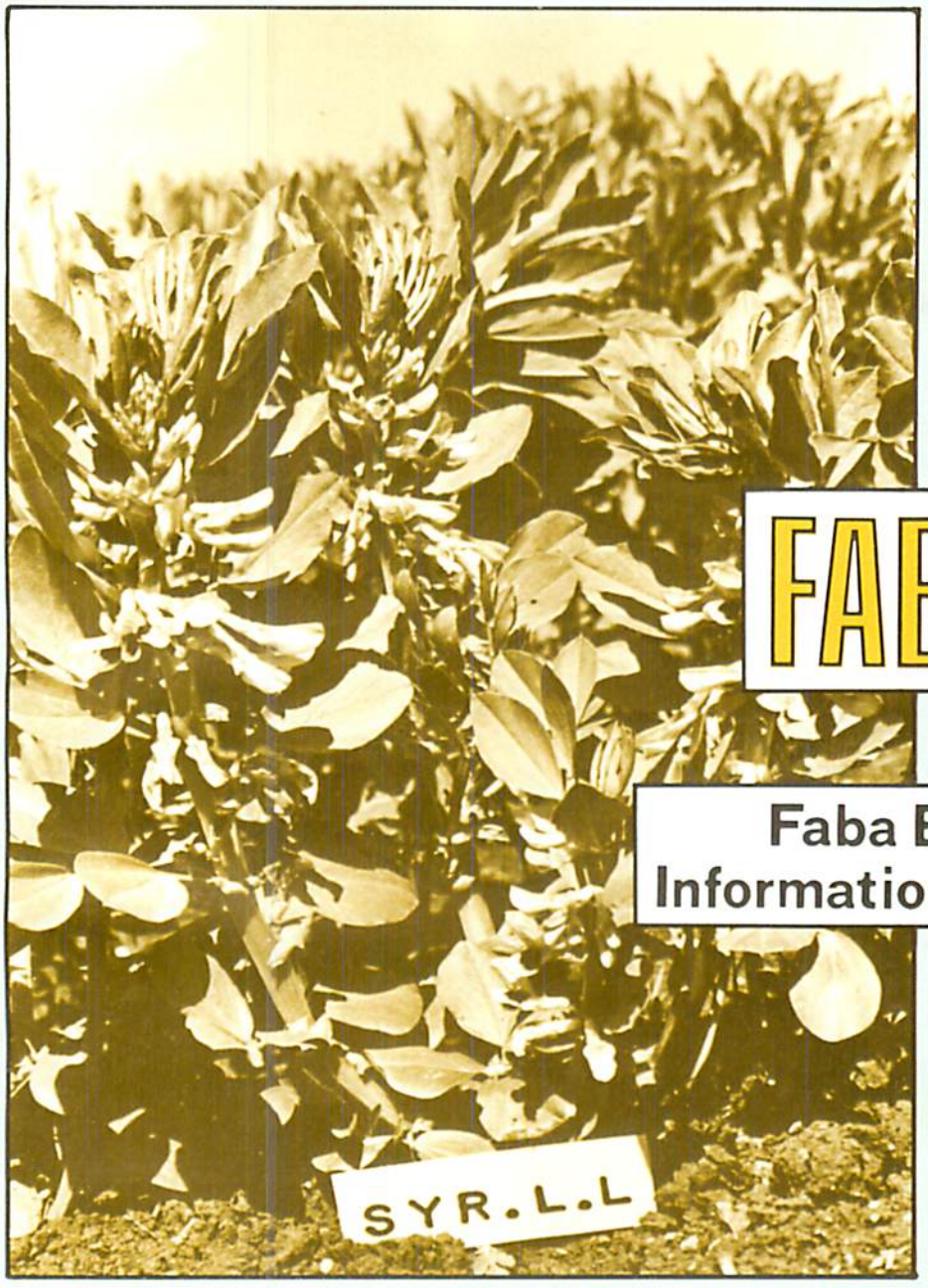


# FABIS

## Faba Bean Information Service

NEWSLETTER
No. 27
December 1990

INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS

(ICARDA)

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The overall objective of the International Center for Agricultural Research in the Dry Areas (ICARDA) is to increase agricultural productivity and food availability in both rural and urban areas, thus improving the economic and social well-being of people in developing countries, particularly in North Africa and West Asia. The center focuses mainly on winter rainfall areas with 200-600 mm annual precipitation. When appropriate, research also covers environments with monsoon rainfall or irrigation.

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### FABIS

FABIS Newsletter is produced twice a year by ICARDA. FABIS, the newsletter of the Faba Bean Information Service, is a forum for communicating faba bean research results. Short research articles provide rapid information exchange, and comprehensive reviews are invited regularly on specific areas of faba bean research. The newsletter also includes announcements. The Faba Bean Information Service provides information on faba bean research free of charge through a question and answer service, bibliographic journals, computer searches, and photocopies.

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COVER PHOTO: Faba bean (*Vicia faba* L.) cv. Syrian local large grown at Tel-Hadya site, ICARDA, Aleppo, Syria

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FABIS

# Faba Bean Information Service

NEWSLETTER 27 December 1990

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## Pests and Diseases



## Seed Quality and Nutrition



## NEWS

# SHORT COMMUNICATIONS
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## Breeding and Genetics — التربية والوراثة

## Multivariate Analysis on the Basis of Physical Quality Characters of *Vicia faba* L. Seed

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### Abstract

**The genetic divergence in 25 genotypes has been assessed through Mahalanobis $D^2$ analysis of physical quality characters. The analysis revealed considerable genetic diversity, and the genotypes could be grouped in three groups. There was no relationship between geographical distribution and genotypic diversity. The genotypes in the cluster having minimum hard seededness have maximum hydration, swelling, and *dal* recovery percentage and protein content per seed.**

### Introduction

Hard seededness is economically an important attribute of *Vicia faba* L. because it adversely affects the cooking quality although it may be associated with high seed viability. The present investigation was undertaken to find out whether the hardseededness of faba bean is related to genetic diversity and how the other physical characters of the seed are associated with hardseededness.

### Materials and Methods

Twenty-five genotypes of faba bean from different parts of India were grown during winter at Livestock Farm, J.N. Agricultural University Jabalpur, India (23.9°N latitude; 79.58°E longitude; at an altitude of 411.87 m) in randomized complete block design with four replications, with 30-cm row spacing and 15-cm plant spacing. The soil of the farm is Typic chromustent with clayey-texture and a pH of 7.5. The crop was fertilized with 20 kg N and 80 kg $P_2O_5$/ha. At maturity, 10 plants from each plot were selected for making observations on 100-seed weight (g), hydration coefficient (%), swelling coefficient (%), hull (%), *dal* recovery (%), cooking time (min) (Shivashankar *et al.* 1974), hard-seed percentage (Annonymus 1985) and protein (g) per seed.

Generalized distance was estimated by $D^2$ statistic (Mahalanobis 1936) and clusters of genotypes were formed by Tocher's method (Rao 1952).

### Results and Discussion

On the basis of the quality characters of the seed, the genotypes were grouped into three clusters. The highest inter-cluster distance was observed between cluster II and III and minimum between I and II with maximum intracluster distance in cluster I (**Table 1**). Cluster I had highest number (11) of genotypes followed by cluster II (8 genotypes) (**Table 1**). Distribution of genotypes from different regions of India in various clusters revealed no relationship between geographic location and genetic diversity. This is probably because collections of faba bean genotypes hold at various locations in India might originally belong to the same geographical area i.e., northern hills of Himalaya.

**Table 1** Average inter-and intracluster $D^2$ and D values (in parenthesis) and composition of clusters on the basis of physical characters of the seed.

| Clusters | I | II | III | Genotypes | Source (number of genotypes) |
|---|---|---|---|---|---|
| I | 986.13 (31.40) | 22973.66 (151.57) | 26972.13 (164.23) | 11 | Bihar(4), Malwa(3), Haryana(2), IARI(1), UP(1) |
| II | | 814.52 (28.54) | 31265.91 (176.82) | 6 | Bihar(2), IARI(2),UP Malwa(1), Haryana(1), Rajasthan(1) |
| III | | | 581.58 (24.11) | 6 | Bihar(3), UP(2) Malwa(1) |

Genotypes of cluster III had maximum hydration coefficient, swelling coefficient, and *dal* recovery percentage followed by cluster I and II (Table 2). Genotypes of cluster III cooked in minimum time; had minimum hard-seed percentage and hull percentage; and had maximum hydration, swelling coefficient, *dal* recovery and protein content per seed. It revealed that to overcome the problem of hardseededness, genetic improvement of faba bean should be done in the background of cluster III.

