# FABIS

## Faba Bean Information Service

NEWSLETTER
No. 18
August 1987

INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS

(ICARDA)

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## FABIS

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COVER PHOTO: Productive faba beans with independent Vascular systems in Lattakia, SYRIA.

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FABIS

# Faba Bean Information Service

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## NEWS

# SHORT COMMUNICATIONS

بحوث مختصرة

## General

مقالة عامة

### Faba Bean in Yunnan, China

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Faba bean has been grown for many years in the Yunnan Province of China. The literature shows that the crop was introduced to other provinces from Yunnan in the Ming Dynasty (Wang 1957). Yunnan has now about 230000 ha under faba bean every year, and in terms of yield Yunnan is the leading province in China. Some of the seed produced is used for human consumption, either processed or unprocessed, but most of it is used as animal feed. The residue is also excellent animal feed, since it is rich in protein. After drying in the sun and crushing, the fine fraction is fed to pigs and the coarse fraction to cattle and horses. Therefore faba bean is important in the animal husbandry of Yunnan.

Small, medium, and large seeded varieties (*Vicia faba minor, equina,* and *major*) are grown although medium-seeded varieties are the commonest. Yields are usually around 1500 kg/ha, but in high yielding plots may be 7500 kg/ha or more. Yields, however, are often affected by frost, insect pests, diseases, and drought. As a result, yields fluctuate in different years.

Faba bean is grown in most parts of Yunnan Province, with the majority planted in October and harvested in April or May the next year. Only in a few mountainous districts do farmers grow faba beans in the summer. The total area under faba bean crop is second only to that under wheat, in rotation with rice, tobacco, or cotton. By growing faba bean instead of wheat the following crop can be sown early, since faba bean matures about one month earlier than wheat. This results in stable, high yields in the following crop. Investigations have shown that rice preceeded by faba bean yields 750-1500 kg/ha more, and cotton following faba bean yields 30-50% more than with other crops. As a result, around one third to one half of the rice fields in Yunnan are under a rice-faba bean cropping system.

In Yunnan, faba bean is sown without tillage after the rice harvest. Seeds are pressed by hand into the unplowed soil, sometimes just under the rice before harvest. In both cases, the fields must be drained or the seeds will rot. After rice harvest, the field is spread with manure, straw, or some loose soil to minimize the loss of soil moisture and ensure seedling emergence. In fields other than paddy, the soil is usually plowed before planting, but no-tillage is occasionally adopted afterwards. A hole is made in the ground for the seed with a stick. Seeding rates are 300-375 kg/ha, with about 300000 plants/ha.

Generally, the main stem is less vigorous than the secondary ones and each plant has 2-3 stems. The number of pods on the secondary stem is greater than that on the main stem. Therefore, much attention should be paid to let the plant have more secondary stems in production. However, too many secondary stems/plant is not desirable either as these causes overgrowth, shading, and lodging. The fields should be irrigated 3-4 times during growth and irrigation at the flowering and pod-forming stages is of the greatest importance. In general, the harvest ratio is 1:1, varying from 0.8:1 to 1.2:1.

Heavy frost occurs in the middle or the last 10 days of January in most parts of Yunnan. To reduce or avoid frost damage, the date of planting should be in the first or the middle 10 days of October, so that the podding stage will occur after heavy frost. If frost occurs in February or march, as has happened in some years, yield losses can be severe.

Many insect pests and diseases attack faba bean plants, mainly aphids, rust, leaf-spots, root rot, and brown-spot. Among these, aphids and rust appear to be the worst. So far, no effective resistant varieties have been developed and faba bean growers still depend on chemical control.

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# Breeding and Genetics

# التربية والوراثة

## Inheritance of Seed Coat Weight in Faba Bean (Vicia faba L.)

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### Abstract

**Statistical analysis of specific seed coat weight in faba bean (*Vicia faba* L.) revealed that the character was under the control of both additive and non-additive gene actions. Somaly and Balady (Local) showed significant GCA effects for lower seed coat weight. In both the parents and the $F_1$ hybrids, there was a small positive correlation between seed coat weight and both seed weight and pod width, but it was not significant.**

### Introduction

Faba bean has a tough seed coat which is responsible for the high fiber content of the seed. The seed coat accounts for 13.17% of the dry weight of the whole seed and it contains 89% of the seed crude fiber and 2.4% protein (Cerning *et al.* 1975; Evans et al. 1972).

A positive correlation between seed coat thickness and seed weight among varieties has been reported by Rowland and Fowler (1977). Therefore, it is necessary to obtain information on the genetic behavior of this character in faba bean.

This investigation was conducted on the genetic system controlling seed weight coat using seed produced by the diallel crossing system of five faba bean varieties.

### Materials and Methods

In this study, which was carried out in 1985, dry seeds of five faba bean (*Vicia faba* L.) parents and 10 hybrids produced from them by the diallel crossing system were used. The parents were Somaly, Balady, Kobrosy, Long Equadore, and Bunyard's Exhibition. Table 1 shows the seed length and width of the varieties used.

Table 1. Length and width (mm) of seeds of the five parents.

| | Parent | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Length | 10-12 | 14-16 | 22-24 | 23-25 | 21-23 |
| Width | 8-9 | 10-12 | 16-18 | 15-18 | 14-16 |

### Determination of specific seed coat weight

Seeds for assessment were placed in water for 6h then the seed coats removed. Fifteen sets of disks (10 in each set) were cut from the seeds with a 4.9 mm sharp cork borer . The disks were dried at 80° C for 2 h and weighed while still warm.

The data were analyzed according to the diallel cross analysis of Griffing (1956a). A Vr/Wr graph was prepared according to Jinks (1954).

### Results and Discussion

In the analysis of variance of the 5x5 diallel cross, both GCA and SCA items were highly significant (Table 2), indicating genetic variation among parental lines and dominance effects. However, the GCA was very large compared with the SCA, indicating the predominant role of the additive type of genetic variance in the expression of specific seed coat weight.

The graph of Vr/Wr is shown in Fig. 1. The five array points exhibit considerable scatter around the regression line which has a slope $b = 0.628 \pm 0.319$. This is not significantly different from zero or unity. However, the line intersects the Wr axis a short distance above the origin of Wr indicating a combination of additive and dominance effects in the determination of this character.

**Table 2.** Analysis of variance of data on specific seed coat weight in a 5x5 diallel cross of faba bean cultivars.

| | d.f. | M.S. | F ratio |
|---|---|---|---|
| Genotypes | 9 | 55539.9 | 957586.1** |
| GCA | 4 | 17404.8 | 1933876.1** |
| SCA | 5 | 2742.5 | 304726.6** |

**Significant at P=0.01

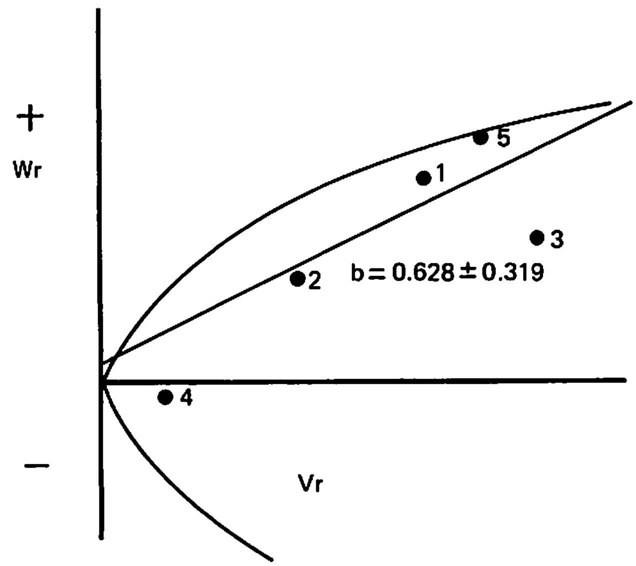


**Fig. 1.** Vr/Wr graph for specific seed coat weight in a 5x5 diallel cross of faba bean cultivars.

Specific seed coat weights and individual values for general and specific combining abilities are shown in Table 3. The specific weights of the seed coats for the five parents varied from 254.6 mg to 509.1 mg with a mean of 356.36 mg. Parents 1 (Somaly) and 2 (Balady) showed significant GCA effects for lower specific seed coat weight. The other three parents showed significant GCA effects for greater specific seed coat weight. This indicates that Somaly and Balady are good general combiners for low specific seed coat weight. Five hybrids showed significant SCA effects for lower specific seed coat weight. Three of them had Somaly and/or Balady as one parent. These two parents are good general combiners for low seed coat weight, so they could be exploited for breeding programs (Griffing 1956a; 1956b; Sprague 1966).

## Correlations

Correlation coefficients were calculated between specific seed coat weight and seed weight, pod width, pod lenght and number of seeds/pod in the parents and $F_1$ generation. All correlations were very small and not significant.

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**Table 3.** Specific seed coat weight of parents (P) and GCA and SCA effects for the arrays and individual cross combinations in the data for specific seed coat weight.

| P | Seed coat weight (mg) | SCA effects | | | | GCA effects |
|---|---|---|---|---|---|---|
| | | 2 | 3 | 4 | 5 | |
| 1 | 254.6 | -33.95** | +12.71** | +50.98** | - 29.75** | - 56.84** |
| 2 | 318.3 | | -12.68** | +38.08** | + 8.55** | -95.04** |
| 3 | 509.1 | | | -55.15** | + 55.12** | +49.19** |
| 4 | 381.6 | | | | - 33.91** | +11.03** |
| 5 | 318.2 | | | | | +91.66** |
| | S E ± | $(S_{ig} - S_{ik}) = 0.11$<br>$(S_{ij} - S_{kl}) = 0.07$ | | | | $(g_i - g_j = 0.07)$ |

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توريث وزن غلاف البذرة في الفول (Vicia faba L.)

ملخص

كشف التحليل الاحصائي لصفة الوزن النوعي لغلاف البذرة في الفول ( Vicia faba L. ) عن ان هذه الصفة تخضع لسيطرة تفاعلات جين أو مورث ذو أثر تراكمي غير تراكمي وقد اظهر الصنفان المحليان ، الصومالي والبلدى تأثيرات معنوية للقدرة التوافقية العامة بالنسبة للوزن المنخفض لغلاف البذرة . وكان هناك ارتباط موجب ضئيل بين وزن غلاف البذرة وكل من وزن البذرة وعرض القرن بين الاصول أو الاباء وهجن الجيل الاول ، ولكنه لم يكن معنويا .

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## Variation of Storage Protein Subunits in Different Genotypes of Vicia faba L.

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### Abstract

**In this study the diversity of seed storage protein patterns in six genotypes of faba bean (*Vicia faba* L.) was examined. The genotypes used were well adapted to South Italy. SDS-PAGE was used to examine the variation in banding patterns of total and globulin seed polypeptides. Little variation among genotypes was detected. With the exception of the local selection "Locale di Putignano", genotypes appeared to be electrophoretically uniform. Our results also confirm that protein composition within genotypes may be characterized reproducibly using bulk seed extracts.**

### Introduction

Faba bean breeding aims to produce new cultivars which are superior for yield and protein content. An important step in this process is evaluation and description of the variability present in collections of *Vicia faba*.

Since 1975, much research has been carried out at Bari Germplasm Institute to assess the variability of many characters influencing yield and protein content in the world collection of *V. faba*. Until now only one study has been carried out to assess the variability of storage protein subunits in relation to the origin of the material (Polignano *et al.* 1986). In order to identify and select superior genotypes with modified major seed protein patterns more investigations are needed.

In our previous work (Polignano *et al.* 1986) we showed that there was an absence of geographic specificity of total storage protein patterns and poor polymorphism in *V. faba*. However, a little variation was detected for some protein subunits, particularly those in group B with medium electrophoretic mobility (Rf = 0.47 - 0.56). Pattern differences in seed storage proteins of *V. faba* L. would be particularly useful for further analysis of the genetic control of single subunits and their utilization in breeding programs.

This paper briefly outlines the results obtained in a study of the diversity in seed storage protein patterns of some genotypes of faba bean well adapted to South Italy (Apulia region).

### Materials and Methods

Seeds of six genotypes of faba bean from the Bari Germplasm collection were analyzed. Two varieties (Aguadulce and Vesuvio), one local selection (Locale di Putignano) and three inbred populations (MG 106865, MG 106590, and MG 106596) were used. These genotypes differ in seed size; Vesuvio ($P_2$) and MG 106596 ($P_5$) have small seed, MG 106590 ($P_4$) has medium seed, and Aguadulce ($P_1$), Locale di Putignano ($P_3$), and MG 106865 ($P_6$) have large seed. For the three groups average weights/1000 seeds were 500, 950, and 1530 g, respectively.

Seeds were collected from plants grown under bee-proof cages at Valenzano (BA) during 1986. Thirty plants of each entry were grown in three row plots. The rows were 70 cm apart and the plants were spaced 30 cm apart within the rows.

To examine variation in protein and globulin patterns among genotypes, bulk samples of seed of each genotype were used according to Goodrich *et al.* (1985). Seed testae were removed and the cotyledons pulverized.

Globulin extraction was carried out according to Scholz *et al.* (1974). Protein extraction and SDS-PAGE were done as reported by Polignano *et al.* (1986) using a 16 x 18 cm vertical slab gel apparatus.

**Results and Discussion**

The general banding patterns of globulin and total seed proteins of the six genotypes are shown in Fig. 1. The protein and globulin patterns of the different genotypes varied in 17 major bands and 13 minor bands. Other, more faintly staining subunits can also be distinguished. The electrophoretic spectrum was divided into three arbitrary groups (A, B, and C) with slow, medium, and fast mobility, respectively. The relative flow (Rf) of bands from the top of the separating gel to the bottom is indicated on the right side of the figure (A: Rf 0.15 - 0.41; B: Rf 0.44 - 0.60; C: Rf 0.66 - 1.00). Molecular weight markers, which were run in all gels, are indicated on the left side of the figure.

The representative one-dimensional gel from a series of analyses of the six genotypes is shown in Fig. 2. The general intensity of staining and spacial arrangement of the bands were similar for the proteins and globulins of all genotypes.

There was little variation, but distinct differences between the polypeptide patterns of the different genotypes in groups A and B. No differences are evident among group C polypeptides. Group B, which comprises the most important globulin fraction, deserves special attention in order to detect differences among different genotypes (Fig. 3).

