date.

Delayed sowing and the tillage treatment significantly increased the Harvest Index of both varieties.

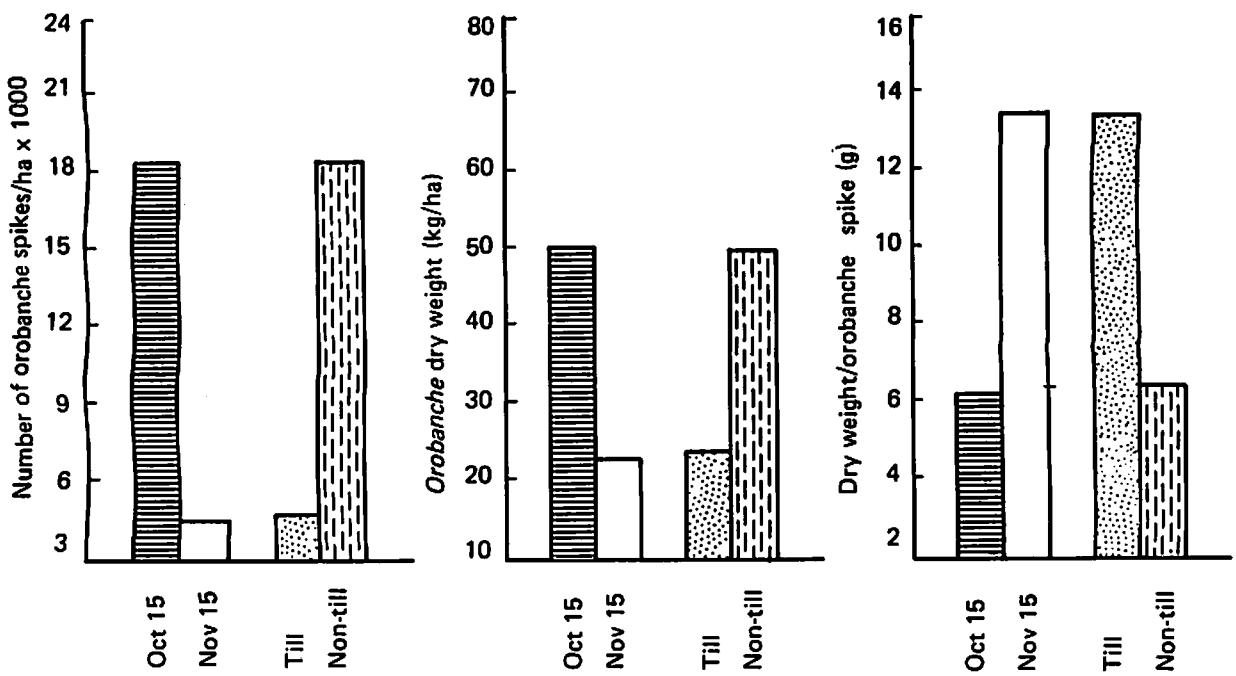

Fig. 2. Effect of sowing dates and tillage systems on *Orobanche* infestation of faba beans.

Table 2. Effect of sowing dates and tillage systems on faba bean seed and straw yields and harvest index across two sites in Minia Governorate, 1982.

Sowing date	Yield (t/ha)						Harvest Index		
	Seed			Straw					
	Till	Non-till	Mean	Till	Non-till	Mean	Till	Non-till	Mean
Oct 15	4.06	3.67	3.87	7.42	7.91	7.67	0.35	0.31	0.33
Nov 15	4.22	5.05	4.63	5.02	6.02	5.52	0.46	0.46	0.46
Mean	4.14	4.36	4.25	6.22	6.96	6.59	0.41	0.38	0.40
LSD at 0.05 probability									
Sowing date			0.60			1.08			0.03
Tillage			ns			ns			0.02
Sowing date x tillage			0.85			ns			ns

Table 3. Effect of sowing date x variety x spray interaction on *Orobanche* infestation, faba bean seed and straw yield, and harvest index across two sites in Minia Governorate, 1982.

		Giza 2			Giza 402			LSD (5%)
	Sowing dates	Control	2 Sp	3 Sp	Control	2 Sp	3 Sp	
Number of *Orobanche*/ha[1]	Oct. 15	5.20	4.04	2.90	4.76	3.84	3.18	ns
	Nov. 15	3.92	3.26	2.52	3.82	3.05	1.87	
Weight of *Orobanche*/ha[1]	Oct. 15	2.43	1.52	0.81	2.12	1.34	1.01	0.33
	Nov. 15	1.56	1.15	0.73	1.43	1.04	0.57	
Seed yield (t/ha)	Oct. 15	3.14	3.99	3.57	3.54	4.61	4.36	ns
	Nov. 15	4.05	5.21	4.11	4.90	4.63	4.89	
Straw yield (t/ha)	Oct. 15	6.34	7.51	6.35	7.60	9.45	8.74	ns
	Nov. 15	4.95	6.15	4.83	5.98	5.55	5.64	
Harvest Index	Oct. 15	0.32	0.34	0.36	0.31	0.32	0.33	ns
	Nov. 15	0.46	0.46	0.46	0.45	0.46	0.47	

1. Log transformed values.

Sowing date x variety x glyphosate interaction

Dry weight of orobanche/ha was reduced by delaying sowing to 15 November at all spray levels with both varieties, except Giza 2 when sprayed twice (Table 3). Applying a third spray to Giza 2 was more effective in reducing orobanche spike number and dry weight in plots sown on 15 October than in those sown on 15 November. This is in agreement with the findings of Mesa-Garcia and Garcia-Torres (1984), who highlighted the need for repeated glyphosate applications on early-planted crops, as early planting extends the broomrape cycle.

Sowing on 15 November was stated earlier to reduce orobanche infestation and favor seed yield compared with sowing on 15 October for both varieties. At the later sowing date and with the reported infestation level of the two sites, Giza 2 sprayed twice yielded only 0.31 t/ha more than the resistant variety, Giza 402, without chemical weed control. At current crop prices and herbicide application costs in Egypt, the rate of return to input costs will be 3:1 for chemical control in the susceptible variety. However, the operational difficulties and overdose risk may make this practice not widely applicable in farmers' fields.

Conclusion

For orobanche control in fields with infestation levels and soil texture similar to those in the present study, Giza 402 could be planted around mid-November without glyphosate application. The zero-tillage system could favor faba bean production.

References

Abdalla, M.M.F. 1982. Characteristics of a local faba bean collection and its reaction to orobanche. Pages 207-212 *in* Faba Bean Improvement (Hawtin, G. and Webb, C., eds.). Martinus Nijhoff, the Hague, the Netherlands.

Aleksiev, A. 1967. Trench ploughing as a control measure against broomrape on tobacco. Bulgarski Tyutyun 12 (3): 13-16.

Frater, K.C. 1975. Broomrape control. New Zealand Tobacco Growers Journal, Nov 1975: 10.

Kukula, S.T. and Masri, H. 1984. Integrated cultural practices and chemical control of *Orobanche crenata* in faba bean. Pages 256-261 *in* Proceedings of the Third International Symposium on Parasitic Weeds, ICARDA 7-9 May 1984. ICARDA, Aleppo, Syria.

Mesa-Garcia, J. and Garcia-Torres, L. 1982. Effect of bean (*Vicia faba* L.) planting dates on broomrape (*Orobanche crenata* Forsk.) phenology and competition. Proceedings 1982 British Crop Protection Conference, Weed 2: 757-763.

Nassib, A.M., Ibrahim, A.A. and Saber, H.A. 1979. Broomrape (*Orobanche crenata*) resistance in broad beans – breeding work in Egypt. Pages 133-135 *in* Food Legume Improvement and Development (Hawtin, G.C. and Chancellor, G.J., eds.). IDRC, Ottawa. Available from ICARDA.

Nassib, A. M., Ibrahim, A. A. and Khalil, S. A. 1982. Breeding for resistance to orobanche. Pages 199-206 *in* Faba Bean Improvement (Hawtin, G. and Webb, C., eds.). Martinus Nijhoff, the Hague, the Netherlands.

Saghir, A.R. and Dastgheib, F. 1978. The biology and control of orobanche: a review. Pages 126-132 *in* Food Legume Improvement and Development (Hawtin, G.C. and Chancellor, G.J., eds.). IDRC, Ottawa. Available from ICARDA.

Schluter, K. and Aber, M. 1980. Chemical control of *Orobanche crenata* in field beans in Morocco. Zeitschrift fur Pflanzekrankheiten und Pflanzenschutz 87 (8): 433-438.

Schmitt, U., Schluter, K. and Boorsma, P.A. 1979. Chemical control of *Orobanche crenata* in broad beans. FAO Plant Protection Bulletin (1979), 27(3).

Zahran, M.K. 1982. Weed and orobanche control in Egypt. Pages 191-198 *in* Faba Bean Improvement (Hawtin, G. and Webb, C., eds.) Martinus Nijhoff, the Hague, The Netherlands.

Zahran, K. 1984. Control of parasitic plants (Broomrape and Dodder) in different crops in Egypt. Final Technical Report, Project No. EG-ARS-15 Public low. 480, USAID. Pages 13-15.

YIELD LOSSES OF FABA BEAN DUE TO APHID ATTACK*

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Introduction

Faba bean (*Vicia faba* L.) is an economically important crop in Egypt, being used for human food and for animal and poultry feed. It is liable to attack by several pests in the field, the most injurious being the cowpea aphid, *Aphis craccivora* Koch. This species is particularly common in Middle Egypt, most probably due to favorable weather conditions. The sensitivity of *A. craccivora* to temperature and its potential for migration has been demonstrated in Australia by Gutierrez *et al.* (1971). Sowing date of *Vicia faba* was found to be one of the most important factors affecting the level of infestation with *A. craccivora* in Sudan (Abu Salih *et al.* 1973). It was mentioned by Hinz and Daebeler (1981) that yield losses in faba bean due to aphids depend on the time and intensity of aphid colonization.

The present work was conducted to study population levels of aphids, the degree of damage to the plants, and, consequently, the effect of each infestation level on faba bean yield. The aim was to determine the correct time of application of a single spray of insecticide for aphid control.

Materials and Methods

An experiment was carried out in the field at Sids Research Station, 150 km south of Cairo, which is a good locality for studying aphid activity. The field was divided into 16 experimental plots 3 x 3 m each, separated by 1 m wide strips of uncultivated land. Faba bean variety Giza 2 was sown on 22 Nov 1982, and the plots were divided into four treatments replicated four times as shown in Fig. 1.

a = Plots sprayed at 2-week intervals with dimethoate to keep them aphid-free. The first spray was on 26 Feb 1983 and the last on 9 Apr 1983, giving a total of 4 sprays.

b = Plots planned to be considered similar to farmers practices; sprayed once with dimethoate when the aphid infestation reached a critical stage on 26 Mar 1983.

c	b	d	a
d	c	a	b
b	a	c	d
a	d	b	c

Fig. 1. Design of experimental plots.

c = Plots artificially infested with *Aphis craccivora* on February 9, 13, and 19, at the time when the aphid population in the fields in the locality consisted of few scattered colonies of nymphs. Infested leaflets or terminals were plucked from all over the area and placed on every second plant in the four experimental plots.

d = Plots left untreated to serve as control.