**Table 2** Cluster mean of different quality characters of the seed.

| Character | Cluster I | Cluster II | Cluster III |
|---|---|---|---|
| 100 seed weight (g) | 21.32 | 16.16 | 20.05 |
| Hydration coefficient (%) | 174.32 | 161.46 | 184.20 |
| Swelling coefficient (%) | 181.73 | 176.34 | 204.79 |
| Hull (%) | 13.89 | 16.75 | 10.50 |
| *Dal* recovery (%) | 84.31 | 84.49 | 87.53 |
| Protein content (g)/seed | 0.047 | 0.039 | 0.049 |
| Cooking time (min) | 67.26 | 53.20 | 41.25 |
| Hard seed (%) | 66.88 | 80.21 | 47.50 |

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## تحليل متعدد المتغيرات على أساس الصفات النوعية الفيزيائية للحبة في الفول *Vicia faba L.*

**الملخص :**

جرى تقدير التباعد الوراثي في 25 طرازا وراثيا من خلال تحليل Mahalanobis D2 للصفات النوعية الفيزيائية، الذي أظهر وجود تنوع وراثي كبير يمكن معه تصنيف الطرز الوراثية ضمن ثلاث مجموعات. ولم تكن ثمة علاقة بين التوزع الجغرافي والتنوع الطرازي الوراثي. وكان للطرز الوراثية في العنقود ذي الحد الأدنى من صلادة الحبة قيم قصوى من التميّه (القدرة على امتصاص الماء)، والانتفاخ، والنسبة المئوية للاسترداد dal ، والمحتوى البروتيني في الحبة.

# Physiology and Microbiology الفيزيولوجيا والأحياء الدقيقة

## Reproductive Abscission Patterns in Faba Bean (*Vicia faba* L. cv. Troy)

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### Abstract

**Abscission patterns of reproductive structures were examined in *Vicia faba* L. cv. Troy grown under controlled-environment conditions. Reproductive structures could abscise as either buds, flowers or fruits but these structures differed markedly in their abscission susceptibilities (flowers > fruits > buds). For any reproductive structure, likelihood of abscission was dependent both on position within the raceme and raceme position on the stem. Overall abscission levels in plants were such that only 17% of buds eventually produced retained fruits.**

### Introduction

The realizations of reproductive sink potential in grain legumes is limited to 10-30% (Sinha 1977) because of premature abscission of reproductive structures, which is thus one of several critical physiological traits determining harvestable yield (Hardwick 1988). Typically, abscission occurs once a precise complement of developing fruits has been established. First-set fruits could cause abscission of younger reproductive structures by the release of abscission inducing factors (Tamas *et al.* 1979; Huff and Dybing 1980) or by competing for available assimilate, mineral nutrients or growth regulators (Clifford 1979; Chapman and Sadjadi 1981). An understanding of the physiological basis of reproductive abscission in grain legumes obviously benefit from detailed information on abscission patterns within the raceme. This work reports an examination of abscission patterns for buds, flowers and fruits in a single cultivar of faba bean grown under controlled-environment conditions.

### Materials and Methods

Plants of *Vicia faba* L. cv. Troy were raised from seed in sand culture (3 plants/pot; pot size = 25cm diam.) in a heated greenhouse with supplementary lighting to provide a 16h photoperiod. Two weeks after emergence, plants were selected for uniformity and thinned to a single plant in each pot. Twenty plants were then transferred to a Sherer-Gillett controlled-environment cabinet (16h photoperiod; 24/17°C day/night temperatures; PAR 350 umol $m^2/s$ at top of plants). Full-strength Hoagland solution (Hoagland & Arnon 1950) was supplied three times weekly. The stage supporting the pots was lowered progressively so that a constant difference (*ca* 100 cm) could be kept between lighting source and the top of plants. No manual tripping of flowers was carried out during the study. The cultivar Troy is highly autofertile and tripping is likely to produce only minor increases in fruit set (D.A. Bond, personal communication).

Racemes were produced on some plants as early as the eighth node, but recording commenced with racemes at node 10 (16 out of 20 plants produced racemes at this node). The total number of positions on racemes at which buds could be initiated ranged from 3-7 but the most usual number was 5. The developmental progress of reproductive structures (Kambal 1969) was noted daily for each position on every raceme. A flower was recognized as such from the fully-reflexed standard petal stage up to the presence of a young fruit of < 1.0cm in length still enclosed by withered petals. Bud and fruit stages were defined as before or after the flower stage respectively. Data for abscission or retention of reproductive structures was collected for successive, nodal positions until the pericarp of fruits on lower reproductive nodes (nodes 10-16) had turned dark brown. At this time, complete abscission/retention data were available for reproductive nodes 10-29 (although reproductive development was continuing for further reproductive nodes up to node 34). It was usual for plants to produce reproductive axillary shoots but data collection for all plants was restricted to racemes produced on the main stem.

## Results and Discussion

The pattern of abscission/retention of buds, flowers and fruits within the raceme is shown for nodes 10-29 collectively in **Table 1**. Clearly, abscission took place as either buds, flowers or fruits, but probability of abscission was by far the highest for flowers at all raceme positions. Probability of fruit retention was highest (34%) at the first raceme postion, was low (8-12%) at the subsequent three raceme positions, and high again (17-18%) at the final two raceme positions. Susceptibility of flowers to abscise increased markedly from the first to the second raceme position (cf. 48% abscission at raceme position 1 with 78% abscission at raceme position 2) and was maintained at a high level (69-78%) at all further positions on the raceme. Probability of bud abscission seemingly fell progressively along the raceme (from 5% abscission at raceme position 1 to <1% abscission at raceme position 6), but there were no obvious changes in probabilities of fruit abscission between raceme positions 1-6. Overall abscission probabilities of buds, flowers and fruits were estimated for nodes 10-29 collectively as: buds = 3%, flowers = 69%, and fruits = 11% (derived from data of **Table 1** but taking into account variation in number of observations at each raceme position). In a similar fashion, the overall retention probability of fruits for nodes 10-29 collectively was estimated as 17% (i.e. % initiated buds which eventually produced retained fruits over this region of the stem.

**Table 1.** Abscission/retention probabilties of buds, flowers and fruits of faba bean in relation to position on the raceme. Data are presented for reproductive nodes 10-29. Values are the mean for 20 replicate plants. n = number of observations upon which each set of values is based. Racemes could initiate buds at up to 7 positions on the peduncle, but data are shown for raceme positions 1-6 only.

| Probability (%) | Position on raceme | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Nodes 10-29** | n=396 | n=396 | n=381 | n=367 | n=337 | n=162 |
| Bud abscission | 5.1 | 4.0 | 3.4 | 1.4 | 0.6 | 0.6 |
| Flower abscission | 47.7 | 78.3 | 71.6 | 78.2 | 69.4 | 72.8 |
| Fruit abscission | 13.4 | 9.3 | 12.9 | 9.3 | 11.5 | 9.9 |
| Fruit retention | 33.8 | 8.4 | 12.1 | 11.1 | 18.5 | 16.7 |

The pattern of abscission/retention of buds, flowers and fruits within the raceme in relation to raceme position on the stem is shown in **Table 2**. It seemed that likelihood of fruit retention within the raceme was not the same for different raceme positions on the stem. For the raceme at node 14, the tendency for a fruit to be retained at the first raceme position was very high (i.e. 85% fruit retention at raceme position 1). In contrast, highest probability of fruit retention for the raceme at node 20 occurred at the last two raceme positions (i.e. 15 and 30% fruit retention at raceme positions 4 and 5 respectively) and fruits had more-or-less similar probabilities of retention ( 15-25%) at successive positions along the raceme at node 26. Examination of data for other individual nodes (data not shown) reinforced the view that these differences were real. Differences partly disappeared when abscission/retention data were assembled for groups of nodes representing lower, middle and upper regions of the stem, but it was still clear that probability of fruit retention for lower nodes was highest at the first raceme position compared with middle and upper ones where probability of fruit retention was more even at first and last positions on the raceme (cf. 53% fruit retention at raceme position 1 for nodes 10-16 and <28% fruit retention at any position on the raceme for nodes 17-23 and nodes 24-29). Trends for abscission patterns of buds, flowers and fruits within the raceme were the same as those already noted for nodes 10-29 collectively except that it seemed that buds were more susceptible to abscission on racemes borne at lower nodes (see 12-2% bud abscission at raceme positions 1-6 for nodes 10-16). Examination of individual node data for nodes 10-16 (data not shown) made it clear that the latter was due to particularly high bud abscission probabilities for racemes borne at nodes 10, 11 and 12.