Small but significant differences were evident among the six genotypes in the presence / absence and intensity of the major bands at Rf 0.46 and 0.49 and the minor band at Rf 0.52. In particular, the presence of the heaviest staining band at Rf 0.46 (band 16) and

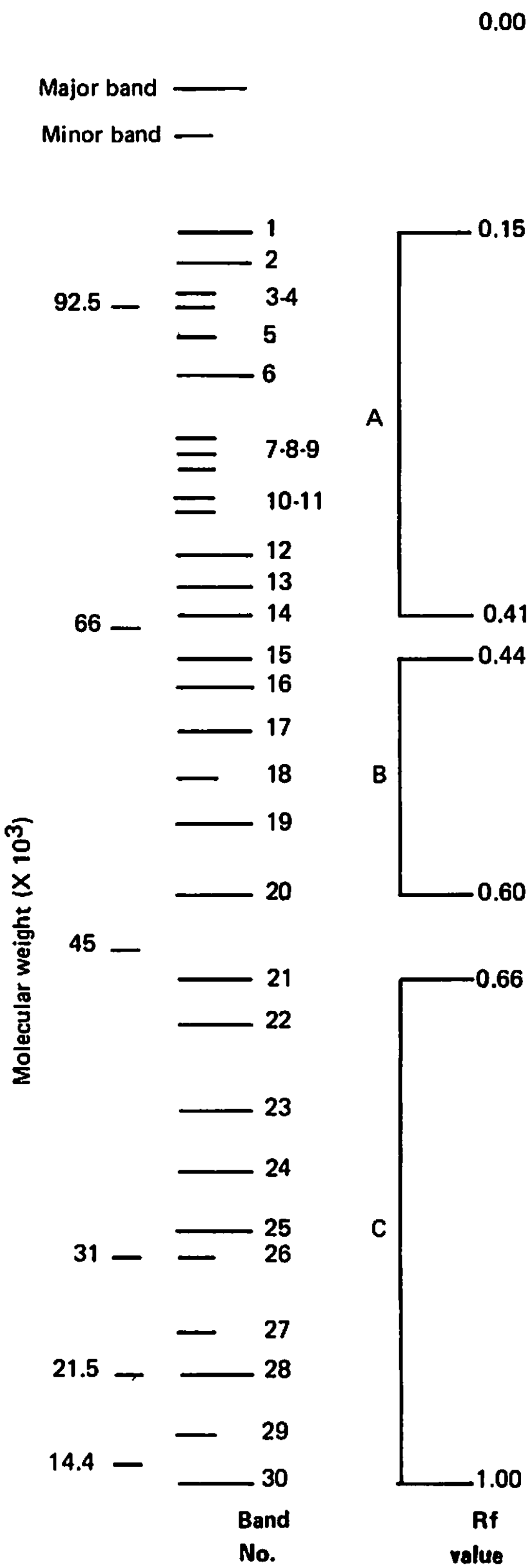


Fig. 1. Protein bands found in the profiles of six genotypes of V. faba L. separated by SDS–PAGE.

the absence of a minor band at Rf 0.52 (band 18) characterize the $P_3$ pattern (Locale di Putignano). The main difference between $P_3$ and the other patterns is the presence and intensity of the major band 16. An identical result was obtained previously by Polignano *et al.* (1986).

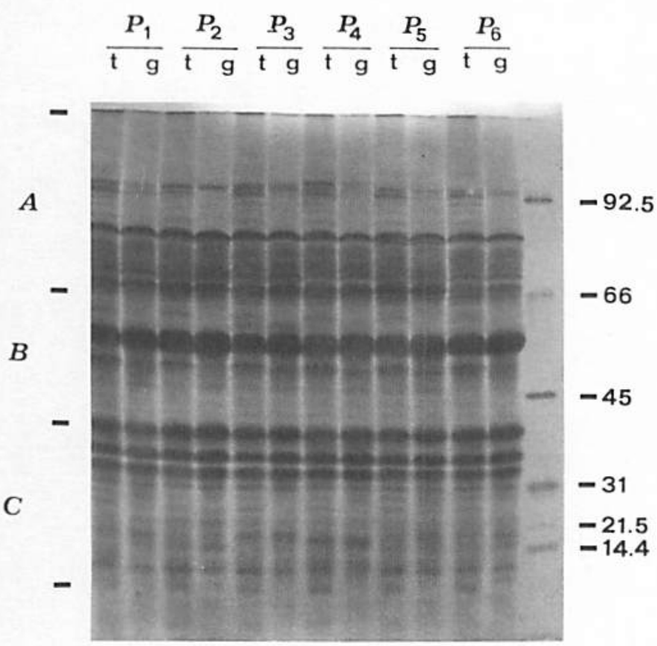


**Fig. 2.** Total protein (t) and globulin (g) composition of seeds of six different genotypes of V. faba L. , using SDS-PAGE. $P_1$ Aguadulce, $P_2$ Vesuvio, $P_3$ Locale di Putignano, $P_4$ MG 106590, $P_5$ 106596, $P_6$ MG 106865.

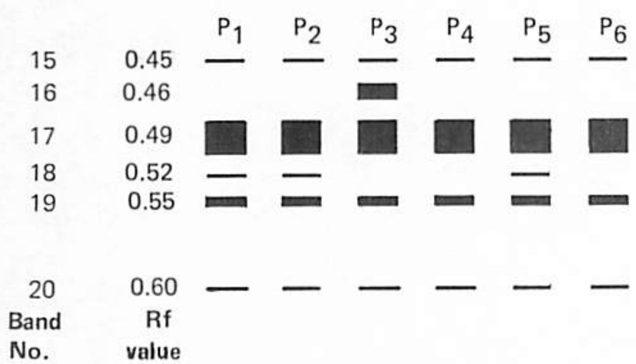


**Fig. 3.** Seed protein patterns (groupB) in six genotypes of V. faba L. : $P_1$ Aguadulce; $P_2$ Vesuvio; $P_3$ Loc. di Putignano; $P_4$ MG 106590; $P_5$ MG 106596; $P_6$ MG 106865.

Wright and Boulter (1974) reported that the polypeptide subunits having a molecular weight of approximately 53 daltons included the most important legumin fractions. The presence/absence of a few bands could be of great value for further work, especially in identifying and selecting superior genotypes.

Our results also confirm that it is not necessary to purify the globulin subunits for large-scale screening since differences in the polypeptide banding pattern for this fraction can be seen from extracts of the total seed. However, a more precise genetic analysis of the heritable variation of the globulin subunits would require purified samples.

Although only a few genotypes were investigated, these results confirm that there are no substantial differences between the patterns of the three botanical groups of *V. faba* L. *major*, *equina*, and *minor* with large, medium, and small seeds, respectively. The bulk approach, which minimizes the variation in protein composition within genotypes, seems to be useful in detecting small but reproducible differences among the six genotypes. This is in agreement with the results obtained by Goodrich *et al.* (1985).

In conclusion, the observed presence / absence of some seed protein subunits with medium mobility (group B) may suggest further investigations for their genetic assessment and significance in relation to qualitative and quantitative protein variability and their level of association with other seed and plant characters.

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الاختلاف في الوحدات الثانوية للبروتين المخزون لطرز وراثية مختلفة من الفول Vicia faba L.

ملخص

تم في هذه الدراسة فحص الاختلافات في نماذج البروتين المخزون لبذور ستة طرز وراثية من الفول ( Vicia faba L.) متأقلمة جيدا في منطقة جنوب ايطاليا . وقد استخدمت طريقة SDS - PAGE لفحص التباين في اشكال الروابط لمركبات الببتيدات المتعددة الكلية وللغلوبيولين في البذور ، وكان فيها اختلاف ضئيل بين الطرز الوراثية . وباستثناء السلالة " Locale di Putignano " المنتخبة محليا فقد ظهر ان الطرز الوراثية متماثلة من حيث الاستشراد او الهجرة الكهربائية "electrophoresis". وتوءكد نتائج تجاربنا المتكررة ان تركيب البروتين ضمن الطرز الوراثية يمكن وصفه باستخدام مستخلصات البذور الاجمالية .

## Isolation and Evaluation of a Bold-Seeded Mutant of Vicia faba var minor

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### Abstract

**A tall variant was isolated from a local faba bean variety maintained at Dholi Centre, Bihar, India. It had long pods and bold seeds. After multiplication and evaluation in later generations it was found to be stable for these characters. The 100-seed weight of the mutant line was 54 g while that of the parent was 32 g.**

### Introduction

A number of workers have obtained useful mutants of faba bean by induced mutagenesis (Sjodin 1971; Abdalla and Hussein 1977; Filippetti and De Pace 1982; 1983; 1986). The search for mutations in landraces of faba bean with desirable traits is very helpful in improving this crop.

In India, *Vicia faba minor* is grown. It has small seeds with a 100-seed weight of 30-40 g. We report here the isolation and evaluation of a bold-seeded mutant isolated from the local variety DB-24.

### Materials and Methods

DB-24, a local faba bean variety, was grown in a yield trial with other varieties in the 1984/85 winter season at Dholi, Bihar. One plant in the DB-24 plot was found to be vigorous and was therefore tagged. When the plant came into flowering, it was covered with muslin cloth to avoid cross-pollination. In the next generation it was multiplied in isolation and in the winter of 1986/87 its agronomic characteristics were evaluated. The mutant DBM-1, with its parent variety DB-24 were tested in 4x3 m plots with 40 cm and 20 cm between rows and plants, respectively. The crop received one supplementary irrigation. The soil in the experimental plot was sandy loam and calcareous. A manurial dose of 30 N:40 $P_2O_5$ was applied at sowing.

### Results and Discussion

Yields and other data are presented in Table 1. The mutant line, DBM-1, was almost double the height of its parent line (Fig. 1) and had much larger pods and seeds (Figs. 2 and 3). There were fewer pods/plant in the mutant line but the difference was not significant and the number of seeds/pod in the mutant was about the same as DB-24. Seed size (100-seed weight) in the mutant was 54 g compared to 34 g in the control, so the yield/plant is higher in the mutant line. DBM-1 yield was 4000 kg/ha compared to 2500 kg for DB-24. With further testing, this could become a new variety.

Table 1. Means for various characters in the mutant DBM-1 and control DB-24.

| Character | Mutant (DBM-1) | Control (DB-24) |
|---|---|---|
| Plant height (cm) | 75.6+4.8** | 42.4+3.2 |
| Stems/plant | 3.2+0.20 | 4.0+0.24 |
| Pods/plant | 28.4+4.6* | 35.3+6.4 |
| Seeds/pod | 3.4+0.12 | 3.2+0.10 |
| Seed yield/plant (g) | 44.4+5.2* | 37.8+4.4 |
| 100-seed weight (g) | 54.0+1.40* | 34.6+1.12 |
| Yield (kg/ha) | 4000* | 2500 |

*Significant at p=0.05; **significant at P=0.01.

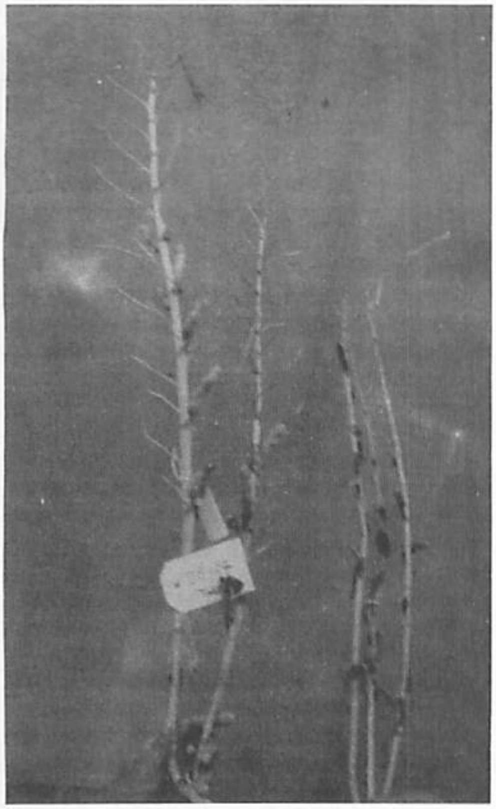

Fig. 1. Plant - mutant (left); control (right).

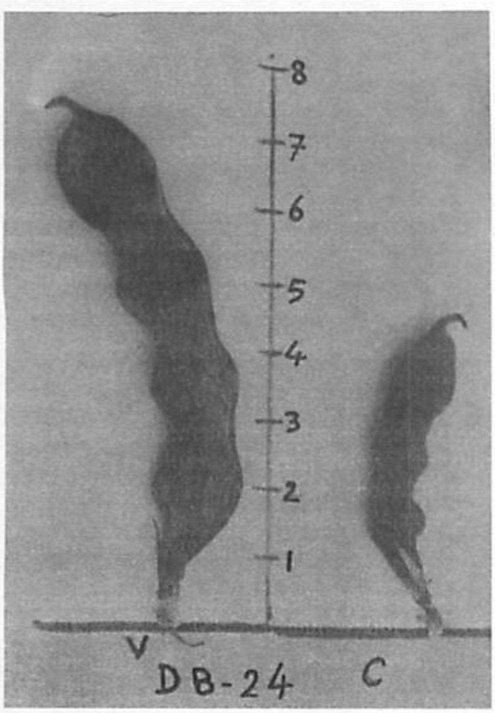


Fig. 2. Pod - mutant (V); control (C).

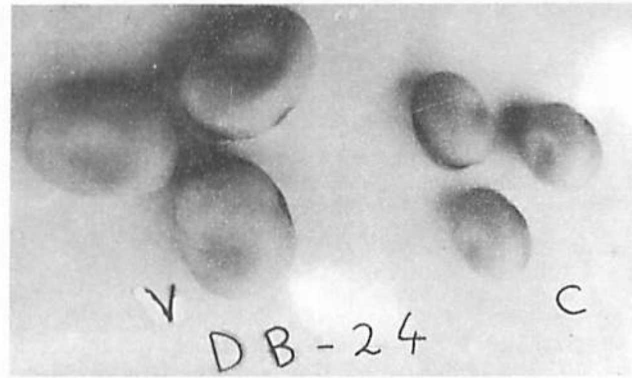


Fig. 3. Seeds - mutant (V); control (C).

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## عزل وتقييم طفرة من الفول (Vicia faba var minor) كبيرة البذور

ملخص

تم عزل نبات طافر طويل من صنف الفول البلدى لدى مركز ( Dholi ) في بيهار بالهند . وهو ذو قرون طويلة وبذور كبيرة . وبعد الاكثار والتقييم في الاجيال التالية وجد بأنها ثابتة لهاتين الصفتين . وبلغ وزن المائة حبة للسلالة الطافرة 54 غ بينما هو عند الاصل الابوى 32 غ .

# Physiology and Microbiology

# الفيزيولوجيا والأحياء الدقيقة

## Effects of Salinity and Relative Humidity on Growth and Ionic Composition of Faba Bean

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**Abstract**

**Faba bean was grown in growth cabinets in nutrient solutions with and without 50 mM NaCl at either 30 ± 5% or 90 ± 5% relative humidity (RH). Plant growth was significantly better under high RH conditions in both non-saline and saline root environments. Cation (K, Na, Ca, Mg) and anion (Cl) accumulation in different plant parts was higher in low RH than in high RH. Hence there was a negative correlation between the ionic built-up in plant shoots and shoot growth depression. The data indicate possibilities of improving plant growth in salt-affected soils by manipulating RH.**

### Introduction

In arid and semi-arid areas of the world, soils tend to accumulate excessive salts in the surface layers. The performance of different plants depends upon the species' salt sensitivity and the concentration of salts in the soil (Greenway and Munns 1980). Excessive salts render soils unsuitable for growing many salt-sensitive crops. In Pakistan approximately 6 million ha out of 15.5 million ha total agricultural land is affected by excessive salts to varying degrees (Muhammad 1978) and as a result, there are substantial yield losses of different crops. One way of utilizing these salt-affected soils is to cultivate salt-tolerant crops and varieties and adopt suitable soil management practices.

One significant physiological effect on plant growth in salt-stressed environments is the osmotic effect of salinity resulting in decreased hydraulic conductivity of roots (O'Leary 1974). In some species, improved growth has been observed in saline root media when the relative humidity is high (Nieman and Poulsen 1967; Prisco and O'Leary 1973; Hoffman and Jobes 1978). This improved growth is attributed to improved water relations in the plant and/or a reduced build-up of salts in the plant tissues. The reduction in plant growth in saline root media is negatively correlated to the salt accumulated in plant shoots (Salim and Pitman 1983).

In general, beans are reported to be sensitive to salts but some species may be moderately tolerant (Maas and Hoffman 1977). Any improvement in plant performance in salt affected soils by manipulating the growth conditions is worthwhile. This preliminary study aimed to investigate the growth response of faba bean in non-saline and moderately saline root environments at two levels of relative humidity. The inorganic ion contents of these plants are reported along with growth data.