Within each plot, 10 plants were marked randomly in the central rows and were examined weekly to evaluate the level of aphid infestation according to the following scale:

1 = no aphids
2 = a few alate aphids
3 = a few scattered colonies of nymphs
4 = many scattered colonies
5 = many large undistinguishable colonies of nymphs.

At each scoring date the degree of damage in each selected plant was recorded according to the following scale:

1 = no apparent aphid damage
2 = slight damage; some curling of the leaves
3 = heavy damage; more curling; slight honey dew production
4 = very heavy damage; extreme curling of the leaves.

The rating for each treatment was the average of 40 individual scorings (10 plants from each of the four replicates).

At maturity, 10 selected plants from each plot were harvested and the following weights were determined: whole plants, dry pods, seeds, and chaff. The number of pods per plant was also determined individually.

* This work is part of the ICARDA/IFAD Nile Valley Project on faba beans.

Table 1. Level of aphid infestation and damage rating in plants from different treatments (average of 40 individual scorings), Sids, 1982/83.

Treatment	Date of inspection	Level of infestation: No. of plants in level					Damage rating: No. of plants in rating			
		1	2	3	4	5	1	2	3	4
Sprayed 4 times	All season	40					40			
Sprayed once	19 Feb 83	30	10				39	1		
	26 Feb	11	21	8			27	11	2	
	5 Mar	8	21	10	1		7	28	5	
	12 Mar	7	21	11	1		7	26	7	
	19 Mar		15	21	4			11	20	9
	26 Mar		4	14	22			3	22	15
	2 Apr	8	24	6	2			1	10	29
	9 Apr	18	22						12	28
Artificially	19 Feb 83	1	16	22	1		21	18	1	
infested	26 Feb		3	34	3		7	31	2	
	5 Mar		8	23	8	1	1	26	12	1
	12 Mar		4	24	9	3		19	18	3
	19 Mar		8	27	5				21	19
	26 Mar		7	12	13	8			10	30
	2 Apr	10	17	12	1				25	15
	9 Apr	19	21						6	34
Untreated	19 Feb 83	27	13				40			
(control)	26 Feb	11	25	4			26	14		
	5 Mar	7	26	4	3		15	23	2	
	12 Mar	5	25	10			9	27	4	
	19 Mar	1	19	17	3		2	18	20	
	26 Mar	2	11	12	15		1	12	17	10
	2 Apr	11	19	9	1		1	19	14	6
	9 Apr	25	15					1	8	31

Results

Level of aphid infestation and rate of damage in plants of the different treatments:

Results in Table 1 indicate the following:

- The four plots designated 'a' which were sprayed periodically with dimethoate were aphid-free during the *whole* season.

- In the plots *'b'* which were sprayed once on 26 March (similar to farmers' practices), 25% of plants harbored a few alate aphids (level 2) up to 19.2% with no apparent aphid damage (rating 1). Late in February a few scattered colonies of nymphs established (level 3) causing some curling of the leaves (rating 2). The aphid population exhibited a gradual build-up during the third week of March and reached a peak (level 3-4) on 26 March; these plots were sprayed on that day. The symptoms of damage reached a rating of 3-4. After chemical treatment, aphids decreased in number but the symptoms did not change during April.

The plots 'c' which were artificially infested with aphids on 9, 13, and 19 February suffered from a rapid

Table 2. Effect of aphid infestation on faba bean yield, Sids 1982/1983.

Treatment	Mean weight/10 plants (g)				Pods/plant
	Whole plants	Dry pods	Seeds	Chaff	
Sprayed 4 times	1459.2	649.5	499.5	809.7	17.2
Sprayed once	949.4	411.2	333.6	538.1	13.4
Artificially infested	713.5	343.0	275.8	370.5	9.6
Untreated (control)	942.6	381.2	298.0	561.4	11.6
LSD 5%		60.05			

build-up of many scattered colonies of nymphs (level 2-4) during March and infestation reached a peak on 26 March (level 2-5). Aphid population decreased gradually during April coinciding with crop maturity. The symptoms of damage ranged between heavy and very heavy during March and were persistant until the last field observation on 9 April.

Untreated plots 'd' harbored few to many scattered colonies of aphids (level 2-4) during March, numbers of which decreased during April, but the plants suffered slight to heavy damage.

Yield

The most important parameter for estimating aphid damage was yield (Table 2). Statistical analysis of the data showed significant differences between the mean seed yields of the different treatments.

The highest weight of seeds, whole plants, dry pods, and chaff, and the highest mean number of pods/plant, were achieved in plots sprayed each 2-weeks with dimethoate aphicide, followed by those sprayed once, similar to farmers' practices, followed by untreated plots. Artificially infested plots showed serious losses in yield.

These results indicate the importance of controlling aphids on faba bean by chemical means once their infestation level reaches a critical stage. Level of infestation number 4 on the scale, indicating many scattered colonies of nymphs, can be considered to be extremely harmful to the crop. It is highly recommended that an aphicidal spray should be carried out just before that stage is reached, which normally occurs during the second half of the month of March in Middle Egypt.

References

Abu Salih, H.S., Ishag, H.M. and Siddig, S.A. 1973. Effect of sowing date on incidence of Sudanese broad bean mosaic virus in, and yield of, *Vicia faba*. Annals of Applied Biology 74: 371-378.

Gutierrez, A.P., Morgan, D.J. and Havenstein, D.E. 1971. The ecology of *Aphis craccivora* Koch and subterranean clover stunt virus. I. The phenology of aphid populations and the epidemiology of virus in pastures in South-East Australia. Journal of Applied Ecology 8: 699-721.

Hinz, B. and Daebeler, F. 1981. Schadwirkung der schwarzen Bohnenblattlaus (*Aphis fabae* Scop.) an Ackerbohnen. Nachrichtenblatt fur den Pflanzenschutz in der DDR 35: 175-178.

IDENTIFICATION OF SOME SOURCES OF RESISTANCE TO DISEASES IN FABA BEAN. I. CHOCOLATE SPOT (*BOTRYTIS FABAE* SARD.)

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Faba bean is extensively grown in Egypt. Average seed yield is lowest in the North Delta region (1.9 t/ha), compared with 2.2 and 2.6 t/ha in Middle and Upper Egypt, respectively. This is mainly due to the greater incidence of chocolate spot (*Botrytis fabae*) and rust (*Uromyces fabae*) diseases in the North Delta region.

The present studies were conducted to determine the field resistance of some faba bean lines to chocolate spot (*B. fabae*), which is the most destructive disease of faba bean in the North Delta region.

Materials and Methods

The studies were carried out at Sakha, Nubaria (North Delta), and Giza research stations during 1980/81, 1981/82, and 1982/83 to identify faba bean breeding lines with resistance to *B. fabae*. The field studies were done under natural epiphytotic conditions at Sakha and Nubaria (disease prevalent area) and under controlled conditions at Giza (disease-free area). The evaluation was also done in the glasshouse at Giza research station.

Field Experiments

In 1980/81, 34 breeding lines, the recommended variety Giza 3, and the highly susceptible variety Rebaya 40 were grown in a randomized complete block design with two replicates at Sakha research station. The experiment was duplicated; plants in one were protected against the disease by spraying with Dithane M45 (Mancozeb), but untreated in the other. Dithane was sprayed four times, starting when 1% infection was observed. The untreated plots were sprayed with water on the same dates.

In 1981/82, 10 promising genotypes, as well as two commercial cultivars, Giza 3 and Rebaya 40, were grown in a split-plot design with three replicates at Sakha and Nubaria research stations. Disease control treatments (Agrimycin, sprayed or unsprayed) were assigned to the main plots, and genotypes to the subplots.

In 1982/83, six genotypes and the two commercial varieties, Giza 3 and Rebaya 40, were tested in a split-plot design with three replicates. Inoculation treatments (plants inoculated with a 150 x 10^3 conidia/ml inoculum from a single chocolate spot isolate, or not inoculated) were assigned to the main plots, and genotypes to the subplots. The trial was conducted under field conditions at Sakha and Nubaria, and under controlled conditions at Giza research station. To ensure successful evaluation at Giza, the plants were inoculated 80 days after emergence with an aggressive *B. fabae* isolate from Nubaria and then covered with polyethylene sheet to maintain leaf wetness overnight, as recommended by Wilcoxson *et al.* (1975), Parlevleit and van Ommeren (1975), Conner and Bernier (1982), and Bernier (1983).

Plot size was 3.6, 5.4, and 5.4 m^2 in 1980/81, 1981/82, and 1982/83, respectively. All recommended cultural practices were followed in the field experiments.

Glasshouse Experiments

The studies were carried out at Giza research station in a glasshouse to evaluate the same genotypes using potted plants and the detached leaf method.

In 1981/82, the 10 genotypes included in the field test, plus Giza 3 and Rebaya 40, were grown in two pot experiments, each with three replicates. In the first experiment, when plants were 40 days old, detached leaves and entire plants were inoculated with a spore suspension (175 x 10^3 conidia/ml) of *B. fabae*. In the second experiment, the plants and leaves were inoculated when 80 days old.

In 1982/83 detached leaves from 80-day old plants were inoculated with a spore suspension (150 x 10^3 conidia/ml) of a single aggressive isolate of *B. fabae* from Nubaria, using a micrometer syringe (Khalil and Harrison 1981).

Varietal reaction to chocolate spot in the field was recorded as percentage infection. In the pot experiments a 0-9 rating scale was used, where 0 = no infection, and 9 = severe infection leading to total defoliation. Average dimensions (in mm) of infection at the inoculated sites were measured in the detached leaf experiments.

Results and Discussion

Field Experiments

In 1980/81, there was little *B. fabae* infection (0-1%) at Sakha until the end of February. From 6 Mar infection gradually increased, reaching a maximum on 15 Apr.

The genotypes differed significantly in their reaction to *B. fabae*. Lines 249/801/80, 249/802/80, 249/803/80, 249/804/80, Seville Giant, R.C. 39/80, and ILB 938 showed the least infection. Lines 139 A/2143/77, 112/3200/74, 122/65/67, 133/2067/77, 90/1966/72, Protein 110/78, Protein 56/78, Protein 114, Comp 2 S_2 L.29, L.58, and NEB 2727/75 were most severely infected. The other 16 lines were intermediate in level of infection.

Dithane M45 application signficantly reduced *B. fabae* infection. However, the degree of reduction differed among the genotypes. The reduction was greatest for the susceptible genotypes and least for the resistant ones.