Some features of these patterns of abscission/retention of reproductive structures within the faba bean raceme are readily explained while others are not. For example, preferential fruit retention at first and last positions on the raceme with a definite decline in fruit retention in middle raceme positions could be due to first-set fruits releasing abscission-inducing factors which then show acropetal (although limited) transport along the peduncle. Similarly, high fruit retention at the first raceme position for a lower node changing to more equal fruit retention at first and last raceme positions for middle and upper nodes could be the result of competition for essential factors (e.g. assimilate, mineral nutrients, growth regulators) which intensifies with further plant development. Such increased competition might arise once seed filling commences at lower nodes (Aufhammer *et al.* 1987). In contrast, it is difficult to provide a precise reason why flowers (and not buds or fruits) are the most likely form in which reproductive structures are shed. In this study, it was noted that recently opened flowers were never shed and most flower abscission occurred in the form of closed flowers showing petal wilting/senescence (Pentland 1990). That reproductive abscission occurs mainly as flow-

**Table 2.** Abscission/retention probabilities of buds, flowers and fruits of faba bean in relation to position on the raceme. Data are presented for single reproductive nodes (nodes 14, 20 and 26) and for groups of reproductive nodes (nodes 10-16, 17-23 and 24-29). Values are the mean for 20 replicate plants. n = number of observations upon which each set of values is based. Racemes could initiate buds at up to 7 positions on the peduncle, but single node data are shown for raceme positions 1-5 only and grouped node data are shown for raceme positions 1-6 only.

| Probability (%) | Position on raceme | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Node 14** | n=20 | n=20 | n=20 | n=20 | n=18 | |
| Bud abscission | 0 | 0 | 0 | 0 | 0 | |
| Flower abscission | 15 | 75 | 75 | 90 | 83 | |
| Fruit abscission | 0 | 15 | 25 | 5 | 0 | |
| Fruit retention | 85 | 10 | 0 | 5 | 17 | |
| **Node 20** | n=20 | n=20 | n=20 | n=20 | n=20 | |
| Bud abscission | 0 | 5 | 0 | 5 | 0 | |
| Flower abscission | 80 | 85 | 85 | 75 | 45 | |
| Fruit abscission | 10 | 5 | 5 | 5 | 25 | |
| Fruit retention | 10 | 5 | 10 | 15 | 30 | |
| **Node 26** | n=20 | n=20 | n=20 | n=20 | n=19 | |
| Bud abscission | 0 | 0 | 0 | 0 | 0 | |
| Flower abscission | 50 | 75 | 85 | 65 | 68 | |
| Fruit abscission | 25 | 5 | 0 | 20 | 11 | |
| Fruit retention | 25 | 20 | 15 | 15 | 21 | |
| **Nodes 10-16** | n=136 | n=136 | n=122 | n=109 | n=88 | n=45 |
| Bud abscission | 11.8 | 10.3 | 9.0 | 2.8 | 2.3 | 2.2 |
| Flower abscission | 29.4 | 69.9 | 70.5 | 82.6 | 84.1 | 86.7 |
| Fruit abscission | 5.9 | 7.4 | 11.5 | 6.4 | 6.8 | 6.7 |
| Fruit retention | 52.9 | 12.4 | 9.0 | 8.2 | 6.8 | 4.4 |
| **Nodes 17-23** | n=140 | n=140 | n=140 | n=140 | n=137 | n=66 |
| Bud abscission | 1.4 | 1.4 | 0.7 | 0.7 | 0.0 | 0.0 |
| Flower abscission | 58.6 | 88.6 | 79.3 | 82.2 | 66.4 | 72.8 |
| Fruit abscission | 19.3 | 6.4 | 9.3 | 9.3 | 9.5 | 10.6 |
| Fruit retention | 20.7 | 3.6 | 10.7 | 7.8 | 24.1 | 16.6 |
| **Nodes 24-29** | n=120 | n=120 | n=119 | n=118 | n=112 | n=51 |
| Bud abscission | 1.7 | 0.0 | 0.8 | 0.9 | 0.0 | 0.0 |
| Flower abscission | 55.9 | 75.8 | 63.1 | 69.5 | 61.6 | 60.8 |
| Fruit abscission | 15.0 | 15.0 | 18.5 | 11.9 | 17.9 | 11.8 |
| Fruit retention | 27.4 | 9.2 | 17.6 | 17.7 | 20.5 | 27.4 |

ers in faba bean has been recongnized but no reasons given (Gates *et al.* 1983). Anatomical constraints posed by vasculature within the raceme are unlikely (White *et al.* 1984) and it is usually thought that little barrier to fruit set exists from lack of pollination in self-pollinated varieties (Chapman and Peat 1978). Since demand for assimilate by flower sinks is much lower than that by bud or fruit sinks in grain legumes (Clifford and Binnie 1988) it could be argued that predominance of flower abscission in faba bean is unlikely to be due to lack of assimilate *per se* but more likely the result of precise chemical signals derived from set fruits or elsewhere in the plant. On the other hand, abscission of

buds and fruits albeit at low levels is probably an effect of competition for a limited assimilate supply. Indeed, high bud abscission at lower nodes as observed in this study, might reflect the necessity of plants to reach a particular developmental stage (e.g. leaf area, root size) before reproductive growth can take priority.

Over-production of reproductive structures and their premature abscission is recognized as an adaptive strategy ensuring maximal fruit set in the face of losses due to adverse environmental conditions, disease, or predation by insects (Stephenson 1981). The physiological basis of premature abscission is not clear (see Introduction), but there is ample evidence for grain legumes that fruit set and total seed weight at least within the raceme can be increased by a variety of treatments (e.g. main-stem decapitation, Binnie and Clifford 1980; removal of excess reproductive structures, Tayo 1980; supply of raceme-localised supplemental light, Myers *et al.* 1987; direct application of growth regulators, Crosby *et al.* 1981).

Elucidation of the physiological basis of premature abscission in faba bean opens up possibilities of yield increases through application of commercial growth regulators. Information on patterns of abscission and retention of buds, flowers and fruits can assist in such elucidation. The spatial relationship between retained and abscising reproductive structures in the faba bean raceme suggests that first-set fruits release growth regulators that induce abscission of remaining buds, flowers and fruits. Although reports of such release exists for some grain legumes they are not conclusive for faba bean (Diethelm *et al.* 1988). The available evidence suggests that it is more likely that reproductive abscission in faba bean is controlled primarily by first-set fruits competing successfully with other reproductive structures for a limited supply of factors (e.g. assimilate, mineral nutrients, growth regulators) that are essential for normal development. Competition for assimilate could become more acute when vegetative growth predominates which might explain why abscission/retention patterns within the raceme of faba bean change with raceme position on the stem (see also Gates *et al.* 1983). Competition for growth regulators, rather than for assimilate, could explain why flowers form the bulk of reproductive losses in faba bean even when they are such small sinks in relation to buds or fruits. Interaction may occur between supply of assimilate and growth regulators so that assimilate export to roots determines the availability to the shoot of root-synthesised cytokinins that influence abscission and/or sink activity of reproductive structures (Clifford 1981). There is evidence that cytokinin sprays are particularly effective at improving fruit set in faba bean (Clifford, Pentland and Baylis, unpublished) as well as in other grain legumes (Carlson *et al.* 1987 and references therein). If such foregoing competitive effects are the prime cause of premature reproductive abscission in faba bean, improvements in fruit set and seed yield on a per plant basis might be achieved through growth regulating chemicals particularly those that are able to alter sink activity of reproductive structures, increase cytokinin production by roots, or reduce carbohydrate allocation to vegetative growth.