### Materials and Methods

Seeds of faba bean cv Fiord were sterilized by soaking in 10% sodium hypochlorite for 15 min then washed in running tap water overnight to soften the seed coat. The seeds were germinated on stainless steel gauze trays suspended over aerated Hoagland solution. Five-day old germinated seedlings were transferred to plastic containers filled with 10 l of control solution continuously aerated in a growth cabinet. The seedlings were held in place with plastic foam plugs through the plastic container lids. When the seedlings were 1 week old, the solution in half of the containers was changed to 50 mM NaCl by stepwise addition of 10 mM NaCl every 3 h. One set of Hoagland solution (control) and 50 mM NaCl treatments in triplicate was then placed in a growth cabinet at 35 ± 5% RH. Another set of containers comprising control and 50 mM NaCl in triplicate was put in another growth cabinet at 90 ± 5% RH. Both these cabinets had a continuous temperature of 25 ± 1°C and light intensity of 250 $E/m^2/s$ for 14 h. Plants were grown for 10 days and during this period the solutions in all the containers were replaced twice with equivalent fresh solutions.

**Table 1.** Effects of salinity and relative humidity on faba bean growth.

| Treatment | Relative humidity | Shoot | | | Root | | |
|---|---|---|---|---|---|---|---|
| | | FW[1] | DW[2] | FW/DW | FW | DW | FW/DW |
| Control | Low | 25.8+3.2 | 2.92+0.42 | 8.83 | 16.4+2.6 | 0.89+0.07 | 18.42 |
| 50 mM NaCl | Low | 17.5+1.1 | 1.90+0.17 | 9.21 | 13.2+1.0 | 0.76+0.06 | 17.37 |
| Control | High | 41.7+3.3 | 4.70+0.28 | 8.87 | 24.6+1.5 | 1.42+0.11 | 17.32 |
| 50 mM NaCl | High | 30.8+2.1 | 3.58+0.11 | 8.62 | 23.7+1.8 | 1.41+0.12 | 16.81 |

[1]Fresh weight (g/plant); [2]Dry weight (g/plant).

Fresh and dry (drying at 70°C) weights of plants were recorded at harvest. For inorganic ion analysis, samples were separated into leaves, stem, and roots and extracted with boiling 1.0N $HNO_3$ followed by two extractions with boiling distilled water. Cations were determined by atomic absorption spectrophotometry and chlorides were estimated using coulometric titration.

## Results and Discussion

Due to practical limitations, only two levels of salt concentration and two of relative humidity could be studied for 10 days. Growth was better in both the control and 50 mM NaCl solution at high RH (Table 1). For both levels of RH, although salt treatment decreased shoot growth compared with that in the control, the magnitude of the reduction of shoot growth at low RH was higher than that at high RH. Similarly root development was also much better at high RH than at low RH. Salt did not reduce root weights at either level of RH. The fresh weight: dry weight ratios for roots were approximately twice those of shoots but the salt treatments and levels of relative humidity did not affect the relative water content of the plant tissues. Better growth of different plant species in both non-saline and saline root media has already been reported by Nieman and Poulsen (1967), Prisco and O'Leary (1973), and Hoffman and Jobes (1978).

The inorganic ion contents of the plants are presented in Table 2. There was differential uptake/accumulation of various ions by different plant organs. Except for Na and Ca, the ion contents of the stems were lowest for all treatments. In control solutions, roots had much higher K contents compared to the leaves but in salt solutions this trend was reversed. The selective uptake of K rather than Na in NaCl solution has been demonstrated by Salim and Pitman (1983) for mung beans. In 50 mM NaCl with high RH, roots and stems effectively retained Na, keeping the leaves relatively free of Na. This mechanism of Na retention by the roots and stem has been reported in *Phaseolus vulgaris* by Jacoby (1964). In low RH conditions with 50 mM NaCl, leaves accumulated more Na than those in higher RH. This is primarily due to higher Na flux and accumulation in roots and stem resulting in leakage to the leaves. After K, Ca was the main cation present in the leaves in all treatments. Accumulation of Ca in leaves as well as in roots significantly increased with decreasing RH in both the control and 50 mM NaCl but the magnitude of Ca accumulation in roots and leaves in the salt treatment was much higher compared to that in control solution. The trend in Mg for the two levels of RH and both solutions was similar to that of Ca, but the trend was more pronounced for the later. The chloride content of the leaves tended to approach the content of K in the plants grown in salt solutions. Cl accumulation in the leaves was relatively high indicating little accumulation in roots and stem, as in the case of Ca and Mg.

Overall, these data indicate increased accumulation of almost all ions, specifically in the leaves, in response to low relative humidity. This is supported by the findings of Nieman and Poulsen (1967).

The total ionic load in leaves and stem was plotted against the corresponding leaf and stem dry weights as a percentage of those of the control under high RH (Fig. 1). There was a negative correlation (r= - 0.756) between the total ionic or salt load and plant growth. This is supported by the reports of Wieneke and Lauchli (1979) and others. The improvement in plant growth in high relative humidity and saline environments may be due to either the improvement in water relations and/or to the reduced salt load in plant shoots.

**Table 2.** Effects of salinity and relative humidity on inorganic ion content ($\mu$eq/g dry weight) on faba bean.

| Treatments | Humidity | Plant part | Ion content | | | | |
|---|---|---|---|---|---|---|---|
| | | | K | Na | Ca | Mg | Cl |
| | | Leaf | 1524 | 7 | 569 | 322 | 29 |
| Control | Low | Stem | 1349 | 15 | 225 | 64 | 22 |
| | | Root | 2007 | 35 | 155 | 242 | 25 |
| | | Leaf | 1713 | 161 | 651 | 278 | 1533 |
| 50 mM NaCl | Low | Stem | 767 | 1177 | 134 | 46 | 663 |
| | | Root | 934 | 2087 | 158 | 160 | 639 |
| | | Leaf | 1270 | 4 | 465 | 211 | 28 |
| Control | High | Stem | 1101 | 6 | 183 | 59 | 23 |
| | | Root | 2256 | 21 | 108 | 296 | 26 |
| | | Leaf | 1665 | 19 | 398 | 245 | 1279 |
| 50 mM NaCl | High | Stem | 934 | 663 | 141 | 30 | 513 |
| | | Root | 1598 | 1201 | 100 | 165 | 732 |

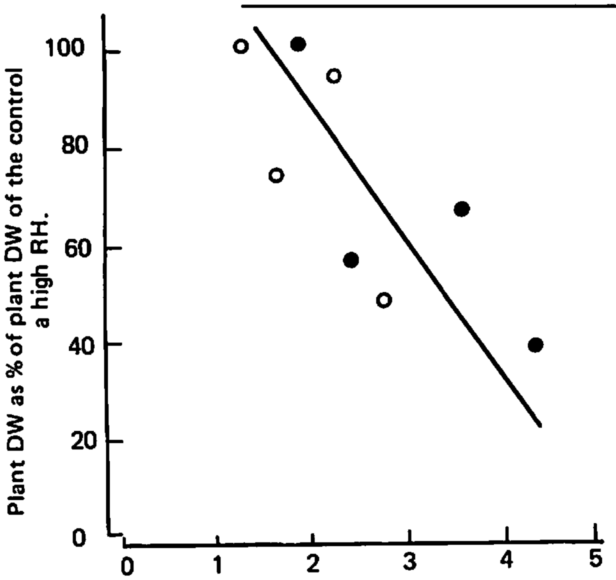


**Fig. 1.** Relationship between ionic load in faba bean leaves (●) and stem (O) and their respective dry weights as % of those of the control in high RH (correlation co–efficient – 0.756).

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تأثيرات الملوحة والرطوبة النسبية على النمو والتركيب الايوني عند الفول

ملخص

زرعت سلالات فول في حجر انبات على محاليل غذائية بغياب أو وجود تركيز 50 mM من NaCl عند 30 ± 5 % او 90±5 % رطوبة نسبية . وكان نمو النبات أفضل بفرق معنوى تحت ظروف الرطوبة النسبية العالية في البيئة الجذرية للمحلولين الملحي وغير الملحي . وكان تراكم الكاتيونات ( K و Na و Ca و Mg ) والانيون ( Cl ) عاليا في مختلف اجزاء النبات عند الرطوبة النسبية المنخفضة منه عند الرطوبة النسبية المرتفعة . وهكذا فان هناك ارتباطا سلبيا بين التركيب الايوني في أفرع النبات وضعف نموها . وتشير هذه النتائج الى امكانية تحسين نمو النبات في الترب المتأثرة بالملوحة وذلك بالتحكم بالرطوبة النسبية .

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## Low Temperature and Faba Bean (Vicia faba L.) Yield

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### Abstract

**The hardiness of the faba bean flower and its ovary covered with corolla till 10 days after fading was observed. Varieties with greater number of flowers and longer duration of flowering had greater ability for self-regulation and complementation under a certain degree of low temperature, hence possessed potentialities of stable high yields. Total dry matter (DM) decreased after top removal, the earlier the removal the greater the decrease. It is total DM increase per unit area that can effectively increase the yield. Dry matter and harvest index can be used for selection of high yielding genotypes. Improvement of environmental conditions and enhancement of field management can also enable the total DM and harvest index to reach a desirable level, i.e., markedly increase the yield.**

### Introduction

The pod shedding rate in faba bean is very high (about 95%). This can be due to a number of factors including: (a) sterility caused by self-incompatibility, (b) poor development of the fertilized seeds, (c) formation of abscission layers at the bases of the flower stalk and the inflorescence axis, (d) competition for nutrients between young pods and the growing point and between bigger and younger pods, and (e) water stress. However, the indeterminate nature of the faba bean inflorescence may to a certain extent make up for this loss. With favorable conditions and good management high yields can still be expected, even if the shedding rate is not markedly reduced.

Faba bean is not generally a low yielding crop and there is great potential for increasing yields. For example, in England Igwits (1982) reported the highest yield to be 10.7t /ha. In China, the highest yield of spring faba bean has reached 9.7t/ha, while in Yunnan Province, 7.71t/ha was achieved in 1984 in a high yield plot of autumn faba bean in the Dachuan Production Brigade in Dali. In 1985, the yield was 8.15t/ha in the Faba 81-52 plot at the Yunnan's Academy of Agricultural Sciences.

Faba bean is very sensitive to the environment, so yields are unstable. Fluctuations between years in Yunnan are largely due to low temperatures injuring the reproductive parts of the plant. Damage is also done by diseases and insect pests. According to records kept from 1980 to 1986 by the provincial weather station at the Yunnan Academy of Agricultural Sciences, 189 days in the 7 years were at or below O°C, with 38.1% of the days at 0 to 0.9°C, 27.5% at -1.0 to -1.9°C, and 34.4% below -2.0°C. Of the days with low temperatures, 71% were harmful to faba bean i.e. temperatures were below 1.0°C. The lowest temperatures generally occur in late January when faba bean is at the flowering and young pod-forming stages. If low temperatures last for a long period, and especially if heavy frost is delayed to the pod forming stages, there can be large yield losses and the whole crop may be lost.

In Yunnan in 1984 yields were good but they were very poor in 1985 and 1986. We have observed that no severe damage occurs due to low temperatures in January, but from the beginning of February onward damage is greater the more frequent the occurrence of low temperatures. At the beginning of February 1985, there were 7 days at and below -2.0°C, and the average yield of the province was 14% lower than that of 1984. In

Table 1. Correlation between time of flowering, growing period, and grain yield.

| Year | Number of varieties | Seeding date | Time of flowering (days from seeding) | Growing period (days from seeding to maturity) | Yield (kg/ha) |
|---|---|---|---|---|---|
| 1984 | 18 | 10/12 | 98 - 120 | 188 - 199 | 4791 - 6237.8 |
| * r to yield | | | - 0.123 | 0.159 | |
| 1985 | 18 | 10/14 | 78 - 91 | 193 - 202 | 2542.5 - 8150.3 |
| r to yield | | | 0.129 | 0.050 | |
| 1986 | 7 | 10/7 | 77 - 89 | 195 - 200 | 1407.8 - 3849 |
| r to yield | | | 0.742 | 0.551 | |

*correlation coefficient = r n = 18 - 2. P.05 = 0.468 P.01 = 0.589
n = 7 - 2 P.05 = 0.754 p.01 = 0.874

1986, there were few days with low temperatures up to the end of February, but historically low temperatures and snow occurred at the beginning of March resulting in a heavy loss of pods and poor yields over a large area.

**Importance of flowering time**

Of the reproductive parts, the young pods of faba bean are most sensitive to low temperatures. The hardiness of the flower and the ovary covered with corolla till 10 days after fading has not previously been reported. Our observations, made from 1 to 6 March 1986 (when freezing temperatures occurred), showed that the flowers starting to blosson in late February which were subjected to 5 days of low temperatures (minimum 5.0°C) were still able to form pods. However, all the young pods which had emerged from the corolla and those containing swelling seeds were frozen and the young seeds necrotized, even though the pod itself survived the cold. This indicates that during anthesis the flowers are much hardier than young pods. Therefore a comparatively safe podding period would be during the time when the lowest temperatures have already occurred. In Kunming, if flowering occurs in the period of heavy frost and much of the podding and pod growth occur after that period, yields should be stable and high. The optimum sowing date has been shown experimentally to occur in the period from the beginning to 20 October and thus damage due to heavy frost can be avoided or reduced.

The responses of early and late varieties to low temperatures are obvious. During the early budding period in late December 1983, severe frost occurred and most of the flower buds were shed because of the cold. Anthesis of different varieties was postponed to mid- and late January. In 1985 and 1986, there were no very low temperatures, so anthesis came earlier than in 1984. In varietal tests conducted for 3 years in adjacent plots with uniform soil fertility, the relationships between time of flowering, growing period, and yield were studied (Table 1).

The correlation coefficients between grain yield and time of flowering and growing period were insignificant except in 1986. The correlations between grain yield and time of flowering were positive except in 1984 when flowering was postponed because of the low temperatures at the early budding stage. This indicates that early flowering and early maturing varieties are detrimental to yield increase. It is worth emphasizing that the negative correlation between grain yield and time of flowering occurred in 1984 when the entire flowering period was delayed and in February of that year temperatures were not very low. In 1985 and 1986, flowering time was normal and the early flowering varieties were obviously at a disadvantage under the severe temperatures in the late growth period (Table 2).

**Number of flowers and period of flowering**

The number of faba bean flowers is determined by the raceme/stem, number of inflorescences/raceme, and number of flowers/inflorescence. The differences between these parameters constitute the varietal differences in flower numbers. de Pace *et al.* (1986) pointed out that varieties with few flowers are suitable for semiarid regions. Dantuma *et al.* (1983) believed that a small number of flowers on the inflorescence is conducive to concentrating the supply of

Table 2. Yields of faba bean varieties with different flowering and mature stages.

| Year | Variety | Flowering stage | | Mature stage | | Yield/ plant (g) | Yield | |
|---|---|---|---|---|---|---|---|---|
| | | date | days from seeding | date | days from seeding | | (kg/ha) | (% of 8152) |
| 1984 | 7903 | 1/26 | 106 | 4/18 | 188 | 19.3 | 5477.3 | 89.2 |
| | 80403 | 1/18 | 98 | 4/23 | 193 | 21.6 | 5847.0 | 95.3 |
| | 8152 | 2/8 | 119 | 4/26 | 196 | 22.7 | 6138.0 | 100.0 |
| 1985 | Bean | 12/22 | 79 | 4/15 | 193 | 16.1 | 4672.5 | 57.3 |
| | 8130 | 12/21 | 78 | 4/18 | 196 | 24.7 | 6567.5 | 79.4 |
| | 8152 | 12/28 | 85 | 4/21 | 199 | 30.1 | 8150.3 | 100.0 |
| 1986 | 8219 | 12/28 | 76 | 4/21 | 196 | 5.96 | 1407.8 | 36.6 |
| | Co8 | 12/26 | 82 | 4/20 | 195 | 6.63 | 1859.3 | 48.3 |
| | 8152 | 1/4 | 87 | 4/24 | 199 | 14.45 | 3849.0 | 100.0 |

nutrients. In our experiment under irrigated conditions, variety 7903 was compared with 8056. The results showed that the initial stage of flowering of both varieties was similar but differed in duration; in 7903 it was only 24 days while in 8056 it was 47 days. After injury due to freezing, 7903 only produced 6.8 pods/plant while 8056 produced 10.43 pods. As the difference in number of pods was 65.2%, the yield of 7903 was only 37.9% that of 8056. As a result, varieties with a greater number of flowers and longer duration of flowering have a greater capacity for spontaneous regulation and complementation at certain low temperatures and hence possess the potential for stable, high yields.