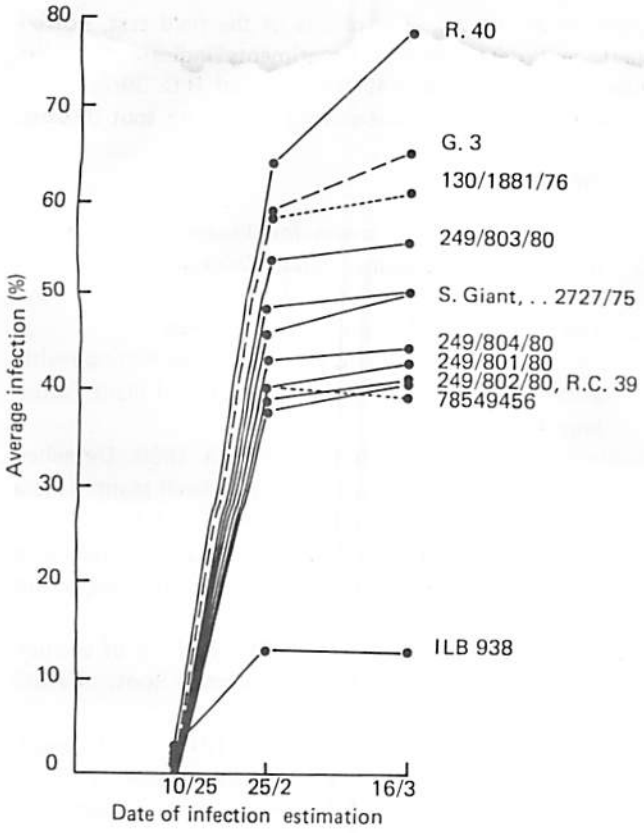

Fig. 1. Development of field infection with chocolate spot on twelve faba bean genotypes at Nubaria in 1981/82.

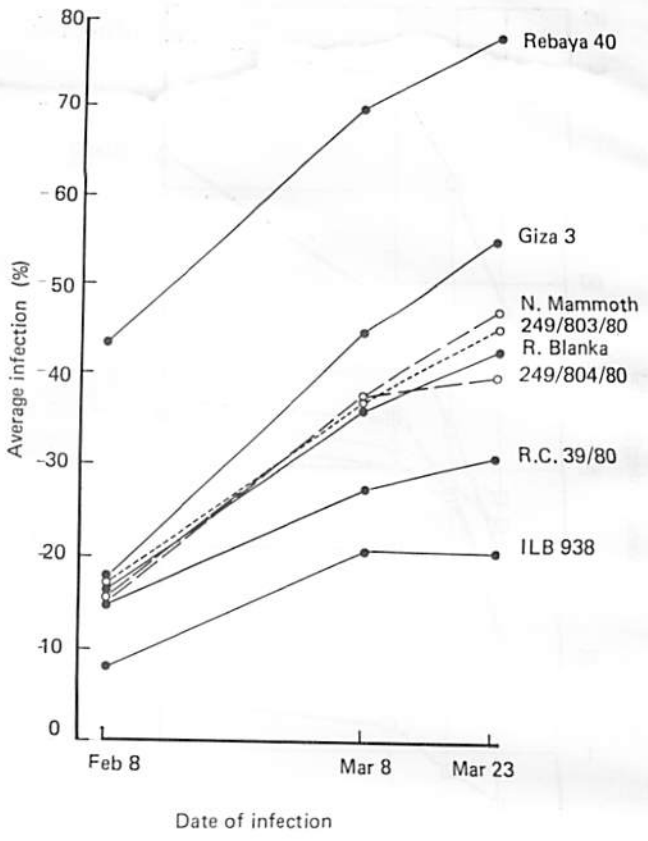

Fig. 2. Development of artificial infection with chocolate spot on eight faba bean genotypes at Nubaria 1982/83.

In 1981/82 at Nubaria, the low level of *B. fabae* infection in early February (Fig. 1) increased from 10-25 Feb to 16 Mar. Agrimycin application reduced chocolate spot infection in all cases; the reduction was significant on 25 Feb and 16 Mar. The same trend was observed at Sakha, although the differences were not significant, because *B. fabae* infection was less.

In 1982/83 at Nubaria, chocolate spot infection was low in early February, and increased gradually up to 23 Mar (Fig. 2). The average infection over all genotypes was significantly higher (48%) under artificial infection than under natural epiphytotic. At Sakha, infection was mild until 20 Mar, and then increased significantly up to 6 Apr (Fig. 3). The inoculated plots at Giza showed the widest range of infection of the three locations (Fig. 4).

ILB 938 was the most resistant line over the three locations, followed by 249/804/80 and R.C. 39/80. All three were significantly more resistant to *B. fabae* than the check Giza 3. Artificial inoculation with *B. fabae* increased infection by about 48% across all locations.

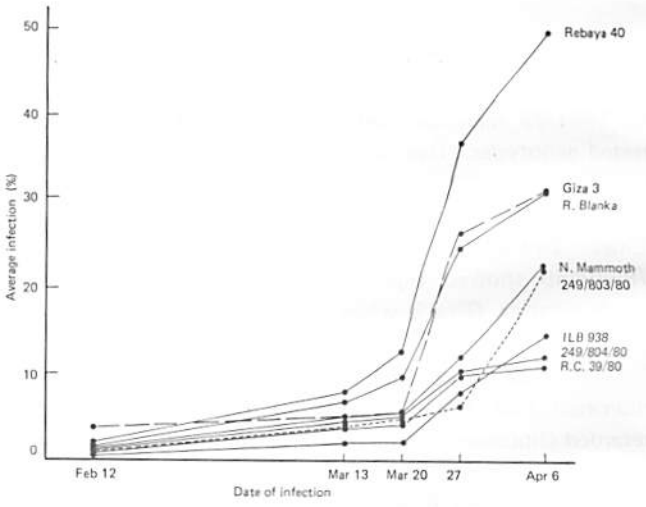

Fig. 3. Development of artificial infection with chocolate spot on eight faba bean genotypes at Sakha 1982/83.

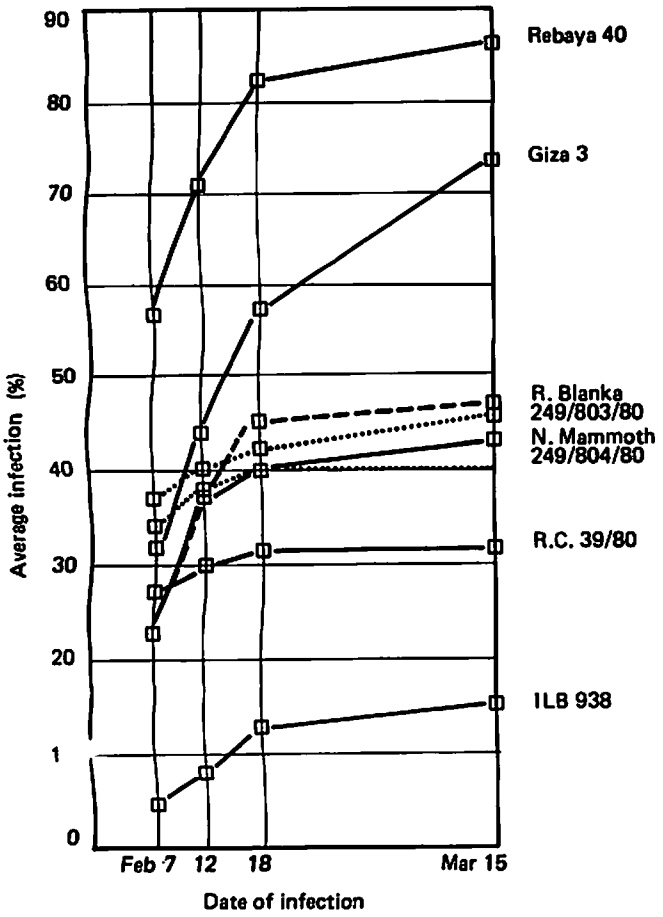

Fig. 4. Development of artificial infection in the field with chocolate spot on eight faba bean genotypes at Giza in 1982/83.

Glasshouse Experiments

In 1981/82 significant differences were observed among tested genotypes. Over the two stages of growth (inoculation at 40 and 80 days of age), line ILB 938 showed the least infection and the lowest rate of disease development. Lines 249/802/80, 249/804/80, Seville Giant, and 78S49456 showed significantly less infection than the check cultivar, Giza 3, when inoculated at 80 days of age.

In 1982/83 results of the detached leaf method indicated that ILB 938, 249/804/80, and R.C. 39/80 retarded chocolate spot disease development.

The resistance to chocolate spot of ILB 938 observed in these trials concurs with the findings of El-Sherbeeny and Mohammed (1980). This line was rated resistant at Lattakia, Syria (Hanounik, personal communication), and ranked first among 13 genotypes tested at Cambridge, UK (Jellis *et al.* 1982). The results of the field test, potted plant, and detached leaf experiments indicate that the three lines, ILB 938, 249/804/80, and R.C. 39/80, may be good sources of resistance to chocolate spot disease.

References

Bernier, C.C. 1984. Strategies for disease control in faba beans. In Faba beans, Kabuli Chickpeas, and Lentils in the 1980s: proceedings of a workshop, 16-20 May, 1983, ICARDA, Aleppo, Syria. (in press)

Conner, R.L. and Bernier, C.C. 1982. Slow rusting resistance in *Vicia faba*. Canadian Journal of Plant Pathology 4: 263-265.

El-Sherbeeny, M.H. and Mohammed, H.A. 1980. Detached leaf technique for infection of faba bean plants (*Vicia faba* L.) with *Botrytis fabae*. FABIS 2: 44-45.

Jellis, G.J., Bond, D.A. and Old, J. 1982. Resistance to chocolate spot (*Botrytis fabae*) in ICARDA accessions of *Vicia faba*. FABIS 4: 53-54.

Khalil, S.A. and Harrison, J.G. 1981. Methods of evaluating faba bean materials for chocolate spot. FABIS 3: 51-52.

Parlevleit, J.E. and van Ommeren, A. 1975. Partial resistance of barley to leaf rust, *Puccinia hordei*. II. Relationship between field trials, micro test plots and latent period. Euphytica 24: 293-303.

Wilcoxson, R.D., Skovmand, B. and Atif, A.H. 1975. Evaluation of wheat cultivars for ability to retard development of stem rust. Annals of Applied Biology 80: 275-281.

PATHOGENIC AND CULTURAL VARIABILITY IN *BOTRYTIS FABAE*

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Introduction

Chocolate spot caused by *Botrytis fabae*, is the most serious disease in faba bean. It is very difficult to control with chemicals or agricultural practices, particularly in regions where extended periods of wet and cool weather conditions prevail (Sundheim 1973, Wilson 1937). Resistant cultivars are the most practical means of reducing losses due to the disease. Unfortunately resistance alone does not always form a complete and permanent solution; when resistant cultivars are released, new strains of the pathogen may arise rendering such resistance less effective (Russel 1978). Studies concerning pathogenic variability in *B. fabae*, as

related to cultural characteristics or geographical origin of the fungus are lacking. However, Hutson and Mansfield (1980) indicated that different isolates of *B. fabae* may vary widely in their pathogenicity and that this pathogen is probably heterokaryotic for virulence factors. Knowledge concerning pathogenic variability in *B. fabae* is therefore essential to plan effective breeding strategies.

This study was initiated to investigate pathogenic and cultural variability among isolates of *B. fabae* obtained from different geographical regions in Syria and Lebanon where chocolate spot is serious.