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## طرز تساقط أعضاء التكاثر في الفول
## *Vicia faba* L. cv. Troy

**الملخص :**

تمت دراسة طرز تساقط أعضاء التكاثر في الفول على الصنف Troy، المزروع تحت بيئات محكمة. وقد تتساقط تلك الأعضاء، كبراعم أو أزهار أو قرون، إلا أنها قد اختلفت بشكل ملحوظ في مدى حساسيتها للسقوط ( أزهار > قرون > براعم ). وبصرف النظر عن نوع العضو التكاثري فقد توقف مدى قابليته للسقوط على مكان توضعه في النورة الزهرية، وعلى مكان توضّع النورة على الساق. وكان إجمالي مستويات الانفصال في النباتات على درجة أتيح معها لـ 17 ٪ فقط من البراعم أن تعطي قرونا في آخر الأمر.

**Agronomy and Mechanization** **المعاملات الزراعية والمكننة**

# Performance of Three Cultivars of Faba Beans (Vicia faba L.) Grown under Rainfed Conditions in the Western Part of the Jamahiria

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**Abstract**

**A field experiment was conducted at the Agricultural Experimental Station, El-Fateh University, Tripoli during the 1983-84 seasons to study the growth and yield of three cultivars of faba bean, namely Giza, Italiana, and Aquadulce, grown under rainfed conditions. The Egyptian cultivar (Giza) proved superior to the other two cvs in almost all the characters studied. It outyielded cvs Aquadulce and Italiana by 25.8% and 95.5%, respectively. In addition, it gave the highest leaf area index, plant height, number of tillers/plant, and number and weight of seeds/plant. Cv Aquadulce produced the highest 1000-seed weight due to its large seed size.**

ولم تُظهر النتائج أية فروق معنوية بين الصنفين أكوادولشي وإيطاليانا في عدد القرون/النبات؛ حيث أعطى كل منهما 4.3 قرن/النبات، بينما كان ذلك العدد أعلى في الصنف جيزة (4.11 قرن/النبات). وتم الحصول على نتائج مشابهة فيما يخص عدد البذور/النبات؛ أي: 14.1، و 8.8، و 31.5 بذرة/النبات على الترتيب السابق نفسه.

ومن حيث عدد الفروع/النبات أعطى الصنف إيطاليانا أقل عدد من الفروع (3.3) مقارنة بالصنفين أكوادولشي (4.07) وجيزة (3.9).

**ثالثا: الغلة**

تدل النتائج الموضحة في الجدول 3 على أن الصنف المصري قد أعطى زيادة معنوية في الغلة البذرية بلغت (0.89 طن/هـ) مقارنة بالصنف أكوادولشي (0.66 طن/هـ). وكانت غلة الصنف الإيطالي متدنية جدا (0.04 طن/هـ). ويعزى تفوّق الصنف المصري على الصنفين الآخَرَين إلى الزيادة المعنوية في المساحة الورقية فيه، وعدد العقد البكتيرية النشطة على جذوره، وعدد القرون والبذور/النبات. وترجع زيادة غلة الصنف أكوادولشي على الصنف إيطاليانا إلى الزيادة المعنوية في طول النبات، والمساحة الورقية، ووزن القرون والبذور/النبات، ووزن الألف حبة.

ولوحظ خلال نمو المحصول تعرّض الصنف الإيطالي للإصابة المرضية؛ وخاصة بمرض تبقع الأوراق (التبقع البني)، وكذلك بالفيروسات، أما الصنفان أكوادولشي والمصري فأظهرا مقاومة للإصابة. كما لوحظ تأخرُ موعد نضج قرون الصنف الإيطالي سبعة أيام لدى مقارنته بالصنف أكوادولشي، ونضجُ الصنف المصري قبل الصنف المحلي بأسبوع. ورغم تأخر موعد نضج الصنف الإيطالي فإن درجة قابليته للانفراط كانت عالية مقارنة بالصنفين الآخرين.

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البذور ووزنها/النبات، ووزن الألف حبة. وتم حصاد كل قطعة تجريبية لتقدير الغلة البذرية بالطن/هـ. واستخدم أقل فرق معنوي (بمستوى 5 ٪) لمقارنة النتائج.

## النتائج والمناقشة

### أولا: صفات النمو

أظهرت نتائج الجدول 1 وجود فروق معنوية في المساحة الورقية بين الصنفين جيزة (31.9 سم) وأكوادولشي (27.0 سم) مقارنة بالصنف إيطاليانا (14.1 سم)، وتم الحصول على نتائج مماثلة بالنسبة لأطوال النبات بين الأصناف؛ أي: 46.6، و 40.0، و 27.8 سم على الترتيب السابق ذاته. كما أشارت النتائج إلى زيادة معنوية في عدد العقد البكتيرية النشطة على جذور الصنف جيزة (175.2 عقدة) مقابل الصنفين أكوادولشي (115.8) وإيطاليانا (95.5).

كما أشارت النتائج إلى وجود زيادة معنوية في عدد العقد البكتيرية النشطة على جذور نباتات الصنف جيزة (175.2 عقدة) مقابل أكوادولشي (115.8 عقدة)، وإيطاليانا (95.5 عقدة).

### ثانيا: مكوّنات الغلة

يوضح الجدول 2 قراءات مكونات الغلة، الخاصة بعدد الفروع والقرون والبذور/النبات، ووزن القرون والبذور/النبات، ووزن الألف حبة. وتشير النتائج إلى تفوّق الصنف المصري بدرجة معنوية في عدد ووزن القرون والبذور/النبات، بينما تفوّق الصنف أكوادولشي، وبدرجة معنوية في وزن الألف حبة (803 غ) بفضل كبر حجم بذوره مقارنة بالصنف جيزة (562 غ)، وإيطاليانا (304 غ) الأصغر حبة.

الجدول 1. متوسطات المساحة الورقية (سم) وعدد العقد البكتيرية وطول النبات (سم) لأصناف الفول الثلاثة.

| الصنف | المساحة الورقية | العقد البكتيرية | طول النبات |
|---|---|---|---|
| أكوادولشي | 27.0 | 115.8 | 40.0 |
| جيزة | 31.9 | 175.2 | 46.6 |
| إيطاليانا | 14.1 | 95.0 | 27.8 |
| أقل فرق معنوي، 5 ٪ | 4.7 | 18.2 | 6.6 |

الجدول 3. متوسط الغلة البذرية لأصناف الفول الثلاثة.

| الصنف | الغلة البذرية |
|---|---|
| أكوادولشي | 0.660 |
| جيزة | 0.890 |
| إيطاليانا | 0.040 |
| أقل فرق معنوي، 5 ٪ | 0.400 |

الجدول 2. متوسطات عدد ووزن الفروع والقرون والبذور/النبات ووزن الألف حبة لأصناف الفول الثلاثة.

| الصنف | عدد الفروع /النبات | عدد القرون /النبات | عدد البذور /النبات | وزن القرون /النبات، غ | وزن البذور /النبات، غ | وزن الألف حبة، غ |
|---|---|---|---|---|---|---|
| أكوادولشي | 4.1 | 4.3 | 14.1 | 18.7 | 13.1 | 803 |
| جيزة | 3.9 | 11.1 | 31.5 | 31.2 | 17.6 | 562 |
| إيطاليانا | 3.3 | 4.3 | 8.8 | 4.5 | 2.6 | 102 |
| أقل فرق معنوي، 5٪ | 0.24 | 5.9 | 8.6 | 7.5 | 4.1 | 159 |

# كفاءة ثلاثة أصناف من الفول (Vicia faba L.) تحت الظروف البعلية في المنطقة الغربية من الجماهيرية الليبية

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## الملخص

خلال الموسمين 84/1983 و 85/1984 تم في محطة أبحاث كلية الزراعة التابعة لجامعة الفاتح بطرابلس تقييم كفاءة ثلاثة أصناف من الفول (*Vicia faba* L.)، هي: البلدي جيزة من مصر، وإيطاليانا من إيطاليا، وأكوادولشي المزروع محليا في المنطقة الغربية من الجماهيرية الليبية. تناولت الدراسة صفات النمو والغلة ومكوّناتها. وقد تفوّق الصنف المصري جيزة في الغلة البذرية على أكوادولشي وإيطاليانا بنسبة 25.8 ٪ و 95.5 ٪ على الترتيب، وكذلك أعطت نباتاته زيادة في دليل المساحة الورقية، وطول النبات، وعدد الفروع والقرون/النبات، ووزن البذور/النبات. وأوضحت الدراسة وجود زيادة معنوية في وزن الألف حبة عند الصنف أكوادولشي (803 غ) مقابل الصنفين جيزة (562 غ) وإيطاليانا (304 غ)، مما يدل على كبر حجم حبّته.