## Dry matter (DM) and Harvest Index

In wheat, Paccaud *et al.* (1985) found that grain yield is significantly positively correlated with biomass and harvest index. This is similar to the findings of Nagl (1981), who calculated the correlations between grain yield and total dry matter in faba bean. Dantuma *et al.* (1983) pointed out that faba bean yield is limited by its total DM which is reflected in harvest indexes.

The results of the population density experiment showed that different densities had little effect on their harvest indexes, whereas the grain yield was increased with total DM. Total DM decreased after topping, the earlier the removal the greater the decrease. Topping resulted in reduced leaf area, poor supply of nutrients to the pods and hence the number of aborted pods and seeds was increased which was reflected in decreased yield as compared to untreated plants. As a result, in production, top removal must be practiced with caution. The varietal trials (1985 and 86), revealed highly significant correlations between grain yield, biomass, and harvest index. The relationship between yield and biomass in 1986, though not significant followed the same trend.

Thompson (1983) reported that total DM is related to leaf area index and green area duration. Field observations showed that the total DM of a certain variety relies largely on the length of its growing period and duration of the green leaf area, not on the plant height and leaf size. Intervarietal differences in harvest index are related to short flowering period, small number of pods, or early leaf shedding. This suggests that the DM and harvest index can be used as a means for identification in breeding work. Meanwhile, the improvement of environmental conditions with better field management can also enable the total DM and harvest index to reach a desirable levels.

Our experiment showed that the growth of the variety 8152 presents a suitable plant type in the faba bean crop, it has a long green leaf duration, high production of grain yield 8.1 t/ha, high production of DM 18.3 t/ha, and high harvest index 44.4%. This proves the great potentialities of faba bean crop.

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## الحرارة المنخفضة وغلال وفيرة من الفول (Vicia faba L.)

### ملخص

لوحظ أن زهرة الفول المغطى مبيضها بالتويج قادرة على تحمل درجات الحرارة المنخفضة حتى 10 ايام بعد ذبولها . وكان للاصناف ذات الازهار الكثيرة ومدة الازهار الطويلة قدرة أكبر على التنظيم الذاتي والتكامل تحت درجة معينة من الحرارة المنخفضة ، وهكذا فانها تمتلك طاقات لانتاج غلال عالية ومستقرة . وقد تناقصت المادة الجافة الكلية بعد ازالة القمة ، وكلما كانت الازالة أبكر كلما كان التناقص اكبر . ان زيادة المادة الجافة الكلية بوحدة المساحة تستطيع زيادة الغلة بشكل فعال ، كما يمكن استعمال المادة الجافة ودليل الحصاد كمعايير للانتخاب في برنامج التربية . وان تحسين الظروف البيئية وادارة الحقول يمكن ان يدفعا ايضا بالمادة الجافة الكلية ودليل الحصاد للوصول الى المستوى المطلوب ، اى زيادة الغلة بدرجة ملحوظة .

## Agronomy and Mechanization

## المعاملات الزراعية والمكننة

# The Effect of Plant Population, Sowing Date, and Pigeon Pea Shelter (Shading) on the Incidence of the Root Rot/Wilt Disease Complex and Yield of Faba Bean

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**Abstract**

**The effects of growing pigeon pea as a shelter, sowing date, and plant density on faba bean yield and its components were investigated. The shelter crop significantly reduced seed yield by 53 and 64% when it was grown for a short and long duration, respectively, due to reduced plant stand and significantly fewer pods/plant. Sowing in November and planting three rows/ridge resulted in significantly greater seed yield than sowing in October with one row/ridge. Sowing date and plant population significantly affected root rot and wilt incidence. Disease incidence decreased with late sowing and was significantly higher at 16.6 plants/m$^2$ than at 49.9 plants/m$^2$.**

Root rot (*Fusarium solani* f.sp. *fabae*) and wilt (*F. oxysporum*) are the major soil-borne diseases of faba bean in the Sudan, where the heavy soil and high soil temperatures predispose the plants to attack. When the crop is planted in early October, both diseases occur early during crop establishment.

In Sudan, faba bean cultivation is being extended to the non-traditional, marginal areas. A number of experiments have been conducted at Shambat and Wad Medani with the objective of reducing soil temperature, and so decreasing the incidence of the root rot/wilt disease complex.

In this field study, pigeon pea (*Cajanus cajan*) was used as a shelter crop and the incidence of root rot and wilt, and yield were recorded. The effects of different sowing dates and plant densities were also examined.

## Materials and Methods

Faba bean variety BF 2/2 was grown under pigeon pea as a shelter crop either for the whole season (long duration) or the pigeon pea was cut when the faba bean flowered (short duration). The crop was also grown under exposed conditions i.e., without a shelter crop. Sowing was carried out on 13 October and 4 November 1982 at two plant densities (16.6 ($P_1$) and 49.9 plants/m$^2$ ($P_2$)). The shelter crop was planted at both sides (one ridge) and the ends (50 cm width) of the experimental plots on 15 August 1982. Faba bean was planted in the center ($P_1$) and in the center and on both sides ($P_2$) of a 60 cm wide ridge and at a 20 cm plant spacing with two plants/hole. Plants were irrigated at intervals of 7 - 10 days. The statistical design was spit-plot with population and sowing date factorially arranged. The shelter crop occupied the main plots and there were four replicates.

## Results and Discussion

Comparing sheltered and unsheltered faba beans, there was no improvement in plant stand/m$^2$ when the crop was sheltered. However, the long duration shelter appreciably reduced plant stand/m$^2$. This could be due to the high competitive ability of pigeon pea and the spacing between the two crops which resulted in the pigeon pea smothering part of the faba bean crop (Table 1).

The shelter crop significantly reduced faba bean seed yield by 53 and 64% for the short and long duration shelter, respectively, due to lower plant stand and significantly fewer pods/plant (Table 1).

Delaying the sowing date from 13 October to 4 November on average significantly increased seed yield by 252 kg/ha, mainly due to a significant improvement in plant stand. This agrees with the result of Salih and Khalafalla (1982) who found that the optimum sowing date for faba bean at Shambat was between 25 October and 10 November.

The interaction between sowing date and shelter was highly significant for seed yield (Table 2). For both sowing dates, the yields of faba beans sheltered for long duration were nearly equal. The yields of plants

**Table 1.** Effects of the duration of shading, sowing date, and plant population on grain yield and some yield components of faba bean at Shambat.

| Treatments | | Grain yield (kg/ha) | Plants/ $m^2$ at harvest | No. of pods/ plant | 1000-seed weight (g) | Mean % of dead plants* |
|---|---|---|---|---|---|---|
| Shading treatments (duration) | | | | | | |
| Short | | 1230 | 16.4 | 17.7 | 417 | 1.97 |
| Long | | 932 | 14.1 | 17.6 | 422 | 1.48 |
| Unsheltered | | 2598 | 16.8 | 25.5 | 425 | 2.34 |
| | S.E. ± | 75 | 0.77 | 0.46 | 9.44 | 0.29 |
| Sowing date | | | | | | |
| 13 October | | 1286 | 11.8 | 21.8 | 431 | 2.44 |
| 4 November | | 1888 | 19.7 | 18.7 | 411 | 1.44 |
| | S.E. ± | 62 | 0.49 | 0.69 | 4.94 | 0.23 |
| Plant density | | | | | | |
| 16.6 plants/$m^2$ | | 1337 | 10.8 | 22.2 | 415 | 2.46 |
| 49.9 plants/$m^2$ | | 1836 | 20.8 | 19.3 | 428 | 1.41 |
| | S.E. ± | 62 | 0.49 | 0.69 | 4.94 | 0.23 |

* Transformed into degrees.

sheltered for a short duration and unsheltered were greater at the November sowing date: the percentage increases over the October sowing date were 45 and 28%, respectively (Table 2).

**Table 2.** The effect of the interaction between shelter and sowing dates on grain yield of faba bean (kg/ha).

| Shelter treatments | Sowing date: 13 October | Sowing date: 4 November | Mean |
|---|---|---|---|
| | (± 108) | | (± 75) |
| Short | 873 | 1587 | 1230 |
| Long | 818 | 1046 | 932 |
| Unsheltered | 2166 | 3030 | 2598 |
| Mean | 1286 | 1888 | 1587 |

Data in parenthesis are SE values.

The plant stand at harvest was doubled from 10.8 to 20.8 plants/$m^2$ (Table 1) by planting three rows (49.9 plants/$m^2$) instead of one row/ridge (16.6 plants/$m^2$). This significantly increased seed yield by 200 kg/ha. Similar findings were reported by Salih (1985) but Ageeb (1981) reported that planting a single row on the east or west side of a north-south oriented ridge or three rows/ridge resulted in the lowest yield.

The incidence of wilt and root-rot was lower in the shaded treatments but the differences were not significant. Sowing date significantly affected disease incidence which decreased with late sowing and disease incidence was significantly higher at 16.6 plants/$m^2$ than at 49.9 plants/$m^2$.

It is clear from our results that the use of pigeon pea as a shelter crop to extend the growing season at Shambat and thereby increase yield was not successful. Seed yield was increased by sowing at the optimum date and at higher plant densities.

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تأثير كثافة النبات وموعد الزراعة والتظليل بالبسلة الهندية Pigon Peas على درجة الاصابة بمرض الذبول وتعفن الجذور وعلى غلة الفول •

ملخص

درست تأثيرات زراعة البسلة الهندية واستعمالها كواقية وموعد الزراعة، وكثافة النبات على الغلة الحبية للفول ومكوناتها • وقد انخفضت الغلة الحبية بدرجة معنوية تحت تأثير المحصول الواقي الى 53 % و 64 % عندما زرع لمدة قصيرة وطويلة على التوالي ، وذلك بسبب تناقص كثافة النبات وقلة عدد القرون/النبات بشكل معنوى • أما الزراعة في تشرين الثاني/نوفمبر بواقع ثلاثة سطور/الظهر ( ridge) فأعطت غلة حبية أعلى معنويا من الزراعة في تشرين الاول/اكتوبر بمعدل سطر واحد/الظهر • وقد أثر موعد الزراعة والكثافة النباتية على درجة الاصابة بمرضي تعفن الجذور والذبول بشكل معنوى ، اذ انها تناقصت مع الزراعة المتأخرة وكانت اعلى معنويا عند16.6 نبات/م$^2$ منها عند 49.2 نبات/م$^2$ •

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# Response of Faba Bean to Chicken Manure and Split Nitrogen Application

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## Abstract

**Under the soil and climatic conditions of Soba Research Farm, faba bean var BF/2/2 was tested for its response to application of chicken manure and nitrogen for three seasons. Application of chicken manure and splitting nitrogen as 20 kg N/ha both at sowing and after 1 month gave the best yields throughout the study. The increase in yield due to chicken manure was in general more than 25%, while combined chicken manure and the two split nitrogen doses gave more than 50% increase. Both chicken manure and two split nitrogen doses combined gave significantly more pods and seeds, and taller plants.**

## Introduction

An earlier report by Yousif (1982) showed that application of manures significantly increased the yield of faba bean. However, it was not clear whether addition of nitrogen in small, split doses would be better for this legume. A starter dose of nitrogen is known to induce the activity of nitrogen fixing bacteria in most legumes. Subsequent nitrogen applications after establishment of nitrogen fixing bacteria might further improve crop yield. The following work was conducted to study the effect of application of split nitrogen and chicken manure to faba bean.

## Materials and Methods

Faba bean var BF/2/2 was tested for its response to chicken manure (0 and 12.8 t/ha) and nitrogen (0 and 40 kg/ha) under the soil and climatic conditions of Soba Research Farm. Chicken manure was applied at sowing, while nitrogen was either applied at sowing or in split equal doses. The split doses were either 20 kg at sowing and 20 kg after 1 month, or 13 kg at sowing, 13 kg at 1 month, and 13 kg 2 months later. The eight treatments were replicated four times. Seeds were sown in the first week of November for the three seasons of the study (1981-84). Weeds and pests were kept to a minimum and the crop was irrigated every 10 days. Yield and yield components were determined and data were analyzed statistically.

## Results and Discussion

Table 1 shows the yield of faba bean for the different treatments. There was no significant yield increase for either nitrogen or chicken manure in 1981/82. However, there is a general trend for increased yield due to application of chicken manure and split nitrogen. The best yield was obtained by applying 13 kg N at sowing and 1 and 2 months after sowing.

In 1982/83 application of chicken manure significantly increased yield but addition of nitrogen did not improve yield no matter how it was applied. In 1983/84 it was very clear that splitting the dose of nitrogen twice (at sowing and 1 month later) gave significantly higher yields when the nitrogen was applied with chicken manure. Application of chicken manure alone increased yield but not significantly.

The average yields for the three seasons revealed that chicken manure increased the yield of faba bean by

**Table 1.** Yield of faba bean (kg/ha) as affected by application of chicken manure and nitrogen, 1981-84.

| Treatment | 1981/82 | 1982/83 | 1983/84 | Mean | Yield increase over control (%) |
|---|---|---|---|---|---|
| Control | 675 | 1364b* | 1125b | 1055 | |
| " + 40 kg N | 750 | 1493b | 1143b | 1129 | 7.0 |
| " + two doses N** | 800 | 1322b | 1312b | 1145 | 8.5 |
| " + three doses N*** | 807 | 1247b | 1114b | 1056 | 0.0 |
| 12.8 t/ha chicken manure | 717 | 2083a | 1268b | 1356 | 28.5 |
| " + 40 kg N | 767 | 2012a | 1330b | 1370 | 29.9 |
| " + two doses N | 817 | 2083a | 1929a | 1610 | 52.6 |
| " + three doses N | 967 | 2083a | 1392b | 1481 | 40.4 |
| S.E. | 92 | 165 | 148 | | |

* Means within each column having common letter (s) are not significantly different using the Duncan Multiple Range Test.

** 20 kg N at sowing + 20 kg N 1 month later.

*** 13 kg N at sowing and 13 kg each at 1 and 2 months later.

**Table 2.** Yield components of faba bean in relation to chicken manure split nitrogen application, 1983-84.

| Treatment | Pods/ plant | Seeds/ plant | Branches/ plant | Height (cm) |
|---|---|---|---|---|
| Control | 8.1b* | 17.0b | 2.3 | 53.9b |
| " + 40 kg N | 8.9b | 17.8b | 1.8 | 58.2b |
| " + two doses N** | 8.1b | 16.1b | 2.1 | 71.8a |
| " + three doses N*** | 10.5ab | 21.2b | 2.5 | 61.1ab |
| 12.8 t/ha chicken manure | 8.0b | 14.7b | 2.4 | 69.0ab |
| " + 40 kg N | 8.6b | 16.5b | 2.5 | 65.1ab |
| " + two doses N | 13.6a | 29.9a | 2.5 | 70.2a |
| " + three doses N | 10.7ab | 17.5b | 2.3 | 69.2a |
| S.E. | 1.2 | 2.6 | 0.2 | 3.4 |

* Values with the same letter are not significantly different using the Duncan Multiple Range Test.

** and *** as shown in Table 1.

more than 25%. Nitrogen application was only effective when applied with chicken manure and at a rate of 20 kg N at sowing and an other 20 kg N after 1 month. In this case both chicken manure and nitrogen increased yield by more than 50%.

Table 2 presents the yield components for the 1983/84 season. Both chicken manure and splitting nitrogen twice gave significantly more pods and seeds, and taller plants.