Materials and Methods

Chocolate spot-infected plants were obtained from faba bean fields in Tel-Kalakh and Lattakia in Syria, and from the Doha area in Lebanon. Infected parts were surface-disinfected in a 0.5% sodium hypochlorite solution for 2 min., plated on FDA medium (200 g faba bean seeds, 18 g agar, and 20 g dextrose), incubated at room temperature, and then subcultured until pure isolates of *B. fabae* were obtained. After 10 days of growth, dilution series were prepared, and single spore isolations were made.

Based on preliminary cultural characteristics, three isolates of *B. fabae* were selected. These isolates were designated L, T, and D, representing Lattakia, Tel-Kalakh, and Doha, respectively.

Plants of seven faba bean lines (BPL 710, 261, 266, 274, 470, 1179, and ILB 1815), selected for diversity of disease reaction, from ICARDA's chocolate spot disease screening nursery, were grown for four months in 25 cm plastic pots in the field. A modification of the detached leaf technique (Hutson and Mansfield 1980) was used to test pathogenic variability among isolates of *B. fabae*. Fully expanded leaflets of similar age were detached from the third node and laid flat on 2-cm-thick moist sponge, lining the bottom of 90 x 40 x 5 cm metal pans. The upper laminal surface was then inoculated separately with different isolates by depositing 0.1 ml droplets of spore suspension containing 6×10^6 spores/ml. One droplet was added on each half of each leaflet, then the pans were immediately covered with polythene sheets and incubated at room temperature ($20 \pm 2^{\circ}C$). Treatments were replicated 3 times in a split plot design with isolates as the main- and faba bean genotypes as the sub-treatments. After 10 days, infections were rated on a 1-9 scoring scale where:

1 = no infection or very few necrotic specks covering 1-25% of the area contacting the inoculum droplet (highly resistant);

3 = necrotic specks covering 26-50% of the area contacting the inoculum droplet (resistant);

5 = necrotic specks coalesced and covering 51-75% of the area contacting the inoculum droplet (moderately resistant);

7 = necrosis covering 76-100% of the area contacting the inoculum droplet (susceptible);

9 = necrosis spreading beyond inoculation site (highly susceptible).

This test was repeated 3 times in the laboratory.

Isolates L, T, and D of *B. fabae* were characterized by studying their growth rate, sporulation, and conidial and sclerotial size, on a Difco potato-dextrose-agar medium (PDA). An agar plug, 5 mm in diameter, taken from the growing margin of a 10-day old colony, was placed in the center of a 9-cm petri dish containing 20 ml of PDA medium, then incubated at $20^{\circ}C$. The growth of each isolate was recorded once every 6 hr by measuring two diameters at right angles. Conidial size and sporulation were measured for each isolate from 12-day old cultures. For conidial size, the length and the width of 30 conidia per isolate were measured. Sporulation of each isolate was determined under the microscope. Plates were flooded with 10 ml of water, then their entire surface was rubbed gently several times using a small brush. The spore suspension formed in each plate was rinsed off throughly into a small beaker and the volume brought up to 50 ml by adding water. Counting was done on 4 samples (0.1 ml each) per replicate. Number of sclerotia per plate was recorded from 28-day old cultures. Sclerotial size was determined by measuring the greatest and smallest dimensions of 30 randomly harvested sclerotia per isolate.

A randomized block design with 4 replicates per isolate was employed for the determination of cultural characteristics.

Results

Faba bean inbred lines varied considerably in their reaction to isolates T, D, and L of *B. fabae* (Table 1), indicating a disease differential potentiality pattern. BPL 710, 261, 266, 274, and 1179, were significantly ($P < 0.01$) more resistant to isolates T, D, and L than were BPL 470 and ILB 1815. Differences in the reaction between BPL 470 and ILB 1815 were also signficant ($P < 0.01$) across all isolates.

The three *B. fabae* isolates varied considerably in their virulence on faba beans. Isolate T was significantly ($P < 0.01$) more virulent than both isolates D and L across all faba bean entries, indicating a distinct pathogenicity pattern.

Table 1. Reaction of detached leaves of certain lines of *Vicia faba* to three different isolates of *Botrytis fabae*.

Origin of isolate	Faba bean lines[1] (BPL) 710	261	266	274	1179	470	ILB[a] 1815
Syria-Tel Kalakh (T)	1.8a	3.5a	3.8a	6.1a	5.8a	7.5a	8.7a
Lebanon-Doha (D)	1.0b	2.1b	2.4b	2.7b	2.4b	5.5b	7.2b
Syria–Lattakia (L)	1.0b	1.8b	2.1b	2.4b	1.8b	5.0b	7.0b

1 Diesease rating on a 1-9 scale. For each column, readings followed by different letters are significantly different ($P < 0.01$) according to Duncan's Multiple Range Test.

The isolates also varied considerably in their cultural characteristics (Fig. 1). The growth rates of isolates T and D were similar, but were significantly ($P < 0.01$) greater than that of isolate L (Fig. 2).

Isolates L and D sporulated significantly ($P < 0.01$) more than isolate T (Table 2). Conidial size ranged from an average of 13.2 x 10.6 µm with isolate D to 15.0 x 12.0 µm with isolate L. These values are within the range of the conidial size of *B. fabae* (Hutson and Mansfield 1980). All three isolates produced irregular black sclerotia. The average number and size of these sclerotia varied considerably among different isolates (Table 3). The average number of sclerotia per plate was significantly ($P < 0.01$) different among the three isolates. Isolate D produced the greatest number of sclerotia, followed by isolate T, and L. The average sclerotial size of isolate T was greatest, followed by isolate D then L.

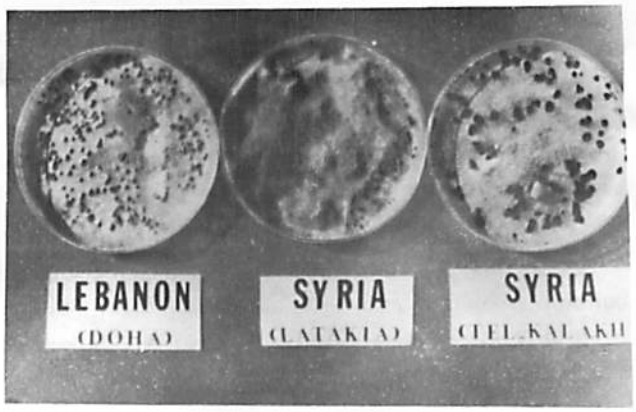

Fig. 1. Three isolates (D, L, and T) of *Botrytis fabae* showing their different cultural characteristics.

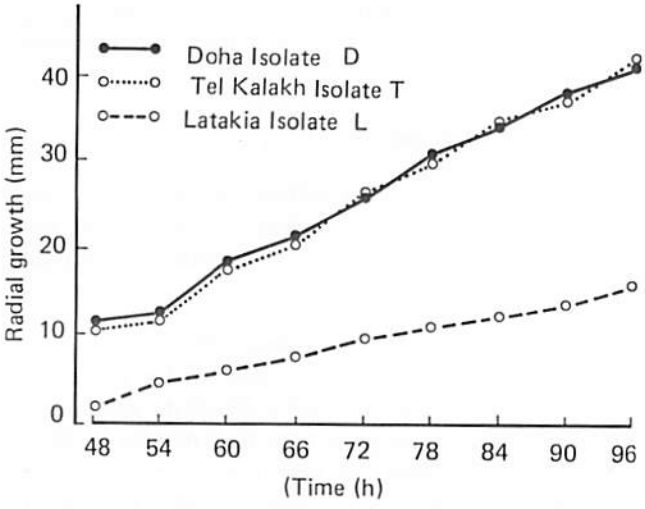

Fig. 2. Growth rate of three isolates of *Botrytis fabae*.

Table 2. Conidial size and sporulation of three isolates of *Botrytis fabae*.

Origin	*B. fabae* isolate	Dimensions of conidia (µm)[1] Length Mean	Length Range	Width Mean	Width Range	Sporulation[2] (X 10^3/ml)
Syria-Lattakia	L	15.0	12.6 - 21.1	12.0	8.4 - 18.0	3240a
Syria-Tel Kalakh	T	13.5	10.5 - 19.0	11.2	8.4 - 16.8	1800b
Lebanon-Doha	D	13.2	10.5 - 16.8	10.6	8.4 - 14.7	3420a

1 Average of 30 readings.

2 Numbers followed by different letters are significantly different ($P < 0.01$) according to Duncan's Multiple Range Test.

Table 3. Number and size of sclerotia of three isolates of *Botrytis fabae.*

Origin	*B. fabae* isolate	Sclerotia per plate[1]	Dimensions of sclerotia (mm)[2]			
			Length		Width	
			Mean	Range	Mean	Range
Lebanon-Doha	D	288 a	2.3	1.0 - 4.0	2.0	1.0 - 3.0
Syria-Tel Kalakh	T	149 b	3.4	1.5 - 5.7	2.9	1.5 - 4.0
Syria-Lattakia	L	107 c	1.3	0.7 - 2.0	1.2	0.7 - 2.0

[1] Numbers followed by different letters are significantly different ($P < 0.01$) according to Duncan's Multiple Range Test.

[2] Average of 30 readings.

Discussion

This investigation revealed a considerable range of pathogenic and cultural variabilities among different isolates of *B. fabae*. The three isolates were highly virulent on ILB 1815, while isolate T was significantly more virulent than isolate D and L across all entries. This is in general agreement with Hutson and Mansfield (1980), who concluded that *B. fabae* may be heterokaryotic for virulence factors. Differences in virulence among isolates T, D, and L should indicate distinct pathogenic variability in *B. fabae*, and must be considered in breeding cultivars resistant to chocolate spot. Although the pathogenicity pattern induced by isolate T is discrete, it would not be appropriate at this stage to designate a race status for it, because it was obtained from a single lesion, and hence may not represent a population (Van der Plank 1975). A wide scale survey is, therefore, needed to determine whether or not such virulence is prevalent in the region.

Based on growth rates, isolates of *B. fabae* can be separated into a slow growing category, represented by isolate L, and a fast growing category represented by isolates D and T. Meanwhile, the fast growing isolates can further be separated into isolate D, with abundant sporulation and sclerotia, and isolate T with sparse sporulation.

Pathogenic variability in *B. fabae* was found to be associated with distinct cultural characteristics. The more virulent isolate T (Table 1) produced significantly ($P < 0.01$) less conidia (Table 2), and formed larger sclerotia (Table 3) than the less virulent isolates D and L.

References

Hutson, R.A. and Mansfield, J.W. 1980. A genetical approach to the analysis of mechanisms of pathogenicity in *Botrytis/Vicia faba* interactions. Physiological Plant Pathology 17: 309-317.

Russel, G.E. 1978. Plant breeding for pest and disease resistance. Butterworths, London. 485 pp.

Sundheim, L. 1973. *Botrytis fabae, B. cinerea* and *Ascochyta fabae* on broad bean (*Vicia faba*) in Norway. Acta Agriculturae Scandinavia 23(1): 43-51.

Van der Plank, J.E. 1975. Principles of Plant Infection. Academic Press, New York. 216 pp.

Wilson, A.R. 1937. The chocolate spot disease of beans (*Vicia faba* L.) caused by *Botrytis cinerea* Pers. Annals of Applied Biology 24: 258-288.