## المقدمة

يعتبر الفول (*Vicia faba* L.) أحد محاصيل البقول الشتوية الهامة الشائع زراعتها في الجماهيرية، لأنه كغيره من المحاصيل البقولية ذو أهمية كبيرة في زيادة خصوبة التربة، وتحسين خواصها الفيزيائية والكيميائية عن طريق تثبيت الآزوت الجوي بواسطة البكتيريا العقدية (الريزوبيا) المتشكلة على الجذور.

إن لدراسة مسافات الزراعة وجرعات التسميد المختلفة ومعدلات البذار أهمية خاصة، نظرا لتأثيرها في نمو وإنتاجية الفول. ففي السودان أفاد Saeed (1968) عن تدنّي الغلة البذرية للفول في الفدان عند الزراعة بمعدّل 148.1 كغ/هـ، في الوقت الذي تؤدي فيه الكثافة النباتية الشديدة ومعدلات البذار العالية إلى تقليل غلة النبات وطول الساق، وتدني إنتاج القرون، دونما تأثير في عدد البذور وحجمها.

وفي طرابلس بالجماهيرية درس Shaalan *et al.* (1977) تأثيرَ مسافات الزراعة والتسميد الفوسفاتي في نمو نباتات الفول المحلي، ووجدوا أن الزراعة على مسافة 30 سم بين الخطوط والتسميد بمعدل 72 و 108 كغ $P_2O_5$/هـ قد أديا إلى زيادة معنوية في وزن القرون والغلة البذرية بالهكتار. وأشارت نتائج Farida & El-Gayed (1976) إلى وجود زيادة معنوية في الوزن الأخضر والجاف للنبات، والغلة البذرية، وحجم الحبة عند التسميد بالجرعتين 300 و 750 كغ سوبر فوسفات (20 ٪ $P_2O_5$)/هـ. كما لاحظا أن إضافة السماد المنغنيزي – سواء عند نقع البذور أو برشه على النباتات – لم تؤثر معنويا في الوزن الأخضر والجاف ، بل قلّلت الغلة البذرية للفول. أما تجارب Ashley *et al.* (1980) فأظهرت إمكانية تحسين إنتاجية الفول، وتفوّق الصنفين فيفرولد وسينل جانيت على الصنف الشاهد سايبرس. كذلك أجرى دحنوش (1985) تجارب تتعلق بتقدير الكفاءة الإنتاجية لأصناف فول كبيرة الحبة تحت ظروف الري التكميلي، ووجد أن الأصناف المدروسة لم تستطع التغلّب على الصنف الشاهد أكوادولشي، سواء أكان ذلك في الغلة، أم في بعض الصفات الزراعية الأخرى.

ويهدف هذا البحث إلى تقييم صنفي الفول المصري (جيزة) والإيطالي (إيطاليانا)، ومقارنتهما بالصنف أكوادولشي من حيث النمو والإنتاجية تحت الظروف البعلية للمنطقة الغربية من الجماهيرية الليبية.

## المواد والطرق

أقيمت التجربة في محطة أبحاث كلية الزراعة التابعة لجامعة الفاتح بطرابلس، خلال الموسمين الزراعيين 84/1983 و 85/1984. وجرى قبل الزراعة إعداد مهد البذور جيدا، وأضيف السماد المركّب 12 أزوت – 24 فوسفور – 12 بوتاسيوم بمعدّل 20 طن سماد/هـ. كانت تربة موقع التجربة رملية طمية، تتراوح درجة حموضتها (pH) ما بين 8.2 – 8.4، وتحوي 0.4 – 0.6 ٪ مادة عضوية وأقل من 1 ج ف م فوسفور متاح.

زرعت التجربة في الأسبوع الأول من ت2/نوفمبر عام 1983، ثم كُرِّرت في العام التالي (1984) وبنفس الموعد. اتُّبع في البحث تصميم القطاعات العشوائية الكاملة بأربعة مكررات، بحيث توزعت مستويات أصناف الفول الثلاثة: المصري والإيطالي وأكوادولشي على 12 قطعة تجريبية، أطوالها 3م X 3م، وتحوي 10 خطوط في كل منها 10 جور في كل جورة بذرة مستنبتة، بحيث كانت المسافة الفاصلة بين الخطوط وكذلك بين الجور في الخط الواحد 30 سم.

ولإجراء التحاليل اللازمة، أخذ متوسط نتائج التجربتين بعد أن اختير 5 نباتات عشوائيا من كل قطعة تجريبية لتقدير متوسط المساحة الورقية باستعمال جهاز خاص بذلك. وقبيل نضج المحصول أخذ عشوائيا أيضا 10 نباتات ناضجة لأخذ متوسطات القراءات التالية: طول النبات، عدد الفروع/النبات، عدد القرون ووزنها/النبات، عدد

# Interaction of Sulphur and Phosphorus Fertilizers on Yield and Nutrient Composition of Faba Bean Grown on Black Soils of Central India

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## Abstract

**A field trial was conducted to evaluate the effect of different applications of sulphur (0, 30, 60 kg S/ha) and phosphorus (0, 40, 80 kg $P_2O_5$/ha) on grain and straw yields and nutrient composition of faba bean grown on a black soil (typic chromustert). Increasing applications of sulphur as well as phosphorus fertilizers significantly increased the grain yield along with the nutrient composition of N, P, K, Ca, Mg, and S up to the level of 30 kg S/ha and 40 kg $P_2O_5$/ha. No significant effect was noticed with further increase in fertilizers dose to 60 kg S/ha and 80 kg $P_2O_5$/ha dose. The highest yield was obtained with a combination of 30 kg S/ha and 40 kg $P_2O_5$/ha. The S and P exhibited a strong synergistic relationship for faba bean nutrition.**

## Introduction

The application of high analysis sulphur-free fertilizers have drastically reduced sulphur input in agriculture. Consequently the soils have become deficient in its inherent reserves, leading to low crop yields. Inclusion of sulphur in fertilizer schedule should, therefore, enhance its availability (Morok and Dev 1980) and also improve the use of other essential nutrients from the soil, which should reflect in terms of yield and quality improvement of the crops. This study examined the effect of S application in combination with phosphate fertilizer on the yield and nutrient content of faba bean.

## Materials and Methods

The study was conducted at the experimental field of J.N. Krishi Vishwa Vidyalaya, Jabalpur, India, on a black soil (typic chromustert) during the 1988/89 season. The soil of the site had a pH of 7.6, 1:2 soil:water ratio, organic carbon 0.41%, available nitrogen 260 kg N/ha, available phosphorus 12.5 kg $P_2O_5$/ha, available potassium 296 kg $K_2O$/ha, and available sulphur 14.4 kg S/ha. The faba bean cv 'JV-2' was sown in 15-$m^2$ plots replicated three times. The treatments, tested in a factorial randomized block design, consisted of different applications of sulphur at the rates of 0, 30, and 60 kg S/ha (gypsum); corresponding to S0, S30, and S60, respectively; and phosphorus at 0, 40, and 80 kg $P_2O_5$/ha (calcium-phosphate), corresponding to P0, P40, and P80, respectively). A basal dose of 20 kg N/ha (urea) and 40 kg $K_2O$/ha (muriate of potash) was also applied uniformly.

At maturity, grain and straw samples were harvested separately and analyzed for total nitrogen, calcium and magnesium (Piper 1967), phosphorus (Koenig and Johnson 1942), sulphur (Bardsley and Lancaster 1960), and potassium.

## Results and Discussion

Data on grain and straw yields of faba bean along with composition of different nutrients are shown in Table 1.

### Yield

A significant increase in the grain and straw yields of faba bean was observed with increased rates of application of sulphur and phosphorus up to a certain level, after which additional applications increased the grain yield insignificantly. The interaction between S and P was significant. In the absence of P fertilizer, the yield increased with increasing rates of S application, but when P was also applied, an intermediate level of S (30 kg S/ha) was sufficient to produce the same level of yield. The highest grain yield was produced at S30 and P80 level (2317 kg/ha). In contrast, no appreciable change in the yield of straw has been found with the fertilizer's applications (**Table 1**).

### Nitrogen concentration

Total N concentration of faba bean increased significantly up to S30 and P40 dose where the maximum level of N content was reached. The increase in N content may be related to better nodulation (Zaroug and Munns 1980).