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**استجابة الفول للتسميد بذرق الدجاج واضافة الازوت على دفعات**

**ملخص**

تحت ظروف التربة والمناخ لمحطة بحوث سوبا للبحوث تم اختبار صنف الفول BF/2/2 لمدى استجابته للتسميد بذرق الدجاج والازوت على مدى ثلاثة مواسم . وقد ادى التسميد بذرق الدجاج واعطاء الازوت على جرعتين بواقع 20 كغ /آزوت/هـ عند الزراعة وبعد شهر واحد منها الى الحصول على افضل الغلال خلال مدة الدراسة . وقد بلغت الزيادة في الغلة الناجمة عن التسميد بذرق الدجاج أكثر من 25 % على العموم . بينما اعطى التسميد المركب من ذرق الدجاج والازوت على جرعتين اكثر من 50 % زيادة في الغلال مع زيادة معنوية في عدد القرون والبذور وطول النبات .

# Density Studies on Faba Bean (Vicia faba)

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## Abstract

**The effects of changes in plant density on yield and yield components were studied in a local strain of faba bean (Tapada da Ajula). The plants were grown at five population densities (10, 20, 30, 40, and 50 plants/m$^2$). The highest yield was obtained at 40 plants/m$^2$ but this was not significantly different from the yields at 30 and 50 plants/m$^2$. The increase in plant density resulted in a reduction in branching and number of pods/plant but little change in pods/stem, seed size, or seeds/pod.**

## Introduction

There is increasing interest in faba beans (*Vicia faba* L.) as a source of protein in the human diet and as livestock fodder. To improve faba bean production in Portugal, production techniques should be improved.

The objectives of this study were to examine the effects of changes in plant density on yield and yield components.

## Materials and Methods

The field experiments were carried out in the 1985/86 winter season at the experimental farm of the Institute of Agronomy in Lisbon. Weather data for the season are summarized in Fig. 1. The cultural practices followed are given in Table 1.

At harvest, 10 plants were randomly selected from each plot and dry weights of aerial parts were calculated on a per plant and unit area basis. Yield and yield components were calculated on a per plant basis. Dry pod yield was determined on a unit area basis and harvest index was calculated as dry pod weight/total dry weight.

## Results

The average yields of the different aerial parts on a per plant basis and per m$^2$ are shown in Table 2. These results indicate that the faba bean plant has a remarkable plasticity in response to variations in plant density. In fact the observed variation in yield is smaller than the differences in plant populations.

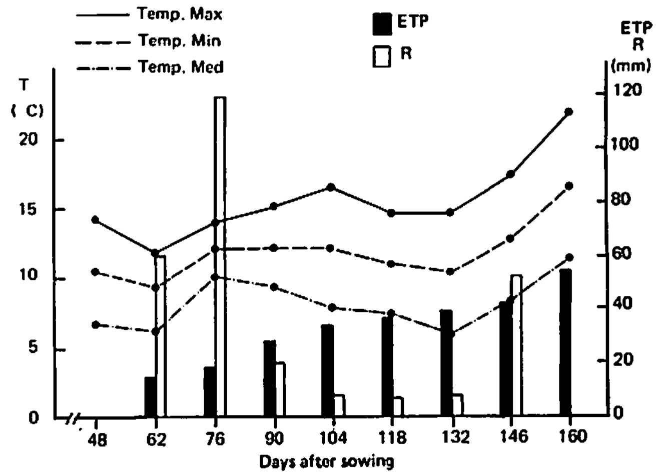


Fig. 1. Climatic diagram for winter 1985/86.

**Table 1.** Cultural practices followed in the 1985/86 field trials, Tapada da Ajuda farm.

| | |
|---|---|
| Cultivar | Tapada da Ajuda |
| Populations | 10, 20, 30, 40, 50 plants/m$^2$ |
| Experimental design | 5x5 Latin square |
| Sowing date | 3 Dec. 1985 |
| Fertilizer | 500 kg superphosphate (18%) |
| Pest control | thiram 200 g/hl s.a. |
| | deltamethrin 1.75 g/hl s.a. |
| | ethiofencarb 5.00 g/hl s.a. |
| Weed control | methabenzthiazuron 3.2 kg/ha s.a. |
| | glyphosate 60 g/ha s.a. |
| Plot size | 2x5 m = 10 m$^2$ |
| Harvest date | 19 May 1986 |

There is a consistent association between number of plants/m$^2$ and yield and there were significant differences in results between the low densities (10 and 20 plants/m$^2$) and the high densities (40 and 50 plants/m$^2$). It is also important to note the expected relative constancy of harvest index (0.46 - 0.49).

The highest yield was obtained at 40 plants/m$^2$ although it is not significantly different from the yields at 30 and 50 plants/m$^2$. Dry weight/plant for the 10 plants/m$^2$ was significantly different from other densities. This could mean that the intra-row competition

**Table 2.** Average dry weights of total aerial plant parts, stems, leaves, and pods on a plant basis and per unit area.

| | Treatments (plants/m²) | Total dry weight (g) | Stem dry weight (g) | Leaf dry weight (g) | Pod dry weight (g) | Harvest index |
|---|---|---|---|---|---|---|
| Values per m² | 10 | 1038 a* | 447 a | 116 a | 475 a | 0.46 a |
| | 20 | 1097 a | 445 a | 113 a | 524 a | 0.48 a |
| | 30 | 1726 ab | 781 ab | 159 ab | 785 ab | 0.46 a |
| | 40 | 2477 b | 1038 b | 221 b | 1219 b | 0.49 a |
| | 50 | 2311 b | 959 b | 258 b | 1094 b | 0.47 a |
| Values per plant | 10 | 103.8 a | 44.7 a | 11.56 a | 47.5 a | |
| | 20 | 54.8 b | 22.7 b | 5.66 b | 26.2 b | |
| | 30 | 57.5 b | 26.0 b | 5.28 b | 26.2 b | |
| | 40 | 61.9 b | 26.0 b | 5.52 b | 30.5 b | |
| | 50 | 46.2 b | 19.2 b | 5.16 b | 21.9 b | |

* Means followed by the same letter are not significantly different at $P = 0.01$ using the Duncan's Test.

**Table 3.** Effect of density on yield components.

| Treatments (plants/m²) | No. of stems/ plant | No. of pods/ stem | No. of pods/ plant | Dry weight 1000-seeds (g) | No. of seeds/ pod | Seed dry weight/plant (g) |
|---|---|---|---|---|---|---|
| 10 | 4.72 a* | 7.12 a | 32.1 a | 526.6 a | 3 a | 47.5 a |
| 20 | 2.52 b | 6.51 a | 16.6 b | 522.0 a | 3 a | 26.2 b |
| 30 | 2.56 b | 6.94 a | 17.6 b | 502.2 a | 3 a | 26.2 b |
| 40 | 3.16 b | 6.40 a | 20.2 ab | 528.6 a | 3 a | 30.5 ab |
| 50 | 2.16 b | 6.11 a | 13.4 b | 535.2 a | 3 a | 21.9 b |

* Means followed by the same letter are not significantly different at $P = 0.01$ using the Duncan's Test.

factor becomes apparent for a plant density between 10 and 20 plants/m² which corresponds to a decrease in intra-row spacing from 20 to 10 cm.

Yield components for the different populations are given in Table 3. From these results we can conclude that the increase in plant density results in a reduction in branching and in pod number/plant without much change in either pods/stem, seed size, or seeds/pod.

### Discussion

The overall results of this study indicate that seed yield could be maximized with a plant population of 40 plants/m², corresponding to a total yield of 24.77 t/ha and a pod yield of 12 t/ha or a harvest index of 49%.

In agreement with Seitzer and Evans (1973) and Ordovas *et al.* (1986), we did not find yield increases for plant densities above 40 plants/m². However, several authors (Soper 1952; Hodgson and Blackman 1956; Kambal 1969; Ishag 1973) observed yield increases for plant densities between 11 and 67 plants/m². This is expected since the maximization of seed yield is genotype dependent as well as environmentally controlled.

Many authors (Sprent *et al.* 1977; Abo El-Zahab *et al.* 1981; Poulain 1984; Ordovas *et al.* 1986) concluded that an increase in plant density leads to a reduction in branching and in pod number/plant without much change in either seed size or seeds/pod. Our study also shows that the number of pods/stem is not affected by plant density.

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دراسات على الكثافة النباتية في نبات الفول

ملخص

درست تأثيرات التغير في الكثافة النباتية على غلال السلالة المحلية من الفول (Tapada da Ajula) ومكونات الغلة عندها . وقد زرعت النباتات بخمس كثافات نباتية ( 10 و 20 و 30 و 40 و 50 نبات/م²) . تم الحصول على اعلى غلة عند كثافة 40 نبات/م² رغم أن الفروقات لم تكن معنوية بمقارنتها بالغلة عند الكثافتين 30 و 50 نبات/م² . وقد أدت الزيادة في الكثافة النباتية الى تقليل عدد الافرع والقرون/نبات ، والى تغير ضئيل في عدد القرون/الفرع،وحجم الحبة ، او عدد البذور/القرن .



# Irrigation Studies in Faba Bean

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## Abstract

**Field experiments were conducted during the winter seasons of 1980/81 and 1982/83 at the Crop Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar to study the irrigation requirements of faba bean. Treatments consisted of zero, one, two, and three irrigations at various physiological stages (branch initiation, flowering, and mid-pod filling). Dry matter accumulation, plant height, branches, pods/plant, and grain and biological yield were strongly influenced by increasing irrigation. This study suggests that irrigation at the flowering stage benefited the crop, but high yield potentiality was achieved by applying three irrigations at branch initiation, flowering, and the mid-pod filling stage.**

## Introduction

Faba bean is a newly introduced crop in Indian agriculture and suitable technology for its cultivation has yet to be worked out. Among the various factors affecting the growth and yield of faba bean, soil moisture condition is most important. Work on the critical growth stages in terms of moisture supply and availability is limited. In the past most of the studies have been carried out in a temperate climate and it may be that crop growth in sub-tropical conditions like those in Pantnagar is different. The present study was therefore carried out to determine the response of faba bean to irrigation at various growth stages in terms of growth, development, yield, and yield attributes.

## Materials and Methods

Field experiments were conducted at the Crop Research Centre of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (29°N and 79°E) during the winter seasons of 1980/81 and 1982/83. Experimental fields were loam to silty clay loam in texture, rich in available nitrogen, phosphorus and potash, and had neutral pH. Field capacity and permanent wilting point were 25.8 and 7.8 for 0-15 cm and 24.2 and 8.2 for 15-30 cm in the first year, and 30.2 and 11.0 for 0-15 cm, and 27.1 and 12.4 for 15-30 cm depth in the second year. In both years, the experiments had a randomized block design with four replications. There were eight treatments; no irrigation, irrigation at branch initiation (BI), flowering (F), mid-pod filling (MPF), branch initiation + flowering (only during 1982/83), branch initiation + mid-pod filling, flowering + mid-pod filling, and branch initiation + flowering + mid-pod filling.

The growth stages, branch initiation, flowering, and mid-pod filling were around 30, 65, and 100 days after sowing during both years. A plant population of 500000 plants/ha was maintained in the experimental plots by adopting a row spacing of 20 cm with a plant spacing of 10 cm. Variety BS 1 (Bihar Selection 1) was planted in the first week of November and harvested in the first week of April in both years. Total rainfall (sowing to harvesting) was 98.5 and 128.5 mm in the first and second year, respectively. Each irrigation was 5 cm deep.

## Results and Discussion

### Growth and development

Dry matter accumulation in stem, leaf, pod, and whole plant was significantly lower in the treatment without irrigation than irrigation at all three stages of crop growth (branch initiation, flowering and mid-pod filling) in both years (Table 1). Two irrigations given at flowering + mid-pod filling resulted in a significant increase in stem dry matter compared with one or two irrigations at all other stages during 1980/81, but in 1982/83 it was similar to no irrigation and significantly lower than two irrigations given at branch initiation + flowering. This trend was probably due to rains which coincided with the flowering period during 1982/83. Crop receiving one irrigation at flowering resulted in a significant increase in leaf dry matter over no irrigation and irrigation at branch initiation, mid-pod filling, and branch initiation + mid-pod filling during 1980/81. However, during 1982/83 one irrigation given at any stage of crop growth (BI/F/MPF) did not influence leaf dry matter significantly over no irrigation. Two irrigations given at branch initiation + flowering, which were also similar to three irrigations at branch initiation + flowering + mid-pod filling during 1982/83, resulted in significantly higher dry matter accumulation in pods and whole plants. Three irrigations given at branch initiation + flowering + mid-pod filling increased total dry matter significantly compared with the other treatments during 1980/81.

Plants were significantly taller with three irrigations at branch initiation + flowering + mid-pod filling than the other treatments during both years (Table 1). El-Nadi (1969) reported that water shortage during the vegetative phase reduced plant height. When the crop was irrigated at all three stages of growth (BI/F/MPF) there was a significantly higher number of branches/plant over the other treatments during 1982/83. Similar results were also recorded by Salem *et al.* (1983).

**Table 1.** Effect of irrigation levels on dry matter accumulation and developmental characters of faba bean.

| Treatment | Dry matter accumulation (g/m$^2$) | | | | | | | | Developmental characters | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stem | | leaf | | Pod | | Total | | Plant height (cm) | | Branches/ plant | |
| | 1980/81 | 1982/83 | 1980/81 | 1982/83 | 1980/81 | 1982/83 | 1980/81 | 1982/83 | 1980/81 | 1982/83 | 1980/81 | 1982/83 |
| No irrigation ($I_0$) | 143 | 102 | 84 | 84 | 386 | 305 | 613 | 491 | 72 | 72 | 4.3 | 2.6 |
| Branch initiation (BI) | 191 | 117 | 86 | 88 | 412 | 382 | 689 | 587 | 89 | 74 | 4.5 | 3.3 |
| Flowering (F) | 182 | 100 | 120 | 85 | 432 | 391 | 734 | 576 | 89 | 65 | 4.7 | 3.1 |
| Mid-pod filling (MPF) | 175 | 106 | 96 | 88 | 425 | 376 | 696 | 570 | 73 | 68 | 4.0 | 3.0 |
| BI + F | | 122 | | 103 | | 455 | | 680 | | 67 | | 3.5 |
| BI + MPF | 196 | 103 | 115 | 89 | 440 | 344 | 751 | 536 | 100 | 65 | 4.2 | 3.0 |
| F + MPF | 217 | 108 | 120 | 93 | 418 | 346 | 755 | 547 | 101 | 64 | 4.0 | 3.0 |
| BI + F + MPF | 243 | 121 | 127 | 98 | 436 | 434 | 806 | 653 | 108 | 84 | 4.5 | 3.6 |
| SE ± | 3.3 | 3.3 | 1.5 | 3.3 | 5.4 | 12.0 | 9.1 | 11.8 | 1.3 | 2.1 | 0.1 | 0.04 |
| LSD (0.05) | 9.8 | 9.9 | 4.5 | 9.9 | 16.2 | 35.4 | 27.1 | 34.7 | 3.8 | 6.2 | 0.3 | 0.1 |

**Table 2.** Effect of irrigation levels on yield and yield attributes.

| Treatment | Grain yield (kg/ha) | | | Biological yield (kg/ha) | | No. of pods/ plant | | No. of seeds/ pod | | 100-seed weight (g) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1980 /81 | 1982 /83 | Mean | 1980 /81 | 1982 /83 | 1980 /81 | 1982 /83 | 1980 /81 | 1982 /83 | 1980 /81 | 1982 /83 |
| No irrigation ($I_O$) | 2499 | 2623 | 2561 | 4999 | 5843 | 15.2 | 9.9 | 2.4 | 2.4 | 25.6 | 22.6 |
| Branch initiation (BI) | 3111 | 2967 | 3039 | 6942 | 6156 | 16.5 | 12.1 | 2.6 | 2.4 | 25.9 | 23.2 |
| Flowering (F) | 3166 | 3186 | 3176 | 6193 | 6875 | 17.2 | 12.3 | 2.6 | 2.4 | 26.1 | 23.8 |
| Mid-pod filling (MPF) | 2611 | 2936 | 2773 | 5559 | 6500 | 15.6 | 12.1 | 2.6 | 2.3 | 26.8 | 24.1 |
| BI + F | | 3811 | 3811 | | 8185 | | 12.8 | | 2.2 | | 24.0 |
| BI + MPF | 3999 | 3655 | 3827 | 7804 | 7875 | 18.1 | 12.2 | 2.6 | 2.4 | 26.2 | 24.5 |
| F + MPF | 3361 | 3655 | 3508 | 8387 | 7781 | 17.2 | 12.1 | 2.6 | 2.4 | 26.4 | 24.0 |
| BI + F + MPF | 3888 | 3905 | 3896 | 8165 | 8593 | 20.2 | 13.6 | 2.6 | 2.4 | 26.1 | 23.1 |
| SE ± | 144 | 80 | | 240 | 80 | 0.3 | 0.1 | 0.02 | 0.07 | 0.1 | 1.0 |
| LSD (0.05) | 460 | 260 | | 720 | 260 | 0.8 | 0.4 | NS | NS | 0.3 | NS |

NS= not significant.