THE CAUSAL ORGANISM OF STEM ROT DISEASE OF FABA BEANS

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Stem rot of faba beans (*Vicia faba*) in England was generally considered to be caused by *Sclerotinia sclerotiorum*, and only sometimes by *S. trifoliorum* (Loveless 1951). Work carried out by Keay (1939) established that *S. trifoliorum* was the causal organism using the taxonomic

criteria then available. She found, however, that there were slight but constant differences in morphological and cultural characters between isolates obtained from faba beans and those from clover, and proposed that the former be regarded as a separate variety, *S. trifoliorum* var *fabae*. This was confirmed by Loveless (1951), who found differences in ascospore size and showed that isolates of *S. trifoliorum* co-inoculated with isolates of *S. trifoliorum* var *fabae* formed incompatibility lines.

The classification of *S. sclerotiorum*, *S. trifoliorum*, and *S. minor* as three separate species has been questioned by some workers (e.g. Purdy 1955) but recent work by Kohn (1979) and Willetts and Wong (1980) on a range of characteristics of isolates of *Sclerotinia* spp. led these authors to confirm that the three species are distinct. Willetts and Wong (1980) concluded, however, that the host range of *S. trifoliorum* was confined to forage legumes and that isolates from grain legumes were included in the same grouping as isolates of *S. sclerotiorum*. This decision was based on isolates collected from French beans (*Phaseolus vulgaris*) and not from faba beans. This paper reports results of a taxonomic study carried out on isolates of *Sclerotinia* spp. collected from faba beans, using some of the techniques described by Willetts and Wong (1980).

Materials and Methods

Isolates

Isolates were derived from diseased faba bean tissue or from sclerotia by surface sterilization in sodium hypochlorite (1% available chlorine) and plating onto potato dextrose agar (PDA). Initially, four faba bean isolates were obtained and identified by studying the electrophoretic patterns of soluble proteins, mycelial characteristics in culture, and mycelial interactions. Later, a further four isolates were characterized using electrophoresis only. All isolates were compared with two standard isolates, one from red clover (*Trifolium pratense*) with dimorphic ascospores typical of *S. trifoliorum* (Kohn 1979) and the other from oilseed rape (*Brassica napus*) with ascospores uniform in size and typical of *S. sclerotiorum*. Details of the isolates are given in Table 1.

Electrophoresis

Sclerotia were cut into small pieces and air dried. About 35 mg were weighed into a glass tube and proteins were dissolved in 250 µl of extracting solution (Smith and Simpson 1983) by soaking at room temperature for 1 h followed by immersion in a sonic bath for 30 min at 60°C and in a boiling water bath for 5 min. The soluble proteins were separated in polyacrylamide gels in the presence of SDS, using separating and stacking gels containing 175 g/l and 30 g/l of acrylamide monomer, respectively (Payne *et al.* 1979). Gels were stained as described by Reid and Bieleski (1968) and Fairbanks *et al.* (1971).

Table 1. Isolates of *Sclerotinia* used in taxonomic study.

Isolate	Locality	Year	Crop
1	Cambs, UK	1982	S.[3] faba bean
2	Cambs, UK	1983	S. faba bean
3	Cambs, UK	1982	W.[3] faba bean
4	Greece[1]	1983	W. faba bean
5	Greece[1]	1984	W. faba bean
6	Essex, UK[2]	1984	W. faba bean
7	Essex, UK[2]	1984	W. faba bean
8	Suffolk, UK[2]	1984	W. faba bean
9	Cambs, UK	1982	Oilseed rape
10	Norfolk, UK	1982	Red clover

1. Isolates obtained from the Institute for Fodder Crops, Larissa, Greece.
2. Isolates obtained from the Agricultural Development and Advisory Service, Eastern Region, UK.
3. S = Spring, W = Winter.

Mycelial Growth

Disks, 0.5 cm in diameter, cut from 4-5-day old cultures of isolates 1-4 and the two standard isolates (9 and 10) were added to 250 ml flasks containing 120 ml of sterile modified Czapek Dox liquid medium (CAT) (Willetts and Wong 1980). The flasks were gently agitated at 25°C for 2 weeks.

Mycelial Interactions

Isolates 1-4, 9, and 10 were grown together in pairs in all combinations on PDA at 20°C in the dark, and examined over a four-week period. Reactions between isolates were classified into four groups: A = compatible, no antagonism; B = faint interaction, white zone; C = interaction, sharp brown demarcation line; and D = strong interaction, brown zone.

Results and Discussion

Isolates could be separated into two main groups based on electrophoretic banding patterns for total soluble proteins. Isolates 1 and 2 had a very similar pattern to the isolate of *S. sclerotiorum* from oilseed rape (isolate 9) and isolates 3-8 had a similar pattern to the isolate of *S. trifoliorum*

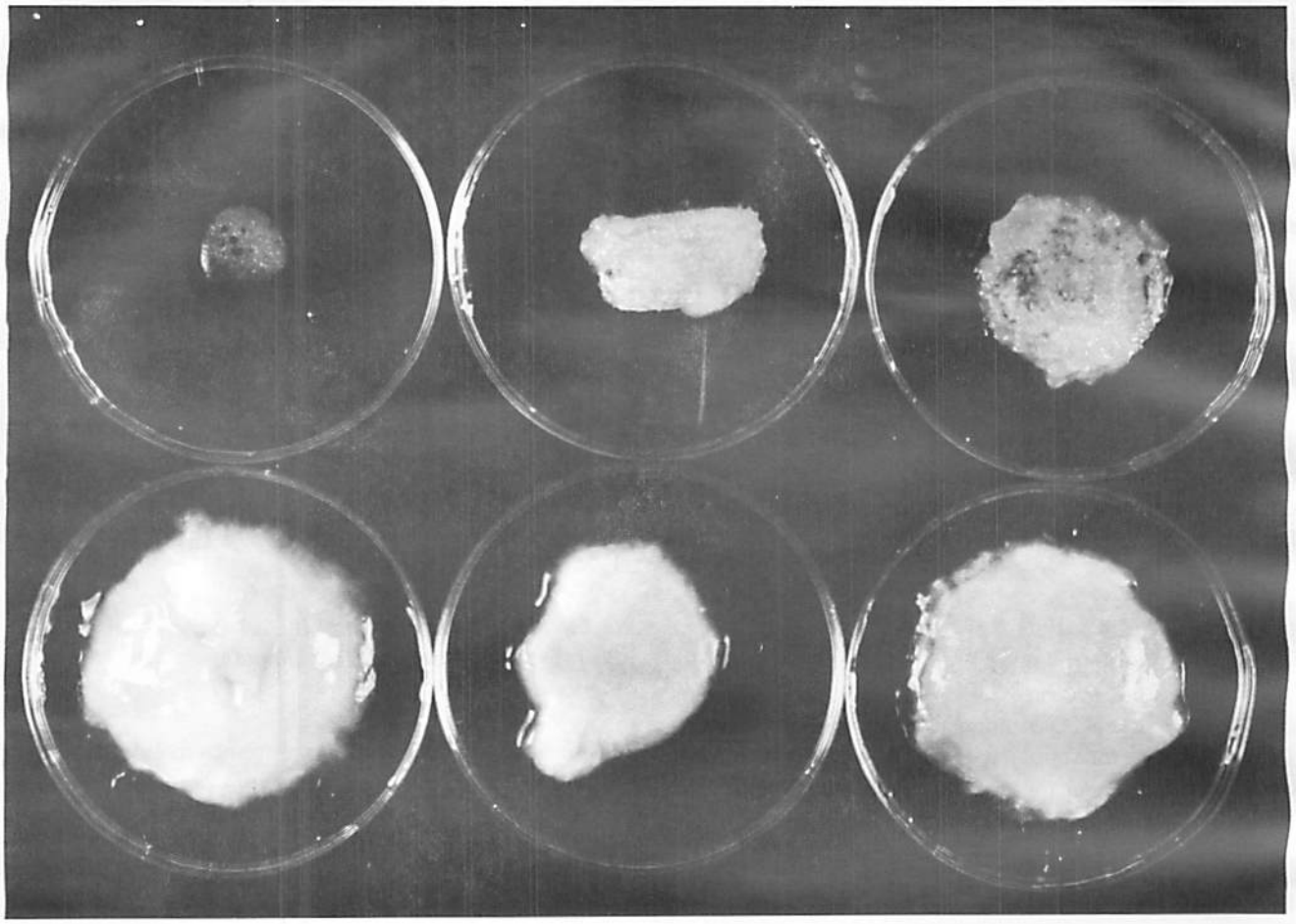

Fig. 1. Growth of *Sclerotinia* isolates in modified Czapek Dox liquid medium.

Top line (left to right) isolates 10, 4, 3
Bottom line (left to right) isolates 9, 1, 2

from red clover (isolate 10). Minor variations in band patterns occurred between individuals within these groups.

The results from the mycelial growth and co-inoculation tests confirmed the identities of isolates 1-4. In liquid culture, isolates 1, 2, and 9 produced white, fluffy, gelatinous pellets with no sclerotia, characteristic of *S. sclerotiorum,* whereas isolates 3, 4, and 10 produced darker, gelatinous, compact pellets with sclerotia at various stages of development, characteristic of *S. trifoliorum* (Fig. 1). The mycelial interactions are shown in Table 2. Isolates showed a compatible reaction or only a slight interaction when co-inoculated with the same isolate or isolates of the same species, as classified by electrophoresis and mycelial growth techniques. The exceptions were the interactions between the faba bean isolates (1 and 2) and the clover isolate (10) of *S. trifoliorum* which were of the 'C' type, a sharply delineated brown line.

Table 2. Interactions between isolates of *Sclerotinia* grown on PDA at 20°C in the dark over four weeks.

	Isolate no. (see Table 1 for details)					
Isolate no.	**1**	**2**	**9**	**3**	**4**	**10**
1	A[1]	B	A	D	D	D
2		A	B	D	D	D
9			A	D	D	D
3				A	B	C
4					A	C
10						B

1. A = compatible; B = faint interaction, white zone; C = interaction, sharp brown demarcation line; D = strong interaction, brown zone.

These results confirm the findings of Keay (1939) and others that *S. trifoliorum* is the usual pathogen attacking winter-sown faba beans. The interaction between the isolates from faba beans and clover confirms the results of Loveless (1951) and may provide evidence for "biotypes" within *S. trifoliorum*. Both isolates of *Sclerotinia* isolated from spring-sown faba beans were identified as *S. sclerotiorum*. As apothecial development in *S. trifoliorum* appears to be confined to the autumn (Williams and Western 1965) and sclerotia appear to have little or no importance as inoculum causing infection directly (Keay 1939), it is not surprising to find that the disease on spring-sown beans is caused by *S. sclerotiorum*, which generally produces apothecia in spring or summer. Stem rot is generally not considered to be a disease of spring-sown beans and the two isolates collected were from single diseased plants in a crop that was otherwise apparently free from stem rot.

Acknowledgements

We thank E.L. Stylopoulos and C.J. Podimatas of the Institute for Fodder Crops, Larissa, Greece, and P. Gladders of tl Agricultural Development and Advisory Service, Cambridge, UK, for supplying isolates. The Greek isolates were imported under licence no. PHF 48/75 from the Ministry of Agriculture, Fisheries and Food.