### Phosphorus content

P content of faba bean also increased significantly by sulphur as well as phosphorus applications. The sulphur application at 30 kg/ha increased P concentration, perhaps because of a synergistic effect in releasing soil phosphorus (Morok and Dev 1980). The interaction of S and P was significant, and the highest content of P in grain (0.38%) was obtained at S30 and P80 dose.

**Table 1** Effect of sulphur and phosphorus fertilizer applications on yield and nutrient composition of faba bean.

| Sulphur (kg S/ha) | Phosphorus (kg P2O5/ha) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 | 40 | 80 | Mean | 0 | 40 | 80 | Mean |
| | | | | Yield (kg/ha) | | | | |
| 0 | 1450 | 1790 | 2122 | 1786 | 1744 | 1189 | 1200 | 1211 |
| 30 | 1690 | 1974 | 2317 | 1993 | 761 | 1171 | 1155 | 1029 |
| 60 | 1947 | 2215 | 2120 | 2090 | 1255 | 992 | 950 | 1065 |
| Mean | 1695 | 1993 | 2186 | | 1086 | 1117 | 1101 | |
| CD(5%) | S and P=2.05 | SxP= 4.06 | S and P= NS | SxP= NS | | | | |
| | | | | Nitrogen content (%) | | | | |
| 0 | 3.78 | 3.92 | 3.89 | 3.96 | 1.40 | 1.54 | 1.73 | 1.55 |
| 30 | 3.87 | 4.01 | 4.08 | 3.99 | 1.49 | 1.59 | 1.63 | 1.57 |
| 60 | 3.98 | 4.08 | 4.06 | 4.04 | 1.49 | 1.68 | 1.82 | 1.66 |
| Mean | 3.87 | 4.00 | 4.01 | | 1.46 | 1.60 | 1.73 | |
| CD(5%) | S and P=0.17 | SxP= 0.29 | S and P=0.09 | SxP= 0.15 | | | | |
| | | | | Phosphorus content (%) | | | | |
| 0 | 0.24 | 0.30 | 0.30 | 0.28 | 0.08 | 0.08 | 0.08 | 0.08 |
| 30 | 0.27 | 0.31 | 0.38 | 0.32 | 0.08 | 0.07 | 0.09 | 0.08 |
| 60 | 0.29 | 0.37 | 0.38 | 0.34 | 0.07 | 0.07 | 0.10 | 0.08 |
| Mean | 0.26 | 0.33 | 0.36 | | 0.07 | 0.07 | 0.09 | |
| CD(5%) | S and P=0.02 | SxP= 0.04 | S and P=NS | SxP= NS | | | | |
| | | | | Potassium content (%) | | | | |
| 0 | 1.08 | 1.12 | 1.12 | 1.11 | 1.08 | 1.23 | 1.37 | 1.23 |
| 30 | 1.12 | 1.13 | 1.12 | 1.12 | 1.27 | 1.43 | 1.50 | 1.40 |
| 60 | 1.15 | 1.17 | 1.15 | 1.16 | 1.37 | 1.48 | 1.58 | 1.48 |
| Mean | 1.12 | 1.14 | 1.13 | | 1.24 | 1.38 | 1.48 | |
| CD(5%) | S and P=NS | SxP= NS | S and P= NS | SxP= NS | | | | |
| | | | | Calcium content (%) | | | | |
| 0 | 0.59 | 0.65 | 0.68 | 0.64 | 2.03 | 2.07 | 2.09 | 2.06 |
| 30 | 0.67 | 0.64 | 0.63 | 0.65 | 2.19 | 2.20 | 2.07 | 2.15 |
| 60 | 0.67 | 0.67 | 0.65 | 0.66 | 2.20 | 2.04 | 2.06 | 2.10 |
| Mean | 0.64 | 0.65 | 0.65 | | 2.14 | 2.10 | 2.07 | |
| CD(5%) | S and P=NS | SxP= NS | S and P= NS | SxP= NS | | | | |
| | | | | Magnesium content (%) | | | | |
| 0 | 0.08 | 0.13 | 0.17 | 0.13 | 0.48 | 0.54 | 0.55 | 0.52 |
| 30 | 0.19 | 0.16 | 0.19 | 0.18 | 0.48 | 0.48 | 0.57 | 0.51 |
| 60 | 0.13 | 0.16 | 0.20 | 0.16 | 0.48 | 0.44 | 0.48 | 0.47 |
| Mean | 0.13 | 0.15 | 0.19 | | 0.48 | 0.49 | 0.53 | |
| CD(5%) | S and P=0.03 | SxP= NS | S and P= NS | SxP= NS | | | | |
| | | | | Sulphur content (%) | | | | |
| 0 | 0.15 | 0.17 | 0.23 | 0.18 | 0.05 | 0.07 | 0.07 | 0.06 |
| 30 | 0.17 | 0.26 | 0.28 | 0.24 | 0.07 | 0.08 | 0.08 | 0.07 |
| 60 | 0.17 | 0.27 | 0.30 | 0.25 | 0.06 | 0.08 | 0.09 | 0.08 |
| Mean | 0.16 | 0.23 | 0.27 | | 0.06 | 0.08 | 0.08 | |
| CD(5%) | S and P=0.03 | SxP= 0.05 | S and P=0.01 | SxP= NS | | | | |

**Potassium content**
There was no significant effect of sulphur and phosphorus fertilizer applications on the potassium content in faba bean. This may be because of the high level of available potassium in the experimental soil.

**Calcium concentration**
Total calcium concentration of faba bean increased with successive applications of S and P up to S60 and P40 dose. The priming effect of sulphur might be responsible for the release of calcium for plant utilization (Shinde *et al.* 1982). The interaction of S and P was nonsignificant.

**Magnesium concentration**
Magnesium content was also increased with successive applications of S and P. The increase due to S applications, may again reflect its priming effect on the availability of magnesium as suggested by Shinde *et al.* (1982). The interaction of S and P was found to be nonsignificant.

**Sulphur concentration**
The total sulphur concentration of faba bean increased significantly with every successive application of sulphur over control, reflecting that the soil was inherently deficient in S. As the soil pool of sulphur became concentrated by fertilizer additions, plant uptake increased (Morok and Dev 1980). Similarly, phosphorus fertilization also helped in increasing the sulphur concentration. The interaction of S and P was significant. The increase in S content with increasing rates of P application was higher in the presence of the higher rate of S than at the lower rate and control.

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## الفعل المتبادل بين الكبريت والسماد الفوسفوري وتأثيره في الغلة والتركيب المعدني لنباتات الفول المزروعة على أتربة سوداء في وسطي الهند

**الملخص :**

أجريت تجربة حقلية لتقييم جرعات مختلفة من الكبريت ( 0، 30، و 60 كغ كبريت/هـ ) والفوسفور ( 0، 40، 80 كغ $P_2O_5$/هـ ) وتأثيراتها في غلة الحب والتبن والتركيب المعدني لنباتات الفول المزروعة على أتربة سوداء ( typic chromustert ). وقد أدت زيادة الجرعة من الكبريت والسماد الفوسفوري إلى زيادة كل من الغلة الحبية بدرجة معنوية، والتركيب المعدني من الآزوت والفوسفور والبوتاسيوم والكالسيوم والمغنيزيوم والكبريت حتى مستوى 30 كغ كبريت/هـ و 40 كغ فوسفور/هـ. ولم يلاحظ أي تأثير معنوي في جرعة السماد حتى 60 كغ كبريت/هـ و 80 كغ فوسفور/هـ. وتم الحصول على أعلى غلة عند إضافة خليط من 30 كغ كبريت/هـ و 40 كغ فوسفور/هـ. كما ظهر أن كلا من الكبريت والفوسفور يدعم بعضه بعضا من حيث تغذية نباتات الفول.

# Faba Bean Water Management at New Halfa

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## Abstract

**Faba bean cv BF 2/2 was irrigated at different intervals in the period from sowing to flowering (14 and 21 days) and from flowering to maturity (7 and 14 days), to determine optimum irrigation regime for New Halfa. Early corp growth (preflowering period) was generally better with dryer than with wetter irrigation treatments, whereas the opposite was true with the growth in the postflowering period. More economic yields were obtained when the crop was irrigated at 21-day intervals up to flowering and at 7-day intervals after onset of flowering. The seed quality was not affected by frequency of irrigation.**

## Introduction

Experiments on faba bean water management have been based mainly on fixed intervals between irrigations throughout the crop developmental period in the new areas under faba bean in the Sudan (Ageeb 1982; Farah and Ageeb 1983). The sensitivity of the crop to water stress differs at different stages of growth (Salter and Goode 1967). Hence irrigating the crop at different frequencies during the different stages of growth may permit optimization of irrigation.