## Yield and yield attributes

The irrigated crop produced a significantly higher grain and biological yield than did the unirrigated crop during both years (Table 2), except for irrigation at the mid-pod filling stage in the 1980/81 season, which was on par with that of the unirrigated crop. The increase in yield due to irrigation ranged from 8 to 52% for the various treatments. Krogmen *et al.* (1980) recorded higher yields of grain, stover, and crude protein in faba bean with increased soil moisture supply and Lockerman *et al.* (1985) indicated that vegetative and reproductive growth of faba bean responded markedly to supplemental moisture.

In this experiment the main component of yield was number of pods/plant, which was lowest and highest when plants were unirrigated ($I_O$) and irrigated at all three stages (BI/F/MPF), respectively (Table 2). The wet regime resulted in highest yield due to a larger number of pods/plant (El-Nadi 1970). Number of seeds/pod and 100-seed weight remained unaffected by increased irrigation, which agrees with Krogmen *et al.* (1980) who did not find differences in 100-seed weight in relation to total water received by the crop.

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## دراسات رى على الفول

### ملخص

اجريت تجارب حقلية خلال موسمي 1980/81 و 1982/83 لدى مركز بحوث المحاصيل في جامعة بانت ج.ب. للزراعة والتكنولوجيا في بانتنجار لدراسة احتياجات الفول للرى . وقد تكونت معاملات الرى من : 0 و 1 و 2 و 3 ريات عند مراحل فيزيولوجية مختلفة ( بداية التفرع والازهار ومنتصف مرحلة امتلاء القرون ) . وقد تأثر تراكم المادة الجافة وطول النبات وعدد الاغصان والقرون/النبات والغلة الحبية والبيولوجية بشكل كبير بتزايد الرى . وتبدى الدراسة أن الرى في طور الازهار يفيد المحصول ، غير انه تم الحصول على طاقة انتاجية عالية عند اجراء ثلاث ريات في مراحل بداية التفرع والازهار ومنتصف امتلاء القرون .

# Relationships Between Seed Yield and Plant Traits, and the Constancy of Harvest Index in Faba Bean

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**Abstract**

**Correlations between seed yield and the plant traits above ground biomass, pod number, 100-seed mass, stem number, and plant number were determined in three experiments in which seasons and genotypes differed. Seed yield was highly and positively most correlated with biomass and pod number, while other characters were of lesser importance. Harvest index showed little variability about a mean of 0.50 over 46 genotypes, and behaved in a manner consistent with a hypothesis that it tends towards constancy over a range of conditions. Seed yield was not correlated with harvest index.**

**Introduction**

Faba bean is a new crop in the wheat-growing areas of eastern Australia, particularly in the states of South Australia and New South Wales where plantings in 1986 were 33000 and 2500 ha, respectively.

Genotypes most suitable for the above environments are early-maturing, autofertile lines originating from the Mediterranean and Middle Eastern regions (Laurence 1979). Some studies have been done on the agronomy of the crop (Baldwin 1980; Marcellos and Constable 1986), and research is now being done to describe the behavior of the breeding system in the Australian context (Marcellos and Perryman 1986; Stoddard 1986). Research is still required, however, to understand the physiology of seed yield. This will assist in managing the crop for greater productivity, and in defining those traits that will be important in plant breeding.

Data are presented here on plant traits which have an important influence on seed yield, and in particular add weight to the proposal that the mechanism behind yield increase is larger overall biomass production (Green *et al.* 1986).

**Materials and Methods**

Three field trials done at this Centre from 1983 to 1986 provided data on the variation in seed yield among different stocks of faba beans, and its relationships with other traits. All genotypes used in these studies were early maturing types originating from Ethiopia, Sudan, United Arab Republic, Lebanon, Syria, Greece, and ICARDA.

In experiment 1, done during 1983, four stocks of faba bean were planted on three occasions, early May and early and late June. Plots were 12 m long by 1.4 m wide and replicated four times. At maturity, quadrats were hand cut and used to determine seed yield, pod number, 100-seed mass, stem number, and plant number.

The second experiment, done in 1985, was a comparison of 16 stocks in a field trial planted during May. The trial design was a "nearest-neighbor" in four replicates, and plot size was 15 m x 1.4 m. Two quadrats were hand cut at maturity to estimate seed yield, above ground biomass, pod number, 100-seed mass, stem number, and plant number.

In experiment 3, in 1986, 30 inbred lines were planted in three replicates during early May to study pollination and fertilization. Plots were single rows 5 m long and 0.5 m apart in three replicates. At maturity, quadrats were hand cut to determine seed yield, above ground biomass, and 100-seed mass.

All data were analyzed for variance and correlation among traits using the GENSTAT program.

**Results and Discussion**

In these experiments, both environment and genotype were varied and influenced the seed yields of the stocks studied. Correlations between seed yield and other plant traits (Table 1) showed clearly that above ground biomass ($r = 0.93$-$0.97$) and pod number ($r = 0.82$-$0.93$) were the most important variables. Pod number in turn was also highly correlated with biomass ($r = 0.92$). The highest correlation for seed yield with 100-seed mass was observed in 1983 when late sowings and a later maturing genotype contributed to a fall in 100-seed mass with these treatments. Plant and stem number were of lesser consequence and, as expected, made their contribution through some impact on biomass.

Harvest indices (HI's) were calculated for the range of 46 stocks in experiments 2 and 3 in which nine stocks were common to both experiments. In experiment

**Table 1.** Summary of correlations between selected variables in the three experiments.

| | Seed yield | Biomass | Pod number | Seed mass | Stem number | Plant number |
|---|---|---|---|---|---|---|
| 1983 | | | | | | |
| Seed yield | 1.00 | | | | | |
| Pod number | 0.82 | | 1.00 | | | |
| Seed mass | 0.68 | | 0.34 | 1.00 | | |
| Stem number | 0.34 | | 0.53 | 0.09 | 1.00 | |
| Plant number | 0.35 | | 0.50 | 0.01 | 0.49 | 1.00 |
| 1985 | | | | | | |
| Seed yield | 1.00 | | | | | |
| Biomass | 0.97 | 1.00 | | | | |
| Pod number | 0.93 | 0.92 | 1.00 | | | |
| Seed mass | 0.59 | 0.56 | 0.32 | 1.00 | | |
| Stem number | 0.66 | 0.63 | 0.69 | 0.32 | 1.00 | |
| Plant number | 0.44 | 0.41 | 0.45 | 0.20 | 0.79 | 1.00 |
| 1986 | | | | | | |
| Seed yield | 1.00 | | | | | |
| Biomass | 0.93 | 1.00 | | | | |
| Seed mass | 0.42 | 0.50 | 1.00 | | | |

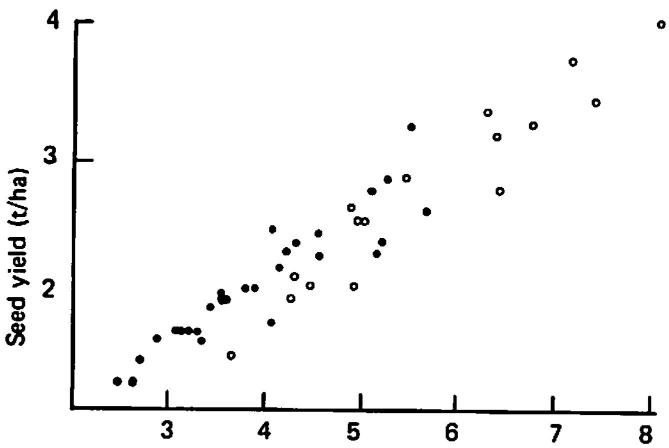


Fig. 1. Relationship between seed yield and above ground biomass for 46 faba bean genotypes grown in 1985 (o) and 1986 (•).

**Table 2.** Summary of harvest index (HI) for faba bean.

| Source | HI |
|---|---|
| Experiment 2 | 0.49 |
| Experiment 3 | 0.54 |
| Ishag (1973) | 0.53 |
| Krogman *et al.*(1980) | 0.44 |
| Green *et al.* (1986) | 0.55 |
| Mean | 0.51 |

2, HI varied from 0.425 to 0.539 about a mean of 0.486. In experiment 3, the range was 0.437 to 0.613 about a mean of 0.541. When data were pooled over all genotypes and the two seasons (Fig. 1), the weighted mean HI was 0.52 and showed comparatively little variation. On the other hand, there was no correlation between seed yield and harvest index as would be expected according to a hypothesis that overall biomass production is the major determinant of seed yield for a species whose HI is relatively constant. The latter view concerning the tendency to constant HI in faba bean is strengthened by the data of others (Table 2) which show a mean HI of 0.51.

Harvest index in faba bean is high compared to wheat for example, indicating a more efficient mechanism for partitioning dry matter. In wheat, Syme (1972) reported a range in HI among entries in an international nursery of 0.310 to 0.496 about a mean of 0.424. Grain yield and HI are often closely and positively related in wheat which may suggest that in a breeding program, selection for yield alone may be adequate for identifying high-yielding genotypes. In faba bean, on the other hand, the data suggest that selection for stocks capable of producing the greatest amounts of biomass over a range of adverse environments may be promising in plant improvement. This is consistent with the view advanced by Neal and McVetty (1984) that in screening large numbers of genotypes for breeding purposes, pods/plant and total dry matter should prove easy to measure and valuable to the plant breeder.

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## العلاقات بين الغلة البذرية والصفات النباتية وثبات دليل الحصاد في الفول

### ملخص

تم تحديد الارتباط بين الغلة البذرية والصفات النباتية والكتلة الحية biomass فوق سطح التربة وعدد القرون ووزن المائة حبة وعدد الفروع وعدد النباتات وذلك في ثلاث تجارب تباينت خلالها المواسم والطرز الوراثية . وقد لوحظ ارتباط موجب وعال بين الغلة البذرية والكتلة الحية وعدد القرون ، في حين كانت بقية الصفات أقل أهمية . كما اظهر دليل الحصاد تباينا قليلا وكان المتوسط 0.50 لـ 46 طرازا وراثيا ، وسلك بطريقة منسجمة مع الفرضية التي تميل الى القول بثباته تحت العديد من الظروف . هذا ولم يكن هناك ارتباط بين الغلة البذرية ودليل الحصاد .

# Seed Quality and Nutrition

# جودة البذور والتغذية

## Chemical Constituents and Electrophoresis of Seed Proteins of Some Species of Vicia

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### Abstract

**This study was carried out on the seed proteins of a number of wild species and two Egyptian cultivars of *Vicia*. Chemical analysis showed no association between mineral composition and *Vicia* species. Starch content varied between 14 and 26%, while protein content was 17-32%. Electrophoresis of seed proteins showed variation among the wild species of *Vicia*. There was little variation among *Vicia narbonensis* varieties; the species most closely related to them was *V. serratifolia*. In addition it has been suggested that *V. narbonensis* var *aegyptiaca* has evolved from *V. narbonensis* var *narbonensis* and *V. narbonensis* var *jordanica*.**

### Introduction

The tribe *Vicieae* includes a number of economically important plants, such as those belonging to the genus *Vicia*. Some of these plants are cultivated and others are wild. Many papers have been published on the chemical constituents of *Vicia faba* seeds, in either the dry or germinating form (Abdel-Akher *et al.* 1958; Hegazi and Salem 1973; Hegazi 1974; El-Tahawi and Hussein 1979). In the last few years, attention has been directed towards the wild species of *Vicia* and some other legumes which could be used on a large scale as a forage (ICARDA 1986); these include *V. sativa*, *V. narbonensis*, *V. ervilia*, and *V. villosa* subsp. *dasycarpa*.

As far we know no work has been published on the chemical constituents of the seeds of wild *Vicia* species. The aim of this study therefore was to quantify the chemical constituents of the seeds of some wild species and to prepare electrophoretograms of the total seed proteins.

### Materials and Methods

#### Biological materials

Seeds of wild *Vicia* species were obtained from ICARDA, Aleppo, Syria and Egyptian cultivars of *V. faba* were obtained from the Agricultural Research Center, El-Dokki, Egypt.

#### Chemicals and reagents

Triz (Trizma base). buffer components, reagents, acrylamide, NN-methylenebisacrylamide, and coomassie brilliant blue were obtained from the British Drug House (BDH), Poole, UK.

#### Mineral determination

P, Na, K, Ca, Mg, and Fe were determined according to the methods of Allen *et al.* (1974).

#### Carbohydrate analysis

The seed flour was extracted several times with hot water to separate the total free sugars which were determined using the phenol-$H_2SO_4$ method of Dubois *et al.* 1956. The residue was washed several times with ethanol and then with distilled water. It was then extracted with 52% perchloric acid for *20 min at 0°C*. This process was repeated three times (McCready *et al.* 1950). The free sugars were determined in the extract using the phenol-$H_2SO_4$ method. The quantity of free sugars in this extract represents the starch content.

#### Protein determination

The total proteins of the meal extracts were determined using the method of Lowery *et al.* (1951).

#### Protein electrophoresis

Electrophoresis was carried out vertically in polyacrylamide slab gel in a LKB apparatus (Lammeli 1970). The seed meals were extracted with Tris/HCl buffer at pH 6.8 for 24 h at 4°C and then centrifuged at 10000 rpm for 20 min. The clear supernatant was analyzed electrophoretically on 10% polyacrylamide gel under non-dissociating conditions, according to the technique of Lammeli (Lammeli 1970). The gel was stained overnight in a 200 ml mixture containing 20 ml of 1% ethanolic dye solution (coomassie brilliant blue) and 180 ml of 7.5% aqueous trichloracetic acid. The latter was also used for destaining.

**Results and Discussion**

The results of the chemical analysis are presented in Table 1, which shows that there is no specific association between mineral composition and *Vicia* species. This is in good agreement with the work of Abdalla and Gunzel (1979), Poulsen and Petersen (1982), Salih and Haradallou (1986), and Newaz and Newaz (1986). The analyses also show that starch and protein are the major seed components. Quantities of starch ranged from 14 to 26%, showing great variation among the wild species. The greatest amount of water-soluble sugars was recorded in the seed meals of the species that had the lowest starch contents i.e., *V. serratifolia* and *V. michauxii.* However, the total carbohydrate contents of the two species were similar to those of other species. As shown in Table 1, the total protein contents varied between 17 and 32%. Although *V. serratifolia* and *V. michauxii* seed meals contained the lowest protein and starch contents, they had the highest water-soluble sugar contents. The variations in mineral composition and starch and protein contents may be attributed to the variation in genotypes, type of seeds, seed size, stock location, and/or environmental conditions.