References

Fairbanks, G., Steck, T.L. and Wallech, D.F.H. 1971. Electrophoretic analysis of the major polypeptides of the human erythrocyte membrane. Biochemistry 10: 2606-2617.

Keay, M.A. 1939. A study of certain species of the genus *Sclerotinia*. Annals of Applied Biology 26: 227-246.

Kohn, L.M. 1979. Delimitation of the economically important plant pathogenic *Sclerotinia* species. Phytopathology 69: 881-886.

Loveless, A.R. 1951. The confirmation of the variety *fabae* Keay of *Sclerotinia trifoliorum* Eriksson. Annals of Applied Biology 38: 252-275.

Payne, P.I., Corfield, K.G. and Blackman, J.A. 1979. Identification of a high-molecular weight subunit of glutenin whose presence correlates with bread making quality in wheats of related pedigree. Journal of Theoretical and Applied Genetics 55: 153-159.

Purdy, L.H. 1955. A broader concept of the species *Sclerotinia sclerotiorum* based on variability. Phytopathology 45: 421-427.

Reid, M.S. and Bieleski, R.L. 1968. A simple apparatus for vertical flat-sheet PAGE. Annals of Biochemistry 22: 374-381.

Smith, D.B. and Simpson, P.A. 1983. Relationship of barley proteins soluble in SDS to malting quality and varietal identification. Journal of Cereal Science 1: 185-197.

Willetts, H.J. and Wong, J.A.-L. 1980. The biology of *Sclerotinia sclerotiorum*, and *S. minor* with emphasis on specific nomenclature. The Botanical Review 46: 101-165.

Williams, G.H. and Western, J.H. 1965. The biology of *Sclerotinia trifoliorum* Erikss. and other species of sclerotium-forming fungi. 1. Apothecium formation from sclerotia. Annals of Applied Biology 56: 253-260.

RESISTANCE TO ASCOCHYTA BLIGHT (*ASCOCHYTA FABAE*) IN A WINTER-HARDY LINE OF FABA BEAN (*VICIA FABA EQUINA*)

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Plant Breeding Institute, Trumpington, Cambridge CB2 2LQ, UK

There is little information on resistance to ascochyta blight caused by infection with *Ascochyta fabae* in faba beans. In the UK, Dodd (1971) studied a range of NW European genotypes and found little variation in resistance. Later, Bond and Pope (1980) observed significantly fewer lesions on the varieties Bulldog, Banner, and Buccaneer than on Throws MS in a naturally infected autumn-sown field trial. Greater variation in resistance has been found in artificially inoculated trials of both winter and spring material, including the ICARDA International Ascochyta Blight Nursery, which have been carried out at the Plant Breeding Institute (PBI), Cambridge. This paper reports the results of three trials in which the winter-hardy inbred line IB18-1/3 has proved to be resistant to ascochyta blight under Cambridge conditions.

Materials and Methods

Trials of winter-hardy genotypes were carried out over two years using plots of four rows of 30 seeds spaced at 10 cm with 30 cm between rows and 60 cm between plots. The outer rows were sown with a standard variety (Bulldog in trial 1, 1981/2, and Banner in trial 2, 1982/3). There were six replications in each trial, arranged as a lattice square in trial 1 and as a generalized lattice in trial 2. Inbred line IB18-1/3, an *equina* type, was selected for high yield at PBI by D.A. Bond after four generations of inbreeding from a cross between the English winter inbred lines 145 and 349 developed at PBI. It was included in both trials as well as in the 1984 ICARDA International Ascochyta

Blight Nursery as an additional entry. This nursery consisted of three rows of 10 seeds spaced at 10 cm with 45 cm between rows and 60 cm between plots. The outer rows were sown with the *Vicia faba major* variety Hylon. There were two replicates of each ICARDA entry, 22 of Hylon, the local control, and 14 of IB18-1/3.

The winter-sown plots were inoculated in March and the spring-sown plots in April with a suspension of approximately 75 ml/plot of 1 x 10^5 pycnospores/ml, derived from cultures of *A. fabae* obtained from English faba bean crops and grown on potato dextrose agar under ultraviolet light (12 h photoperiod). Disease was recorded in the winter-sown trials as the percentage of plants with lesions in April and the percentage of pods with lesions just before maturity. In the spring-sown ICARDA Nursery the severity of foliage infection late in June and pod infection late in July was scored on a 0-9 scale, where 0 = no infection and 9 = extensive lesions.

Results and Discussion

Data are presented for IB18-1/3 compared with a number of standard varieties in the winter-sown trials, and compared with the local control (Hylon), the Syrian control (ILB 1814), the Egyptian variety Giza 4, and the most resistant entries (i.e. all entries with foliage or pod scores of under 3) in the ICARDA nursery.

Inbred line IB18-1/3 was consistently the most resistant entry in each trial, both in the foliage and the pods (Tables 1 and 2). In both winter trials it had significantly (at least P = 0.05) less infection than Throws MS, which was the most widely grown variety in the UK for many years. In the disease nursery it was significantly (P = 0.05) more resistant in either foliage or pods than nearly all the ICARDA entries. It is noteworthy that four of the six entries in the ICARDA nursery with foliage or pod scores of under 3.0 originated in the UK.

This is believed to be the first report of resistance to ascochyta blight in a winter-hardy inbred line. As such it is particularly valuable to breeders as a source of resistance in winter faba bean breeding programs and for the production of winter-hardy composite varieties. Initial results from crossing programs using IB18-1/3 suggest that the resistance is heritable.

Table 1. Leaf and pod infection in winter-sown faba bean trials, 1981/82 (Trial 1), and 1982/83 (Trial 2).

Entry	Angle (%) ascochyta blight infection[1]			
	Young plants		Pods	
	Trial 1	Trial 2	Trial 1	Trial 2
IB18-1/3	11.0	–0.2	1.3	14.6
Bulldog	24.8	14.3	1.8	15.4
Maris Beagle		8.0		16.0
Banner		13.5		*18.9*
Bourdon		10.7		25.8
Webo	31.5		16.2	
Throws MS	33.0	15.8	22.1	26.9
Polar	35.1		35.5	
SED (72 df)	6.66	4.06	4.08	5.75

1. Adjusted means after analysis of variance.

Table 2. Leaf and pod infection of faba beans in spring-sown ICARDA International Ascochyta Blight Nursery, 1984.

Entry			Incidence of disease (0-9 scale)	
Selection no.	ICARDA accession no.	No. of reps.	Leaves	Pods
IB18-1/3		14	1.1	0.1
80-14998-1	ILB 382[a]	2	1.5	*3.0*
79-70015-1	BPL 74[a]	2	2.5	0.5
79-70015-4	BPL 74[a]	2	2.5	2.0
80-14422-2	BPL 460	2	2.5	6.5
80-14435-3	BPL 472	2	2.5	5.0
80-14998-3	ILB 382[a]	2	3.5	1.0
Syrian control	ILB 1814	2	3.0	4.0
Giza 4	ILB 1820	2	5.5	7.0
Hylon		22	5.6	*5.4*
SED (31 df)				
Comparison between Hylon & IB18-1/3			0.25	0.47
Comparison between IB18-1/3 & ICARDA accessions			0.54	*1.04*
Comparison not involving Hylon or IB18-1/3			0.72	1.38

a. UK origin

References

Bond, D.A. and Pope, M. 1980. *Ascochyta fabae* on winter beans (*Vicia faba*): pathogen spread and variation in host resistance. Plant Pathology 29: 56-65.

Dodd, I.J. 1971. Some aspects of the biology of *Ascochyta fabae* Speg. Ph.D. thesis, University of Hull.

RESISTANCE TO BEAN YELLOW MOSAIC VIRUS IN *VICIA FABA*

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Bean yellow mosaic virus (BYMV) is a widespread virus in faba beans (*Vicia faba* L.). The virus is transmitted by many aphid species in the non-persistent manner and its very wide host range provides many sources for infections and/or possibilities for overwintering. Yield losses are rath· .igh, especially when early infections occur. Therefore, identification of resistance to BYMV is very important for plant breeders.

Two sources of resistance to BYMV were found in sibling groups of inbred lines in a screening program. In the first case four out of 20 siblings were resistant, segregating in the third generation; there was no further segregation in the following two generations. This indicates that the responsible gene is recessive and homozygosity had been established. In the second case the resistance segregated in the fourth inbreeding generation: one out of ten siblings was resistant and all inbred progenies of the resistant one were also resistant. This gene may also be recessive.

The two sources of resistance found are different as they are directed to different strains of BYMV. Crosses have been made to elucidate the real heredital pathway and the progenies are being evaluated.

Preliminary investigations on the mechanism of resistance showed that no hypersensitivity is involved. Probably there is an extreme resistance to virus infection. Eight and 16 days after inoculation no virus could be detected by enzyme-linked immunosorbent assay in either inoculated or subsequently appearing leaves of a resistant line. High concentrations of virus were found in all plant parts of a suscept ›le line, irrespective of symptom expression.

MEETING REPORTS

FABIS/LENS Users' Workshop

A users' workshop on the FABIS and LENS (Lentil Experimental News Service) services was held at ICARDA, 28-29 Nov 1984. The aim of the workshop was to assess the progress and achievements of the two services to date, and to help determine their future development.

The workshop was attended by seven scientists from outside ICARDA; Dr. D. Bond and Dr. F. Bisby (UK), Dr. A.M. Nassib (Egypt), Dr. S.H. Qureshi (Pakistan), Dr. N.I. Haddad (Jordan), and Dr. B. Sadri (Iran).

Presentations covered the histories of the two news services and their documentation components, the information needs of scientists in developing countries, a survey of FABIS and LENS users, and the Vicieae Data Base project.

Recommendations of FABIS/LENS Users Workshop

NEWSLETTERS

1. Those users of FABIS and LENS attending the meeting and those contacted through a questionnaire have all found the newsletters and their associated documentation activities invaluable sources of information.

2. The meeting was extremely appreciative of the financial support of the International Development Research Centre (IDRC) to FABIS and LENS.

3. Both newsletters, FABIS and LENS, should continue largely in their present form, frequency, and production process. There is no need to turn the newsletters into refereed journals, but preliminary results published in the newsletters can later be published in more substantial form in refereed journals.

   In addition, the workshop recommends that a regional refereed journal on crop production be initiated, not necessarily by ICARDA. Some of the participant scientists may take the initiative in this venture.

4. The newsletters should continue to include commissioned review and feature articles on aspects of research on lentils and faba beans.

5. FABIS should follow a similar format to LENS for research articles, including an abstract.

6. The Style Guides in the newsletters should clearly state that good quality black and white photos are acceptable to illustrate the articles. The Style Guide should also be more specific about the figure size for submission and where to submit articles.

   Clear, hand-written articles and figures are acceptable from certain developing countries, where authors have no secretarial assistance.

7. Appropriate FAO production data on lentils and faba beans should continue to be published in the newsletters.

8. Summaries and abstracts of unpublished reports such as PhD theses should be included in the newsletters, as well as summaries of projects and reports of institutions such as research stations from the region. Summaries of such reports should be limited to 500 words. They may be solicited through an announcement in the newsletters as well as through the CARIS data base.