The aim of the present study was to examine whether irrigation at fixed interval could be modified in order to reduce water consumption (WC) or number of irrigations without decreasing yields.

## Materials and Methods

The experiment was conducted at the New Halfa Research Farm in Eastern Sudan (15° 19' N, 38° 41' E). Soil of the site was alkaline, slowly permeable, and high in montmorilonite. The distribution of soil water with depth was uniform after irrigations. The top 100 cm of soil held about 116 mm available water; almost half of it is held in the top 20 cm, and about 100 mm in the depth of 0-60 cm.

Cyclic wetting and drying with routine irrigations is usually confined to the upper 60 cm of the soil (Farbrother and Adam 1975). The experimental site had been cropped with wheat preceded by cotton. The soil was ploughed, harrowed, leveled, and ridged at 60 cm row spacings. Seeds of the faba bean cv BF 2/2 were sown in holes (3 seeds/hole) 20 cm apart on each side of the ridges during the first week of November 1985. Eighty-six kg N/ha (urea) and 43 kg $P_2O_5$/ha (triple phosphate) were applied two weeks after sowing. Irrigation was made (i) at 14-day intervals throughout the growing season (control), (ii) at 14-day intervals during preflowering and at 7-day intervals thereafter, and (iii) at 21-day intervals during preflowering and at 7-day intervals thereafter. A randomized block design was adopted using three replications.

The "angaia system" of irrigation of the Gezira farmers (surface irrigation on ridges of plots of equal sizes; usually 2.1 ha is divided into 14 equal units each known as an angaia) was used. The plot size was 75x8 m, separated by 3-m alleys to reduce the effects of lateral water movement between treatments. The volume of water given to each treatment was measured through 6-inch pipes using a propeller type meter (Hersey Sparting, Burgess Hill, Sussex, England). Water was applied until it was approximately 5 cm deep between the ridges to allow the soil to absorb water according to its need, since plots with longer watering intervals would absorb more water than those of the shorter intervals.

All plots received two irrigations at 7-day intervals to help establish the crop before the differential irrigation treatments were imposed. Flowering occurred 15-18 Dec 1985, and harvesting was in February 1986. The whole plots were harvested.

The data were analyzed and means were compared according to the Duncan's Multiple Range Test as described by Steel and Torrie (1960) Economic evaluation was made using partial budget analysis at prevailing costs and prices in the 1985/86 season. Sensitivity analysis was also carried out to test the stability of most profitable alternatives with variation in factor costs and product prices.

## Results and Discussion

The highest grain and total biological yields were obtained

**Table 1** The effect of irrigating faba beans at fixed intervals during the preflowering and postflowering periods on yield at New Halfa.

| Irrigation regime (days) PRE-F | POST-F | Number of irrigations | Grain yield (kg/ha) | Biological yield (kg/ha) | Pods/ plant | 100-seed weight (g) |
|---|---|---|---|---|---|---|
| 14 | 7 | 14 | 2344a[1] | 4269a | 14.0a | 45.8a |
| 14 | 14 | 9 | 1912b | 3787a | 13.9a | 44.4a |
| 21 | 7 | 13 | 2164a | 3912a | 13.6a | 46.8a |
| SE± | | | 46.41 | 56.0 | 2.82 | 1.89 |

1) Figures within each column followed by different letter(s) are significantly different at P= 0.05 according to the Duncan's Multiple Range Test.

**Table 2** Seed quality of faba beans as affected by irrigation intervals at New Halfa.

| | Irrigation regime 14/7 days | 21/7 days | SE± |
|---|---|---|---|
| Non-soakers seeds (%) | 13.4 | 10.7 | 1.38 |
| Hydration coefficient (%) | 200.1 | 200.5 | 1.66 |
| Total defects | 25.6 | 23.2 | 1.30 |
| Increase in weight after processing (%) | 39.8 | 41.4 | 2.57 |

when irrigation was at intervals of 14/7 days, whereas the lowest yields were recorded with continuous irrigation at 14-day intervals (**Table 1**). These results confirm that faba bean is less sensitive to water shortage in the preflowering than in the postflowering period (Farah and Ageeb 1983, 1984, and 1985).

*Seed Quality*

Irrigation frequency did not significantly affect seed quality. However, the best seed quality, judged by the percentage of non-soaker seeds, total defects, and weight after processing, was observed when irrigation was at every 21 and 7 days before and after flowering, respectively (**Table 2**).

*Economic Evaluation*

The differences in yield between the 14/7 and 21/7 days watering regimes was not significant. Thus, the average yield of the second regime, which had a lower variable cost due to lesser number of waterings, was considered applicable to the two regimes and compared with the 14/14 days regime for economic analysis (**Table 3**). The 21/7 days watering regime proved highly profitable and increased the net benefit by Sudanese Pound (SDP) 1301/ha over the 14/14 regime. Since the increase in variable costs was SDP

**Table 3** Partial budget analysis of the irrigation-intervals experiment conducted at New Halfa during the 1985/86 season.

| | Irrigation regime 14/7 days | 14/14 days |
|---|---|---|
| Variable costs | | |
| Number of waterings | 13 | 9 |
| Cost of watering/ha (SDP) | 31 | 31 |
| Total variable costs (SDP/ha) | 403 | 279 |
| Benefits | | |
| Seed yield (kg/ha) | 2254 | 1912 |
| Field price (SDP/ha)[1] | 2.22 | 2.22 |
| Gross benefits (SDP/ha) | 5670 | 4245 |
| Net benefits (SDP/ha) | 5267 | 3966 |

1) Field price = Farm gate price - costs variable with yield.

124/ha, returns due to investment were high representing a marginal rate of return of 1049%. This implies that SDP 10.49 increase in net benefits were realized with every SDP 1 additional investment in irrigation.

The sensitivity analysis regarding faba bean price decrease and increase in variable costs (cost of irrigation) were done through calculation of break-even faba bean price as well as break-even percentage increase in variable costs. The results of this study showed that faba bean prices could decrease to about SDP 0.363/kg before the 21/7 days watering regime becomes less profitable; a price reduction of 84%. On the other hand, variable costs (cost of irrigation) could increase by 1149% before the same situation is expected; a tolerable increase of almost 11.5 folds. These results reveal the high economic and stable variability of the 21/7 days watering regime.

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## إدارة ري الفول في حلفا الجديدة

الملخص :

تم ري صنف الفول BF2/2 على فترات مختلفة تمتد من الزراعة حتى الإزهار ( 14 و 21 يوما )، ومن الإزهار حتى النضج ( 7 و 14 يوما )، وذلك لتحديد أفضل نظام للري في حلفا الجديدة. وكان النمو المبكّر للمحصول ( فترة ما قبل الإزهار ) أفضل بشكل عام في معاملات الري الأكثر جفافا منه في معاملات الري الأكثر رطوبة، في حين كان العكس صحيحا في النمو خلال فترة ما بعد الإزهار. وتم الحصول على غلال اقتصادية أكثر عند ري المحصول بفاصل 21 يوما حتى الإزهار، وبفاصل 7 أيام بعد بداية الإزهار. ولم تتأثر نوعية الحبة بتكرار الريات.

# Effects of pH, Phosphate and Manganese on Spring-Sown *Vicia faba* L.

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## Abstract

**A field experiment was conducted at the Rothamsted Experimental Station, UK, in 1990 to test the effects on spring-sown faba bean of four levels of soil pH in combination with four amounts of soil phosphate, with and without foliar sprays of manganese. At pH 4.6 the crop failed with all but the largest amount of P. Yields were increased by increasing levels of pH to 7.7, the maximum tested, but did not increase with increasing amounts of soil extractable P above 12 mg/kg of soil. There was no response to manganese.**

## Introduction

A long-term experiment started at Rothamsted in 1962 showed, in three years 1962- 64, that yields of spring-sown *Vicia faba* (cvs Garton's 30B and Garton's Pedigree) increased with increasing pH to about pH 7 but not above this. The same experiment showed no overall yield benefit from an annual dressing of phosphate of 63 kg $P_2O_5$/ha although it did lessen the loss of yield from too great a pH (Moffatt 1967). The experiment has since been used for a series of tests on other crops (e.g., Bolton 1977). It was again used in 1990 for spring beans to check on a modern cultivar the original findings on the effects of pH, to take advantage of a modification to the experiment which allows a test of four levels of soil P and to examine the response to foliar sprays of manganese over a range of pH.