Electrophoresis of the total seed proteins (Fig. 1) showed that the broad and slowest migrating bands of the total protein extracts of the wild species are similar to the band purified from *V. faba* and characterized by Matta *et al.* (1981). This broad band was designated globulin by Osborn (1924). Fig. 1 shows variation in the electrophoretic patterns of the total seed proteins of the wild species. It also shows that the variation among the three varieties of *V. narbonensis* is less than that amongst the different species. This agrees well with the work of Sammour (1985) on the seed proteins of the tribe *Vicieae.* On the basis of protein electrophoresis, it can be concluded that *V. serratifolia* is the most closely related to *V. narbonensis.* However, although the varieties of the latter species have the same broad band and have the same relative mobility (Rm), there are differences in both the number and Rm of the fastest bands. It is interesting that one of the fastest bands of *V. narbonensis* var *aegyptiaca* is comparable to that of *V. narbonensis* var *narbonensis* and the other is comparable to that of *V. narbonensis* var *jordanica.* Such data leads the author to speculate that *V. narbonensis* var *aegyptiaca* evolved as a result of hybridization between the other two varieties.

**Table 1.** Proximate composition of the seed flour of a number of wild and cultivated species of *Vicia.*

| | Component (%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Vicia* species | Na | K | Ca | Mg | Fe | P | Water soluble sugars | Starch | Total protein |
| *V. anatoliea* | 0.58 | 0.14 | 0.38 | 0.66 | 0.27 | 0.20 | 5.78 | 24.02 | 27.6 |
| *V. panncnica purpuracens* | 0.43 | 0.15 | 0.35 | 0.60 | 0.34 | 0.11 | 6.08 | 22.71 | 31.05 |
| *V. narbonensis* var *jordanica* | 0.41 | 0.14 | 0.38 | 0.32 | 0.40 | 0.22 | 6.56 | 17.74 | 31.08 |
| *V. serratifolia* | 0.48 | 0.13 | 0.35 | 0.35 | 0.82 | 0.42 | 8.28 | 15.06 | 19.02 |
| *V. narbonensis* var *narbonensis* | 0.44 | 0.14 | 0.38 | 0.35 | 0.40 | 0.28 | 7.22 | 18.83 | 23.20 |
| *V. narbonensis* var *aegyptiaca* | 0.48 | 0.14 | 0.35 | 0.37 | 0.23 | 0.20 | 7.02 | 19.42 | 29.25 |
| *V. peregrina* | 0.48 | 0.13 | 0.40 | 0.35 | 0.43 | 0.11 | 6.24 | 20.80 | 31.12 |
| *V. hybrida* | 0.49 | 0.12 | 0.35 | 0.39 | 0.60 | 0.21 | 6.52 | 16.95 | 27.00 |
| *V. monantha* | 0.48 | 0.16 | 0.35 | 0.47 | 0.34 | 0.16 | 5.70 | 15.37 | 27.25 |
| *V. michauxii* | 0.51 | 0.16 | 0.38 | 0.29 | 0.82 | 0.41 | 10.08 | 14.91 | 17.00 |
| *V. faba* Giza 3 | 0.52 | 0.16 | 0.32 | 0.36 | 0.26 | 0.86 | 6.30 | 25.98 | 31.50 |
| *V. faba* Giza 402 | 0.52 | 0.14 | 0.30 | 0.56 | 0.55 | 0.53 | 7.78 | 25.93 | 23.40 |

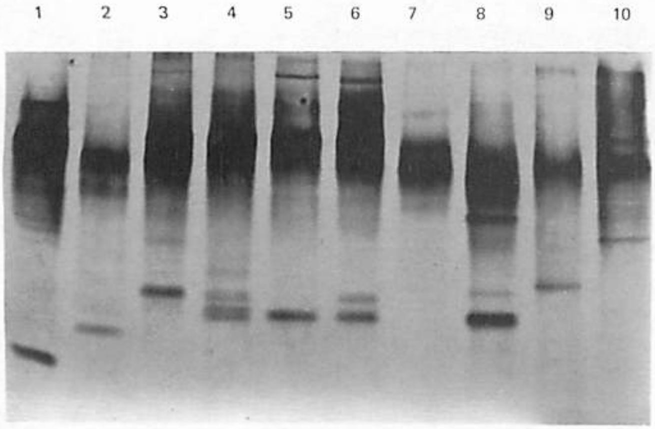


**Fig. 1.** 10% non-dissociating polyacrylamide gel electrophoresis of the total seed protiens of the following species of Vicia: 1) Vicia anatoliea, 2) Vicia pannonica purpuracens, 3) Vicia narbonensis var. jordanica, 4) Vicia serratifolia, 5) Vicia narbonensis var. narbonensis, 6) Vicia narbonensis var. aegyptiaca, 7) Vicia peregina, 8) Vicia hybrida, 9) Vicia monantha, and 10) Vicia michauxii.

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المكونات الكيميائية والهجرة الكهربائية ( الاستشراد ) electrophoresis لبروتينات بذور بعض انواع البيقية Vicia .

ملخص

نفذت هذه الدراسة على بروتينات بذور عدد من الانواع البرية للبيقية اضافة الى صنفين مصريين منها . واظهر التحليل الكيميائي عدم الترابط بين التركيب المعدني وطراز البذور . وقد تراوح محتوى النشا بين 14 و 26 % بينما كان المحتوى البروتيني من 17 - 32 % . كما أظهر الاستشراد لبروتينات البذور وجود اختلافات ضمن الانواع البرية للبيقية . وقد ظهر اختلاف ضئيل بين أصناف البيقية النربونية وكان النوع V. serratifolia اقرب الانواع اليها . بالاضافة الى ذلك اقترح بان الصنف V. narbonensis var aegyptiaca قد تطور من V. narbonensis var narbonensis و V. narbonensis var jordanica .

# Variation in Testa Fraction with Seed Weight in Faba Bean

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## Abstract

**The fraction of the whole seed contained in the testa was measured on 30 inbred lines of faba bean developed from Mediterranean, Middle Eastern, North African, and Indian sources. There was an inverse relationship between testa fraction, which varied from 12.2 to 18.2% across genotypes, and 1000-seed weight which was 280-620 g. A group of Indian lines had high testa fractions, in excess of 16%.**

## Introduction

The main faba bean cultivar grown in Australia has a 1000-seed weight of about 400 g. High seeding rates are required to achieve optimum yields (Marcellos and Constable 1986) and, as Rowland and Fowler (1977) have also reported, it would be desirable to develop cultivars with smaller seeds.

A factor that may need to be considered in developing smaller seeded cultivars is the seed coat. This contains about 90% of the crude fiber in the seed and appears to comprise 11-18% of the whole seed according to genotype. Therefore, in producing smaller seeded cultivars it would be desirable to reduce the testa fraction to a minimum. One approach to determining the available variation, which is used here because of its simplicity, is to measure the testa fraction by weight. Alternatively, as has been adopted in Canada by Rowland (1977) and Rowland and Fowler (1977), seed coat thickness may be considered.

## Materials and Methods

Thirty inbred lines developed from Mediterranean, Middle Eastern, North African, and Indian sources were planted in single 5 m rows, 50 cm apart in randomized blocks replicated three times. At harvest, 1 m of each row was hand cut and used to estimate various traits including seed yield. Twenty seeds were randomly selected from each yield sample and used to determine the mean weight of testa as a fraction of the whole seed. This was done by soaking the seeds in water for up to several hours until the testa softened and could be peeled off by hand. Both testa and cotyledons and embryo were oven dried at 80°C and weighed separately.

Data were analyzed using analysis of variance and regression.

## Results and Discussion

The testa fraction varied from 12.2 to 18.2% across genotypes about a mean of 15.0%. The variance ratio for the effect of genotype was highly significant ($P > 0.001$) and standard errors were low; 0.26% for replicate and 0.51% for replicate by genotype.

Fig. 1 shows that the testa fraction increased as seed weight decreased, and there was evidence of an inflection in the data at a seed weight around 360 g/1000. A linear model of the form ln(testa %) = a + b ln (seed weight) was fitted and accounted for 57% of the variation in Fig. 1.

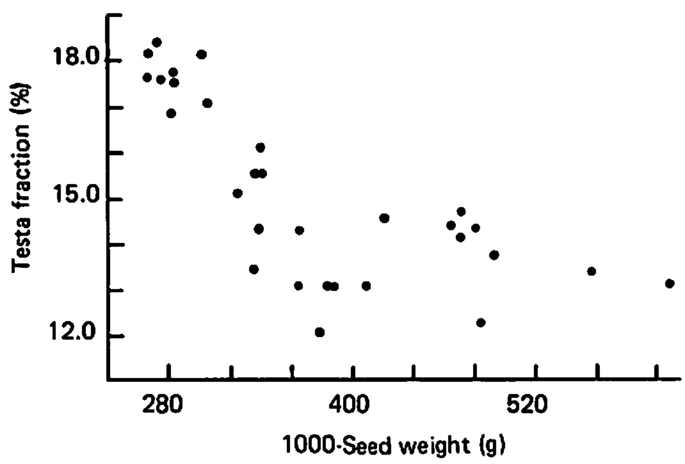


Fig. 1. Relationship between the testa fraction in the whole seed and 1000-seed weight for 30 faba bean genotypes.

Data were further studied by grouping the origins of the 30 genotypes into testa classes (Table 1). The major contribution to the trend in Fig. 1 was clearly made by the group of small-seeded cultivars originating from India, and which all had testa fractions in excess of 16% of the whole seed. A group from Ethiopia and

**Table 1.** Grouping of genotypes by testa fraction and origin.

| Testa % | Genotypes | Origin | Testa % | Genotypes | Origin |
|---|---|---|---|---|---|
| < 12.99 | 4 | Ethiopia, Sudan, ICARDA | 15.0-15.99 | 3 | Sudan, Lebanon, ICARDA |
| 13.0-13.99 | 7 | Ethiopia, Lebanon, ICARDA | 16.0-16.99 | 2 | ICARDA, India |
| 14.0-14.99 | 6 | Greece (Fiord), Ethiopia, Unknown (TF157), ICARDA | > 17.0 | 8 | India |

ICARDA tended toward smaller testa fractions, below 14%; however, none of the genotypes examined here had testa fractions below 12% as did many of those studied by Rowland (1977).

Although significant differences in seed coat thickness were found among genotypes by Rowland (1977) and Rowland and Fowler (1977), there was no significant correlation between testa fraction and seed weight. This result contrasts with findings reported here which show that the testa fraction increased as seed weight decreased with 30 cultivars of diverse origin.

When the data for the group of genotypes from India having testa fractions exceeding 16% are deleted from Fig. 1, the relationship between testa fraction and seed weight becomes poor. This latter result is consistent with that found by Rowland (1977) who observed a correlation of - 0.24 between the testa fraction and seed weight.

There appears to be no published information on the genetic control of the testa fraction. In this regard, the genotypes from India may be useful in crosses with those having 11% testa to gain insight into the genetic relationships.

**References**

Marcellos, H. and Constable, G.A. 1986. Effects of plant density and sowing date on grain yield of faba beans in northern New South Wales. Australian Journal of Experimental Agriculture 26: 493-496.

Rowland, G.G. 1977. Seed coat thickness and seed crude fibre in faba beans (*Vicia faba*). Canadian Journal of Plant Science 57: 951-953.

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

**التباين في جزىء القصرة عند اختلاف حجم البذرة في الفول**

**ملخص**

تم قياس جزء الغلاف الخارجي للبذرة في 30 سلالة نقية من الفول منشوءها حوض البحر المتوسط والشرق الاوسط وشمال افريقيا والهند . وكانت هناك علاقة عكسية بين جزىء القصرة الذى يتراوح بين 12.2 الى 18.2 % للطرز الوراثية ووزن الالف حبة الذى كان من 280 - 620 غ. وكان جزء القصرة لمجموعة من الاصول الهندية عاليا تجاوز 16 % .

## Contributors' Style Guide

**Policy**

The aim of FABIS Newsletter is to publish quickly the results of recent research on faba beans. Articles should normally be brief, confined to a single subject, good quality, and of primary interest to research, extension, and production workers, and administrators and policy makers.

**Style**

Articles should have an abstract (maximum 250 words) and whenever possible the following sections:introduction, materials and methods, and results and discussion. Authors should refer to recent issues of FABIS for guidance on format. Articles will be edited to maintain uniform style but substantial editing will be referred to the author for his/her approval; occasionally, papers may be returned for revision.

**Disclaimers**

The views expressed and the results presented in the newsletter are those of the author(s) and not the responsibility of ICARDA. Similarly, the use of trade names does not constitute endorsement of or discrimination against any product by ICARDA.

**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, postal address, and telex number if available. Figures 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. Good quality black and white photographs are acceptable for publication. Photographs and figures should preferably be 8.5 cm or 17.4 cm wide.

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

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**

3 g; 18 mm; 300 $m^2$; 4 Mar 1983; 27%; 50 five-day old plants; 1.6 million; 23 ug; 5°C; 1980/81 season; 1980-82 seasons; 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*: Khalil, S. A. and Harrison, J.G. 1981. Methods of evaluating faba bean materials for chocolate spot. FABIS No. 3: 51-52.

*Books*: Witcombe, J. R. and Erskine, W. (eds.). 1984. Genetic resources and their exploitation-chickpea, faba beans, and lentils. Advances in Agricultural Biotechnology. Martinus Nijhoff/Dr. W. Junk Publishers, The Hague, The Netherlands, 256 pp..s 1;*Articles from books*: Hawtin, G. C. and Hebblethwaite, P. D. 1983. Background and history of faba bean production. Pages 3-22 *in* The Faba Bean (*Vicia faba* L.) (Hebblethwaite, P.D., ed.). Butterworths, London, England.

*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. and Webb, C., eds.), ICARDA/IFAD Nile Valley Project, 7-11 Mar 1981, Cairo, Egypt.

**Submission of articles**

Contributions should be sent to FABIS, Documentation Unit, ICARDA, P.O. Box 5466, Aleppo, Syria.

# NEWS

# أخبار

## Announcements

### The Release of One of ICARDA's Germplasm lines in Iran

The line ILB 1269 which was one of 12 entries provided in 1982 to Iran for testing in the Gorgan Research Station, was released as Barakat and recommended for the Caspian Region. In four years of testing Barakat significantly outyielded the local check in terms of dry seed and green pod yields.

**FOR FURTHER INFORMATION LOOK IN FABIS 19.**

### GRADUATE RESEARCH TRAINING OPPORTUNITIES IN FOOD LEGUME IMPROVEMENT PROGRAM

One of ICARDA's main goals is to help national programs build up their research capabilities so that countries within the region can solve food production problems with their own expertise. Hence ICARDA has a high interest in training future scientists for the region.

In 1986, the Center established The Graduate Research Training Program (GRT). This Program is intended primarily to assist Master of Science or Doctor of Philosophy candidates who are enrolled at national universities within the ICARDA region. Men and women who are selected for the program will have an opportunity to conduct their thesis research at ICARDA sites under the co-supervision of University and Center scientists.

The food Legume Improvement Program of ICARDA encourages national research institutes and universities to nominate candidates for Graduate Research Training on faba beans, lentils, and kabuli chickpeas:

* Breeding,
* Physiology,
* Microbiology,
* Entomology, and
* Pathology

Under the terms of an ICARDA GRT Program award, the research scholar (M. Sc) or fellow (Ph. D) receives financial support to cover direct costs for a maximum of 12 months, which may be spread over 2 years. This allows the student to conduct field research during two growing seasons. Awards include accomodation, a monthly stipend in Syrian currency, health and accident insurances, baggage and roundtrip international air travel, local travel, and allowances for research materials and thesis or dissertation preparation. Travel for dependents, university tuition or fees, and any other costs incurred by the scholar/fellow are not covered by the award.

There are no deadlines for nominations. The ICARDA Training Coordination Unit will accept nominations at any time. Candidates may be nominated by a national research program, a university within the region (preferably by a university that has a collaborative agreement with ICARDA), or by an ICARDA research program.

ICARDA seeks candidates who have the potential to become successful research scientists within the region. It favors research projects that will contribute to the Center's goals and to the research goals of the national programs.