9. Membership of the Coordination Committee should be expanded to include, for FABIS, members from China and South and Central America; and, for LENS, a member from Turkey.

   Key legume researchers in the ICARDA region and Coordination Committee members should be requested to
   a. solicit more articles for the newsletters
   b. procure relevant documents for the ICARDA documentation unit
   c. assist in keeping the mailing list current.

10. New and obsolete cultivars should be listed in the newsletters, which should announce that contributions describing new cultivars are welcomed. The newsletters should also publish lists of current, established cultivars.

11. An address list of CGIAR centers working on legume documentation should be published in the newsletters.

12. Newsletters should be mailed under individual names, and not bulk mailed.

DOCUMENTATION

13. An appeal should be made to both ICARDA staff visiting national programs and national program personnel visiting ICARDA to collect documents

from national program libraries and other sources pertaining to lentils and faba beans for ICARDA's documentation unit.

14. A documentation/information component should be fitted into ICARDA training courses. Information should be gathered on training for documentalists at the other international centers as an initial step in the strengthening of documentation in the region. Increased familiarity with recent developments in documentation is required by the staff of the ICARDA documentation unit.

15. Donor agencies may be approached to develop a microfiche network for North Africa and West Asia.

16. Nile Valley Abstracts should be updated and a revised edition published.

17. The meeting recommended the production of a directory of lentil researchers and the revision of the directory of faba bean researchers.

18. The meeting recommended that articles in Arabic, with an English summary, be accepted for publication in the newsletters. Arabic abstracts of articles written in English should be made.

    These Arabic abstracts and Arabic articles should be published in a separate cover to the English newsletters and distributed to Arabic speakers with the English version.

DATA BASES

19. The meeting noted with interest Dr. Bisby's presentation on factual botanical data bases, and plans for the International Legume Database, for possible linkage with germplasm data bases such as those at ICARDA, and possible dissemination arrangements with the BIOSIS TRF. It was agreed that the possibility of collaboration (as donors or recipients) be explored.

Second International *Vicia faba* Cytogenetics Review Meeting, 9-13 April 1984, Wye College, UK.

Plant cytogenetics has been radically altered in recent years by the impact of molecular biology and electron microscopy. The second International *Vicia faba* Cytogenetics Review Meeting continued the process of reexamining the plant's genome from a fundamental view point.

Contributions at the meeting also covered other genera. Increasingly, the cytogenetics of *Vicia faba* is seen as a collaborative effort internationally among a number of institutions, and this meeting aimed to identify both research objectives and how, by systematic cooperation, they can be more easily achieved.

The papers presented were:

"Changing perspectives in plant chromosome studies"
G.P. Chapman, Wye College, UK

"Implications of a better knowledge at the molecular level in the use of cytoplasmic male sterility in *Vicia faba*"
G. Duc, INRA, France

"Inducible repair processes in *Vicia faba* root tip meristems"
Prof. R. Rieger, Gatersleben, DDR

"*Pisum* interspecific hybrids and tissue culture – a tool for molecular cytogenetics"
S.A. Tarawali, Wye College, UK

"Interspecific hybridization between *Vicia narbonensis* and its related species"
Prof. K. Yamamoto, Kagawa University, Japan

"Characterization of *Vicia faba* trisomics"
A. Martin, Cordoba, Spain

"C-banding in *Vicia* species"
G Ramsay, University of Reading, UK

"Standards employed in distinctness, uniformity and stability tests of faba bean cultures"
J. Higgins, NIAB, Cambridge, UK

"Progress and problems in breeding for high seed protein through mutations in *Vicia faba* in Egypt"
Prof. A.M.T. Abo Hegazy, Cairo, Egypt

"Research objectives and problems of breeding *Vicia faba* in Madhya-Pradesh"
Prof. A.S. Tiwari, Gwaliar, India

"Identification of some sources of resistance for chocolate spot and rust in faba beans"
S.A. Khalil, Giza, Egypt

"Seed borne pathogens of *Vicia faba* with reference to their control"
Prof. M.N. Khare, Jabalpur, India

For the first time, the proceedings of the meeting will be published. This is as a book "Systems for Cytogenetic Analysis in *Vicia faba* L" edited by G.P. Chapman and S.A. Tarawali. It has 18 papers arranged in eight sections (1. Intact and Broken Chromosomes, 2. Trisomics and Linkage, 3. Disease Resistance, 4. Population, 5. Interspecies Hybridisation, 6. Haploidy, 7. Mutant Physiology, 8. Conclusions and an Appendix listing the known genetic variation in *Vicia faba*).

The conclusions of the meeting were as follows:

1. The recommendations of the Sutton Bonington General Review Meeting (September, 1983) were endorsed and the priority given to cytogenetics noted especially.

2. There should be continuing emphasis in the *Vicia faba* research program to establish linkage groups on each chromosome which could then be individually researched.

3. Recognising that tissue culture is of importance to *Vicia faba*, we wish to support intensive efforts into *in vitro* techniques in this species.

The value of exchanging workers between laboratories was recognised as were the similar interests of *Pisum* cytogeneticists who, it was felt, could usefully be invited to meetings for *Vicia faba* cytogenetics.

At a future meeting, the emphases were to be for

1) Chromosome research in *Vicia faba*
2) Breeding research in *Vicia faba*
3) Protein metabolism and genetic engineering
4) Germplasm resources of *Vicia faba*

* The conclusions of the First International *Vicia faba* Cytogenetics Review Meeting were published in FABIS 6, 19-20. 1983.

There is no doubt that at this second meeting there was a most useful exchange of ideas among those whose interests range from molecular biology to practical breeding. It was recognised that the cytogenetic contribution to breeding was potentially very important and it has become possible to identify much more precisely both specific problems in need of attention and the means available to solve them.

The organisers would like to thank all those who contributed to the success of the meeting.

G.P. Chapman
S.A. Tarawali

3rd International Symposium on Parasitic Weeds, May 7-9, 1984, ICARDA, Aleppo, Syria

Fifty participants from 18 countries attended the workshop, which was sponsored by the International Parasitic Seed Plant Research Group, the German Agency for Technical Cooperation (GTZ), and ICARDA.

Nine technical sessions covered various aspects of parasitic ganiospermic plants of the Loranthaceae, Hydnoraceae, Scrophulariaceae, and Orobanchaceae families. Subjects covered included basic research on structure, ecology, physiology, and biochemistry of the parasites, and their biology and control. The symposium provided a unique opportunity for interaction between scientists specializing in different research disciplines.

The proceedings of the symposium have been printed by ICARDA for the International Parasitic Seed Plant Research Group (IPSPRG). They include four papers on the biology and host resistance for Loranthaceae; five papers on the biology, ecology, and host specificity for Scrophulariaceae; seven papers on the biochemistry and physiology of *Striga*; four papers on host resistance, and control and research techniques for *Striga*; five papers on biochemistry, physiology, and control of *Cuscuta*; seven papers on physiology, resistance breeding, and control of *Orobanche* and one paper on the key to an East African species of *Striga*. The proceedings comprises 265 pages and is available from:

C. Parker
Weed Research Organization,
Begbroke Hill, Sandy Lane,
Yarnton, Oxford 0X5 1PF, UK

Cost including postage is US$ 20.00 or equivalent in Sterling, payable to 'Third Parasitic Weed Symposium.'

A single copy, free of charge is available from Communications and Documentation Department, ICARDA, P.O. Box 5466, Aleppo, Syria, to scientists from the developing countries.

ANNOUNCEMENTS

Reprints

ICARDA has been designated as the world center for information on faba beans, and as such we are trying to assemble a complete collection of papers relevant to this subject.

We would be most grateful if readers who have published papers relating to faba beans would send reprints to:

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

Lentil Experimental News Service (LENS)

LENS, a scientific newsletter published jointly by the Univer'y of Saskatchewan and ICARDA with financial supp t from IDRC, is designed to improve communication among world lentil researchers.

For your free copy write to:
LENS
Documentation Unit ICARDA
P.O. Box 5466, Aleppo, SYRIA

New EEC Joint Faba Bean Trials

D.A. Bond, Plant Breeding Institute, Maris Lane, Trumpington, Cambridge CB2 2LQ, UK

At a meeting in Brussels on 21 November 1984 (Chairman Dr. J. Picard) EEC faba bean scientists confirmed their plans for conducting a new series of Joint Faba Bean Trials from 1985 to 1987. Nineteen varieties will be grown at 13 locations in NW Europe and phenological and yield data will be recorded. The emphasis will be on comparing varieties produced by different breeding methods (hybrids, inbreds, and synthetics) and on those with markedly different plant architecture (e.g. determinate habit). Co-ordination is at present by the Plant Breeding Institute, Cambridge, UK, and results will be analyzed by Dr. E. Ebmeyer of Gottingen University, West Germany.

A series of agronomy trials, to be conducted in conjunction with the joint variety trials, is also planned. These trials will be coordinated by Dr. P.D. Hebblethwaite of Nottingham University, UK. The aim is to obtain more detailed agronomic and physiological data on a limited number of varieties.

Another group of faba bean researchers is expected to be formed by EEC countries in the Mediterranean area with a view to planning joint trials of varieties suited to southern Europe.

Need More Information

Opportunities for Training and Post-Graduate Research at ICARDA

ICARDA has active training courses on the development and improvement of food legumes, cereals, and forages with ICARDA's research scientists, trained instructors, and proven programs. For a complete brochure of the training opportunities at ICARDA, please write to Training Department.

Mailing List

We are having many items of correspondence returned, due to those on our mailing list having changed their addresses or left their place of employment without notifying us. Obviously this represents a considerable waste of money to the FABIS service.

We request that those who currently receive FABIS should inform us of any change in their address or position in good time to allow us to maintain an efficient service.

Forthcoming Meetings

15-19 April 1985

3rd International *Vicia faba* Review Meeting: Genetics and Breeding of *Vicia faba*, Gatersleben, German Democratic Republic

This review meeting follows the two earlier ones held at Wye College, UK, in 1983 and 1984. The subjects to be covered include:

a) Chromosomal research and genetics
b) Breeding
c) Protein metabolism and genetic engineering
d) Germplasm resources

Attendance at the meeting is limited to 40 participants. The approximate cost of registration, accommodation and meals will be US $180.00. For participation, please write to:

Prof. Dr. R. Rieger,
Zentral Institut fur Genetic und
Kulturpflanzenforschung,
DDR-4325 Gatersleben,
DDR

24-28 June 1985

3rd International Symposium on Iron Nutrition and Interactions in Plants, Lincoln, Nebraska

Details from:
Dr. R.B. Clark,
USDA-ARS, 101 KCR (Agronomy),
University of Nebraska,
Lincoln, NE 68583-0817,
USA

7-10 July 1985

Potassium in Agriculture. An International Symposium

The symposium will be held at the Westin Peachtree Plaza Hotel, Atlanta, Georgia, USA, and is sponsored by the Potash and Phosphate Institute (PPI), American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, National Fertilizer Development Center (NFDC-TVA), International Fertilizer Development Center (IFDC), and the Foundation for Agronomic Research (FAR).