Selection is thus based on three broad areas of consideration: the personal qualities and academic background of the candidate, the nature of the proposed research, and the relationship between ICARDA and the nominating institution.

Nomination forms are available from the ICARDA Training Section Office. For further information, write to:

GRT Program
Training Coordination Unit
ICARDA
P.O. Box 5466
Aleppo, Syria

## OPPORTUNITIES FOR VISITING REGIONAL SCIENTISTS IN THE FOOD LEGUME IMPROVEMENT PROGRAM

FLIP invites the national programs in the region to nominate scientists working on faba bean, lentil, or kabuli chickpea improvement to join the visiting scientists program at ICARDA.

A visiting regional scientist is generally an experienced research scientist or senior-level administrative officer of national agricultural programs in the region.

This program was initiated to enhance research capabilities of national agricultural programs through the collaborative support of ICARDA scientists.

The visiting regional scientist will spend 1 month - 2 years.

Candidates should be Ph.D. holders. For further information, write to:

Food Legume Improvement Program,
ICARDA,
P.O. Box 5466,
Aleppo, Syria

**If you have any**

* faba bean news
* announcements of meetings
* book reviews
* new research interests
* suggestions

Please send them to:

**FABIS**
**ICARDA, Box 5466**
**Aleppo, SYRIA**

# إعلانات

فرص تدريب باحثين متخرجين في برنامج البقوليات الغذائية

يتجلى احد الاهداف الرئيسية لايكاردا في مساعدة البرامج الوطنية على بناء قدراتها البحثية حتى تتمكن بلدان المنطقة من حل مشاكل انتاج الغذاء معتمدة على خبراتها . وهكذا فان لايكاردا اهتماما كبيرا بتدريب علماء المستقبل في المنطقة .

وفي عام 1986 انشأ المركز برنامج بحوث تدريب للدراسات العليا ( GRT ) الذى يهدف بصورة رئيسية الى مساعدة الطلاب المسجلين في الجامعات الوطنية ضمن منطقة ايكاردا لنيل درجة الماجستير او الدكتوراة . وستتاح للدارسين والدارسات الذين يتم اختيارهم للبرنامج فرصة تنفيذ بحوث اطروحاتهم في محطات بحوث ايكاردا تحت اشراف مشترك بين علماء الجامعة والمركز .

ويشجع برنامج تحسين البقوليات الغذائية في ايكاردا مؤسسات البحوث الوطنية والجامعات على تسمية مرشحين لبرنامج بحوث تدريب الخريجين على الفول والعدس والحمص الكابولي في :

- التربية
- الفيزيولوجيا
- الاحياء الدقيقة ( الميكروبيولوجيا )
- الحشرات
- الامراض

وعلى مدى المنحة التي تمتد لمدة سنتين يتلقى المرشحون للحصول على ( الماجستير ) او ( الدكتوراة ) دعما ماليا لتغطية النفقات المباشرة لمدة اقصاها 12 شهرا . وهذا يتيح للطلاب اجراء بحوث حقلية على مدى موسمين زراعيين . وتتضمن المنحة : الاقامة ، ومخصصات شهرية يتقاضاها المتدرب بالعملة السورية ، والتامين الصحي والتأمين ضد الحوادث ، ونفقات السفر ( ذهابا وايابا ) . أما مخصصات السفر لافراد العائلة ، ونفقات أو رسوم التعليم الجامعي ، واية تكاليف اخرى يحتاجها الدارس او زميل البحث فلا تغطيها المنحة .

ولا يوجد موعد محدد لانتهاء الترشيح ، اذ تقبل وحدة تنسيق التدريب الترشيحات في اى وقت . ويمكن قبول المرشحين من برامج البحوث الوطنية والجامعات في دول شمال افريقيا وغرب آسيا ( وتعطى الاولوية للجامعات التي يكون بينها وبين ايكاردا اتفاقية تعاون ) .

وترحب ايكاردا بالمرشحين ذوى الكفاءة ليصبحوا علماء وباحثين ناجحين في المنطقة ، وتفضل مشاريع أطروحات البحوث التي ستسهم في تحقيق أهداف كل من المركز والبرامج الوطنية .

لذا يتم الانتقاء وفق اعتبارات أساسية ثلاث : الصفات الشخصية والخلفية العلمية للمرشح ، وطبيعة البحوث المقترحة والعلاقة بين ايكاردا والجهة المرشحة .

وتتوفر استمارات الترشيح لدى مكتب قسم التدريب في ايكاردا . ولمزيد من المعلومات يرجى الكتابة الى :

GRT Program
Training Coordination Unit
ICARDA
P.O.Box 5466
Aleppo, Syria

فرص للعلماء لدى برنامج تحسين البقوليات

يوجه برنامج البقوليات الغذائية دعوة للبرامج الوطنية في المنطقة لترشيح علماء يعملون في مجال تحسين الفول والعدس او حمص الكابولي للانضمام الى البرامج البحثية للعلماء من مختلف الدول .

ويكون العالم عادة باحث متمرس ، او مدير اداري لدى برامج البحوث الوطنية في المنطقة . وقد انشئ هذا البرنامج لدعم القدرات البحثية لبرامج البحوث الوطنية ويمكن للعالم أن يجرى بحوثه خلال مدة تتراوح من شهر واحد الى سنتين .

ويجب ان يكون المرشحون من حاملي درجة الدكتوراة . ولمزيد من المعلومات يرجى الكتابة الى :

Food Legume Improvement Program
ICARDA
P.O.Box 5466
Aleppo, Syria

# BOOK REVIEW

# مطالعات في الكتب

## Aphids

### Their Biology, Natural Enemies and Control

**Edited by A.K. Minks and P. Harrewijn**
Published by Elsevier Science Publishers B.V., Amsterdam.
ISBN 0-444-42630-2
Hardcover price $ 149.00
450 pp.

This book is the first in a series of three volumes; it contains updated information on more than 4000 species of aphids, including: evolution, physiology, behavior, and host plants. Understanding these aspects and their interrelationships is essential if scientists are to develop right means of controlling aphids. Although aphids are considered as the most important insect pests on many crops, most of the literature about them is fragmented, and does not provide the general picture that emerges in this text.

Because some areas, e.g. host-plant relations, polymorphism, behavior, and aphid control are rapidly developed, future volumes will detail advances in breeding for resistance, biological control (these subjects will be covered in Volume C), and the role of natural enemies (Volume B) in aphid control.

**Contents:** Morphology and Systematics - Anatomy and Physiology - Reproduction, Cytogenetics and Development - Biology - Aphids and their Environment - Evolution - Organization (Structure) of Population and Species, and Speciation - Glossary - General Index - Index to the Aphids.

## DOCUMENT COLLECTION

With the financial support of the International Development Research Centre (IDRC), ICARDA is building up its document collection on faba bean. The collection will be used to supply needed documents to scientists in developing countries.

We would be grateful if readers who have any relevant documents would send them to:

FABIS
ICARDA
Box 5466
Aleppo, Syria

# Need More Information ?

# للمزيد من المعلومات

**Free Catalog of ICARDA Publications**
Request your list of all currently available publications from the Scientific and Technical Information Program (STIP).

**ICARDA Information Brochure**
ICARDA's historical background and research objectives are outlined in English and Arabic. For your copy, contact STIP.

**LENS (Lentil Newsletter)**
This newsletter is produced twice a year at ICARDA. Short research articles are published and comprehensive reviews are invited regularly on specific areas of lentil research. The newsletter also includes book reviews, key abstracts on lentils, and recent lentil references. For further information write LENS.

**RACHIS (Barley, Wheat and Triticale Newsletter)**
This ICARDA service is aimed at cereals researchers in the Near East and North Africa region and Mediterranean-type environments. It publishes up-to-the-minute short scientific papers on the latest research results and news items. RACHIS seeks to contribute to improved barley, durum wheat, and triticale production in the region: to report results, achievements, and new ideas; and to discuss research problems. For further information, write RACHIS.

**Field Guide to Major Insect Pests of Faba Bean in the Nile Valley (English and Arabic)**
This pocket field guide for research and extension workers explains how to identify and control the main insect pests of faba bean in Egypt and Sudan. The distribution, description, and biological characteristics are given for each insect, along with the type of injury, assessment of damage, and recommended control measures. A key to injuries is included. Insects and the damage they cause on faba beans are illustrated with 41 color photos. For your copy, write FLIP.

**Field Manual of Common Faba Bean Diseases in the Nile Valley (English and Arabic)**
This pocket field manual is a tool for field workers to diagnose and control diseases of faba beans in Egypt and Sudan. Symptoms, development, and control of various diseases are discussed, and symptoms are illustrated with 38 color photos. Also included are rating scales for disease resistance in faba bean lines and a glossary of basic phyto-pathological terms. For your copy, write FLIP.

**Field Guide to Major Insect Pests of Wheat and Barley (Arabic)**
This field guide in Arabic covers fungal, bacterial, viral, and physiological diseases, as well as insects and nematodes, that attack wheat and barley crops in the Middle East and North Africa. Forty-four insects and diseases are discussed and illustrated with 72 color photos. For your copy, write Cereals Improvement Program.

**ICARDA's Food Legume Improvement Program**
In English and Arabic, the 24-page illustrated information brochure briefly describes research projects on lentil, faba bean, and chickpea treated either as single crops or as a group. For your copy, write FLIP.

**Screening Chickpeas for Resistance to Ascochyta Blight A Slide-tape Audio-tutorial Module**
This slide-tape audio-tutorial module is the first in the food legume training series. It is designed for the use of legume trainees during the training courses at ICARDA as well as for scientists and their support staff in the various national programs. This module is also useful educational material for universities and training departments in national research systems. For your copy of this publication or package, write Training Department.

**Checklist of Journal Articles from ICARDA 1978 - 1987**
This checklist, compiled to bring information to the attention of the scientific community, consists of references of articles by ICARDA research scientists submitted to refereed scientific journals as of 1978. Each reference includes within year of publication: author, primary title, volume number, issue number, pagination, language code of the article and/or summary when necessary, and AGRIS reference number. For your copy write: STIP.

**Opportunities for Field Research at ICARDA**

This brochure is intended primarily to assist Master of Science candidates, who are enrolled at national universities within ICARDA region and selected for the Graduate Research Training Program. It explains to them the opportunity they have to conduct their thesis research work at ICARDA research sites under the supervision of distinguished international scientists. For your copy, write GRI Program, Training Coordination Unit.

## ARE YOU MOVING ?

If you are moving, please let us know your new address as soon as possible.
Send it to:

FABIS
ICARDA
Box 5466
Aleppo, Syria

اعلان الى العلماء والباحثين العرب الكرام

يسر المركز الدولي للبحوث الزراعية في المناطق الجافة ( ايكاردا ) ، اعلامكم بان مركز بحوث التنمية الدولية ( IDRC ) في أوتاوا ـ كندا،قد وافق على تقديم دعم مالي لمشروع فابس FABIS مدته ثلاث سنوات اعتبارا من بداية عام 1987 ولغاية 1989 . ويحيطكم علما بان ادارج اللغة العربية ضمن النشرة الاخبارية للفول يشكل أحد أهم أهداف هذا المشروع .

ويمزيد من السرور نعلن اسرة تحرير " FABIS " للباحثين العرب العاملين في مجال تحسين محصول الفول . انها ستبدأ اصدار نشرتها العلمية باللغتين العربية والانكليزية بدءا من هذا العام 1987 . لذا فيرجى من الاخوة العلماء الراغبين في نشر بحوثهم باللغة العربية التفضل بارسالها الى العنوان التالي : مجلة " فابس " . ايكاردا ـ قسم التوثيق ، ص.ب. 5466 حلب ـ سورية

ملاحظة :

تتم كتابة البحث بلغة عربية واضحة . وفق الترتيب التالي :

1) الملخص ويكتب باللغتين العربية والانكليزية .
2) المقدمة .
3) المواد والطرق .
4) النتائج .
5) المناقشة ويمكن دمجها مع النتائج وتصبح ( نتائج البحث والمناقشة ) .
6) المراجع .

## المعاملات الزراعية والمكننة



## الفيزيولوجيا والأحياء الدقيقة



## التربية والوراثة



## مقالة عامة

# فابس

## مشروع المعلومات المتخصصة عن الفول

فابس ، نشرة علمية 18 ، آب/اغسطس 1987

المحتويات

## ايكاردا والمجموعة الاستشارية للبحوث الزراعية الدولية

يتمثل الهدف العام للمركز الدولي للبحوث الزراعية في المناطق الجافة ( ايكاردا ) في زيادة الانتاجية الزراعية والموارد الغذائية المتاحة في المناطق الريفية والحضرية بهدف تحسين الوضع الاجتماعي والاقتصادى لشعوب البلدان النامية وخاصة في شمال افريقيا وغرب آسيا . وتركز ايكاردا اهتماماتها بصورة رئيسية على المناطق التي تعتمد في زراعتها على الامطار الشتوية التي تتراوح من 200-600 مم سنويا ، وعندما تستدعي الضرورة ستمتد دائرة بحوثها لبعض مناطق بيئية مروية او ذات امطار موسمية .

ويضطلع المركز بمسوءولية عالمية في تحسين الشعير والعدس والفول ، وبمسوءولية اقليمية في تحسين القمح والحمص والنظم الزراعية والثروة الحيوانية والمراعي والمحاصيل العلفية . كما ويعتبر تدريب وتأهيل الباحثين الزراعيين في البلدان النامية ، وتبادل نتائج البحوث معهم أحد أهم الانشطة التى تقوم بها ايكاردا .

وقد ساهمت المجموعة الاستشارية للبحوث الزراعية الدولية ( CGIAR ) بتاسيس ايكاردا في سوريه عام 1977 كمركز للبحوث لا يتوخى الربح . أما المجموعة الاستشارية للبحوث الزراعية الدولية فهي هيئة غير رسمية من المتبرعين تضم حكومات ومنظمات وموءسسات خاصة ، وتدعم البحوث الزراعية في جميع انحاء العالم بهدف تحسين الانتاج الغذائي في البلدان النامية ، وذلك من خلال شبكة موءلفة من ثلاثة عشر مركزا دوليا للبحوث من بينها ايكاردا . وتغطي أعمال الشبكة بحوثا على أنظمة المحاصيل والثروة الحيوانية التي تسهم في تأمين ثلاثة ارباع الغذاء في البلدان النامية .

## فابس

تصدر ايكاردا نشرة " فابس FABIS " العلمية ثلاث مرات في السنة بدعم مالي من مركز بحوث التنمية الدولية ( IDRC ) في اوتاوا بكندا ، وهي نشرة علمية متخصصة بالفول ، وتعتبر وسيلة اتصال لتبادل نتائج البحوث حول هذا النبات . وتضم النشرة بحوثا مختصرة تهدف الى ايصال المعلومات بسرعة ، اضافة الى بعض المقالات العامة التي تدعو اليها أسرة التحرير بشكل منتظم وتتناول مجالات معينة من بحوث الفول . كما تضم النشرة بعض الاعلانات . وهذه النشرة تقدم المعلومات حول بحوث الفول دون مقابل من خلال قسائم الاستجواب والتصوير النسخى ( الفوتوكوبي ) وجمع الوثائق العلمية المتعلقة بالفول .

## الاشتراكات

توزع نشرة " فابس " العلمية دون مقابل للباحثين المعنيين بنبات الفول . وللاشتراك فيها يرجى الكتابة الى :

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

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## هيئة التحرير

الدكتور موهان ساكسينا/محرر علمي
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السيد نهاد مليحه والسيدة فيونا طومسون/محرران
السيدة مليكه عبد العالي مارتيني/مساعدة
الدكتور وليد سراج والسيد خالد الجبيلي/الملخصات العربية

صورة الغلاف : سلالات من الفول ذات جهاز وعائي مستقل في اللاذقية بسورية .

# فابِس

نشــرة علميــة متخصصة بالفول

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