More than 50 participants will present papers on potassium production and marketing, potassium's role in plants, the behavior of potassium in soils, and potassium nutrition of the major crops grown throughout the world. Each speaker has authored a chapter of a book which is being published by the American Society of Agronomy, and will be available at the symposium.

The registration fee for the symposium is $140, and will cover the proceedings, "Potassium in Agriculture," and the planned events.

To obtain an official registration form, accommodation information, and other facts about the symposium, write to:

Potash and Phosphate Institute
2801 Buford Hwy.,
NE, Suite 401
Atlanta, Georgia
USA 30329

Ask for the Potassium in Agriculture Symposium packet.

8-15 Aug 1985

Science and Technology Education and Future Human Needs

An international conference will be held at Bangalore, India, August 8-15, 1985. The principal aim of the conference is to identify practical ways in which science and technology education can contribute to national development. It is hoped that one of the outcomes of the conference will be a reappraisal of what should be taught in both schools and universities in order to promote development.

18-23 Aug 1985

13th International Congress of Nutrition, Brighton, UK

Details from:
Nutrition Society,
Chandos House,
2 Queen Anne Street,
London, W1M 9LE, UK

21-25 Oct 1985

Arid Lands Conference, Arizona, USA

Contact:
Dr. G.P. Nabham
Office of Arid Land Studies
University of Arizona
Tucson, Arizona 85721 USA

BOOK REVIEWS

Genetic Resources and Their Exploitation - Chickpeas, Faba beans and Lentils

The book, a joint endeavor of ICARDA and IBPGR, is based on lectures delivered by specialists in a 1982 training course sponsored by both institutions at ICARDA on the genetic resources of chickpeas, faba beans, and lentils. The book provides a continuum between the collection and evaluation of genetic resources, and their utilization. It discusses collecting and maintaining genetic resources of chickpeas, faba beans, and lentils.

The book is divided into eighteen chapters covering:

- practical collection and initial documentation of food legume germplasm
- keys to successful storage of samples of orthodox seeds
- seed storage methods under ideal conditions: low moisture content and low temperature
- main steps for computerizing passport and evaluation data
- collection, isolation and maintenance of food legume Rhizobia
- plant quarantine principles, methodology, and seed health of food legumes
- utilizing food legumes' wild relatives and primitive types
- utilizing genetic resources in a national food legume program
- taxonomy, distribution, and evolution of chickpea and its wild relatives
- collecting and evaluating chickpea genetic resources
- exploitation of chickpea genetic resources
- taxonomy distribution and evolution of faba bean and its wild relatives
- genetic resources of faba beans
- strategies for exploiting the faba bean gene pool
- evaluating and utilizing faba bean germplasm in an international breeding program
- taxonomy, distribution, and evolution of lentil and its wild relatives
- genetic resources of lentils
- evaluating and utilizing lentil germplasm in an international breeding program

A limited number of copies of the book are available free for ICARDA cooperators working in developing countries, from FABIS/ICARDA/P.O. Box 5466/Aleppo, Syria.

Other copies are available from the publisher:
Martinus Nijhoff/Dr. W. Junk Publishers
P.O. Box 566, 2501 CN The Hague,
The Netherlands

Hebblethwaite, P.D. (ed.). 1983. **The Faba Bean (*Vicia faba* L.). A basis for Improvement.** Butterworths, Kent, England. 624 pp., hard cover, illustrated. $ 55.00. ISBN 0 408 10695.

Although one of the oldest crops in the world, interest on the improvement of faba bean has gained momentum in only the past few decades. One of the most productive food legumes, this crop could play a very significant role globally in providing good quality vegetable protein at a low price, for human food and animal feed. Recognition of this fact has been responsible for the increased research thrust on the improvement of this crop.

'The Faba Bean' attempts to bring together and critically review the substantial amount of basic and applied research that has been carried out globally on this important crop. The book consists of five major sections. The first deals with the back-ground, physiology, and breeding in 11 distinct subsections. The second deals with crop husbandry in two subsections. The third section provides a coverage of pest problems in three subsections, one each dealing with aphids, nematodes, and other pests. The fourth is devoted to diseases in four subsections, one each covering root, viral, shoot, and parasitic diseases. The last section of the book deals with harvest and post-harvest technology of the crop. The presentation of the subject matter is very balanced and systematic. Each subsection is contributed by one or more authors, who are all experts in their particular subject. Thus a wealth of information has been put together in a concise fashion in each section, which ends with an impressive bibliography. The book is well printed, with high quality line drawings and photographs. An exhaustive word index at the end of the book enhances its value to the readers.

This book comes to readers after the arrival of the first authoritative book on the crop, 'Faba bean Improvement' (edited by G. Hawtin and C. Webb) published for ICARDA/IFAD Nile Valley Project by Martinus Nijhoff, The Hague, The Netherlands in 1981. Nevertheless the comprehensiveness of its coverage and its emphasis on highlighting the areas in which further research is needed, makes 'The Faba Bean' an indispensible book for all those who are interested in increasing and stabilizing the productivity of faba beans.

M.C. Saxena
Food Legume Improvement Program, ICARDA,
Aleppo, Syria

Saxena, M.C. and Stewart, R.A. (eds.). 1983. **Faba Bean in the Nile Valley.** Report of the First phase of the ICARDA/IFAD Nile Valley Project (1979-82). Martinus Nijhoff Publishers, The Hague, The Netherlands. 151 pp. ISBN 90-247-2846-0.

This book gives a detailed report of the first phase of the ICARDA/IFAD Nile Valley faba bean project. Much of the work described concerns on-farm trials, which involve farmers, extension workers, and national program scientists from Egypt and Sudan.

The multidisciplinary nature of the research, bringing together socioeconomic and agricultural researchers, is a major feature of this unique and highly praised project.

This report should prove useful to all scientists, agricultural administrators, and agricultural research organizations interested in faba beans.

Copies of the book are available free to scientists in developing countries from the Food Legume Improvement Program at ICARDA. Others may obtain copies from Kluwer Academic Publishers Group, P.O. Box 322, 3300 Dordrecht, The Netherlands.

El-Fouly, M.M. (ed.). 1984. **Proceedings of a grain legumes workshop,** March 1981, International Center for Rural Development, Mariut, Egypt. Sponsored by NRC, Cairo, GTZ, W. Germany, and ICARDA. 311 pp., bibl., tabs.

Available from Dr. M.M. El-Fouly, NRC, Cairo, Egypt.

Cicer arietinum. The coverage includes environmental requirements, symbiotic nitrogen fixation, mineral nutrition, method of cultivation in Spain, diseases and pests, and nutritive value for human consumption and animal feed.

Cubero, J.I., Moreno, M.T. (Eds.). **Leguminosas de grano.** Mundi-Prensa, Madrid, Spain, 359 pp.

Various aspects of grain legumes production and improvement are presented in this multi-author book. The legumes covered include *Vicia faba, Lens culinaris,* and

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

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 Bureau of Pasture and Field Crops, Hurley, UK.

Copies may be obtained from:
FABIS
Documentation Unit, ICARDA
P.O. Box 5466, Aleppo, SYRIA

Bibliography of the Scientific Research Papers Published by ARC Staff 1970-1983, Vol. 1. Ministry of Agriculture, Agricultural Research Center (ARC), Giza, Egypt. 1984.

This is a comprehensive bibliography of material published by staff of research institutes of the ARC Egypt. There are more than 50 references on faba bean, including agronomy, irrigation, pathology, and pest control.

Nitrogen Fixation, Volume 3: Legumes (W.J. Broughton, ed.). Oxford University Press, UK. 1983. 325 pp. $47.95. ISBN
0-19-854555-X.

This book emphasizes the host aspect of symbiotic nitrogen fixation. It has chapters on taxonomy of legumes, mineral nutrition, agronomy, physiology, and morphology of perennial legumes, nodule development and senescence, nodule metabolism, nitrogen uptake, transport, and utilization, and energy relationships.

Biology of the Rhizobiaceae. Supplement 13 of the International review of Cytology (Giles, K.L. and Atherley, A.G., eds.). Academic Press, USA. 1981. 331 pp. ISBN 0-12-364374-0.

The book discusses the taxonomy and identification of the Rhizobiaceae. Of particular interest to FABIS readers are the later chapters which present the genetics, molecular biology, and agricultural and morphological aspects of *Rhizobium* spp.

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Contributors' Style Guide

Policy

The aim of the newsletter is to publish quickly the results of recent research. Articles should normally be confined to a single subject, be of good quality and of primary interest to research, extension and production workers, administrators and policy makers. Articles for publishing in the newsletter should not be submitted to or published in any other journal.

Editing

Articles will be edited to preserve uniform style but substantial editing will be referred to the author for his approval; occasionally, papers may be returned for revision.

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Similarly, the use of trade names does not constitute endorsement of or discrimination against any product by ICARDA.

Language

The Newsletter will be published in English but ICARDA will endeavour to translate articles submitted in Arabic and French.

Manuscript

Articles should be typed double spaced on one side of the page only. The original and two other legible copies should be submitted. The contributor should include his name and initials, title, program or department, institute and postal address and telex number if available. Photographs, figures, tables etc. should be either 8.5 cm wide (single column) or 17.5 cm wide (double column including space). Figures and diagrams should be drawn in India ink; send original artwork, not photocopies. Define in footnotes or legends any unusual abbreviations or symbols used in a figure or table.

Units of measurement are to be in the metric system, e.g., t/ha, kg, g, m, km, ml (= mililiter), m^2.

The numbers one to nine should be written as words except in combination with units of measure; all other numbers should be written as numerals, e.g., Nine plants, 10 leaves, 9 g, ninth, 10th, 0700 hr.

Examples of common expressions and abbreviations

3g, 18 mm, 300 m^2, 4 Mar 1983; 27% ; 50 five-day old plants; 1.6 million; 23 µg; 5^oC; 1980/81 season; 1981-82; Fig., No.; FAO, USA. *Fertilizers:* 1 kg N or P_2O_5 or K_2O/ha.
Mon, Tues, Wed, Thurs, Fri, Sat, Sun; Jan, Feb, Mar, Apr, May, June, July, Aug, Sept, Oct, Nov, Dec.
versus = vs, least significant difference = LSD, standard error = SE±, coefficient(s) of variation = CV(s).
Probability: Use asterisks to denote probability * = $P < 0.05$; ** = $P < 0.01$; *** = $P < 0.001$.

Botanical. Include the authority name at the first mention of scientific names. Cultivar(s) = cv(s), variety = var(s), species = sp./spp., subspecies = subsp., subgenus = subg., forma = f., forma specialis = f.sp.

References

Journal articles: Murphy, P.T. and Milfin, B.J. 1982. The origin of barley. Euphytica 31: 183-192.

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Papers in Proceedings: Hawtin, G.C. 1982. The genetic improvement of faba bean. Pages 15-32 *in* Faba Bean Improvement: Proceedings of the Faba Bean Conference (Hawtin, G.C. and Webb, C. eds.), ICARDA/IFAD Nile Valley Project, 7-11 Mar 1981. Cairo, Egypt. Martinus Nijhoff Publishers, The Hague, The Netherlands.

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