The response to manganese sprays is well established in the UK (Bould *et al.* 1983) and by analogy some farmers have also been applying them to faba bean. The symptoms of manganese deficiency on faba bean have been described (Wallace 1951) but no field experiments have been done in the UK on the effects of manganese treatments on this crop. If such effects occur they may be greater on soils with greater pH (Ministry of Agriculture, Fisheries and Food 1976).

## Materials and Methods

The experiment was done at Rothamsted on a silty clay loam soil using the cultivar 'Alfred' sown at 60 seeds/m² on 6 Mar 1990. The experiment was designed to test all combinations of (i) four levels of soil pH: 4.6, 5.6, 6.5, and 7.7 (1:2.5 in $H_2O$), established by differential applications of calcium carbonate in previous years, (ii) four levels of soil Phosphate: 9, 12, 27, and 34 mg/kg of soil, using the Olsen method (Olsen *et al.* 1954), also established by earlier differential applications of superphosphate, and (iii) two levels of manganese application, 0 and a spray at 0.19 kg Mn/ha at the four-leaf stage on 30 April followed by a spray at 0.10 kg Mn/ha just before flowering on 5 June. Both sprays were applied as chelated manganese (Mn-EDTA; 'Vytel') in 200 l of water. The treatments were arranged in two randomized blocks of 16 plots, for the combinations of four levels of pH with four levels of P, each plot was split for the test of 0 v Mn. Sub plots were 6x9 m separated by 1 m paths. Seed yields were taken from a central 2.3x9 m area on 15 August. Crop protection chemicals used were those common in good farming practice (McEwen and Yeoman 1989), excluding any that contained manganese.

## Results and Discussion

The year was unusually hot and dry, only 116 mm rain fell between sowing and maturity, 165 mm less than the average. Nevertheless the best yields (**Table 1**) were similar to the average of 3.3 t/ha given by the UK crop in recent years (Ministry of Agriculture, Fisheries and Food 1990).

The previous work showing much loss of yield at lower levels of pH was confirmed but with a more severe effect at the lowest level --only the combination with the highest level of P (34 mg P/kg soil) gave a measurable yield. Yield increased with each increase of pH up to 7.7, the maximum

Table 1. Effects of pH, P, and Mn on the seed yield (t/ha at 85% DM), seeds/pod, and 100-seed weight (g DM).

| Whole plot treatment | | Sub-plot treatment | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | | | Mn | | |
| pH | P (mg/kg) | Yield | Grains/ pod | 100-grain weight | Yield | Grains/ pod | 100-grain wieght |
| 4.6 | 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 27 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 34 | 0.6 | 4.9 | 36 | 0.3 | 2.9 | 39 |
| 5.6 | 9 | 1.7 | 2.0 | 38 | 1.6 | 1.8 | 39 |
| | 12 | 1.9 | 2.2 | 38 | 1.8 | 2.1 | 38 |
| | 27 | 2.0 | 1.8 | 41 | 1.9 | 1.7 | 42 |
| | 34 | 2.5 | 2.6 | 39 | 2.0 | 2.2 | 41 |
| 6.5 | 9 | 2.2 | 2.3 | 39 | 2.0 | 2.2 | 39 |
| | 12 | 2.8 | 3.0 | 38 | 2.6 | 2.9 | 36 |
| | 27 | 2.6 | 2.5 | 42 | 2.8 | 2.8 | 41 |
| | 34 | 2.8 | 2.7 | 42 | 2.8 | 2.9 | 41 |
| 7.7 | 9 | 2.6 | 2.4 | 42 | 2.4 | 2.3 | 42 |
| | 12 | 3.2 | 3.3 | 39 | 3.0 | 2.9 | 40 |
| | 27 | 3.3 | 3.1 | 40 | 3.1 | 2.9 | 43 |
| | 34 | 3.3 | 3.2 | 41 | 3.4 | 3.3 | 42 |
| SE± | | 0.24 | 0.25 | 0.8 | 0.24 | 0.25 | 0.8 |

1) Standard errors do not apply to combinations with pH 4.6.

tested. The highest level of P was beneficial at the two lowest levels of pH but there was no significant benefit above 12 mg P/kg soil at the two higher levels of pH. Manganese had no significant effect on yields at any level of the other factors. Leaf samples were taken from the most recently formed leaves of treatments other than the lowest pH just after full pod set to measure manganese contents. These were decreased by increasing pH from 5.6 to 7.7 (608 to 344 ppm Mn in the dry matter, mean of P and Mn levels) and by increasing P from 9 to 34 mg/kg of soil (875 to 621 ppm Mn, mean of pH and Mn levels) but were slightly increased by the manganese treatment (684 to 812 ppm Mn, mean of P and pH levels). These concentrations of Mn were all greatly in excess of those of about 20 ppm or less shown to lead to Mn deficiency symptoms in other species (Chapman 1966).

Only the lowest pH had a large effect on stem and pod numbers, mainly because many plants died before maturity. Yield benefits from increased pH and P came mainly from increases in numbers of grains/pod but with some increases in 100-grain weights particularly from increasing pH at the lowest rate of P (**Table 1**).

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## تأثيرات حموضة التربة والفوسفور والمنغنيز في الفول *Vicia faba L.* المزروع في الربيع

**الملخص :**

أجريت في عام 1990 تجربة حقلية، بمحطة تجارب روثامستد في المملكة المتحدة، لاختبار تأثر الفول الربيعي بأربعة مستويات من حموضة التربة مع تواليف من أربع كميات من فوسفور التربة بوجود وغياب رش المجموع الخضري بالمنغنيز. فعند درجة الحموضة 4.6 فشل المحصول في جميع المعاملات ما عدا المعاملة بأكبر كمية من الفوسفور. وقد ازدادت الغلة بزيادة مستويات درجة الحموضة إلى 7.7، وهي أعلى درجة مختبرة، لكنها لم تزدد مع زيادة كميات الفوسفور المستخلص من التربة إلى أعلى من 12 مغ/كغ تربة. ولم تظهر استجابة للمنغنيز.

## Chemical Composition of Faba Bean Plants at Early-Green and Green Seed Stages

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**Abstract**

**The biomass productivity as well as the chemical composition of different plant parts were studied in *Vicia faba* L. var *major* cv 'White Windsor' at the early-green and green seed stages of growth. It was concluded that the faba bean plant parts remaining after the harvest of green seeds can be used either as a fodder supplement or included in the mineral circulation of the agrosystem.**

## Introduction

Faba bean (*Vicia faba* L. var *major*) is grown as a vegetable crop mainly for green seed production in Poland (Labuda 1989). However, harvesting of green seeds is usually practiced when plants are still in development and new pods are forming. After harvest the remaining plant parts (i.e., leaves, stems, and immature pods) are left in the field unused. The present study was undertaken with the aim to highlight the importance of the different faba bean plant parts that remain after the harvest of green seed through the assessment of their biomass productivity and chemical composition.

## Materials and Methods

A field experiment with one *major* type of faba bean (cv 'White Windsor') was conducted at Lublin, Poland (51°14' N, 22°18' E, and altitude of 215 m), during the 1987 season. Soil of the site was brown loess having 9.0 kg/ha organic carbon, 19% clay, 118 nmol (+)/kg CEC, with 166, 403, and 70 mg of available P, K, and Mg per kg soil, respectively. The soil pH was 6.2. Seeds of the faba bean cv White Windsor were sown on 25 Apr 1987, at a soil depth of 5 cm, in rows 40 cm apart and 20 cm between seeds within rows. Harvesting of faba bean plants was performed at two dates, 17 and 27 Apr 1987, corresponding to the early-green and green seed stages of growth, respectively.

Plant parts were separated and each was analyzed for dry matter (at 105°C), crude protein (as 6.25 x Kjeldahl N), crude fiber (acidic-alkaline hydrolytic method), crude fat (as ethyl ether extract), crude ash (at 550°C), and nitrogen free extract (by balance).

The mineral composition was determined after mineralization of the plant material with sulfuric acid and by using hydrogen peroxide. Total N was determined by the Kjeldahl method; P was measured colorimetrically by the vanado-molybdic method; K by flame photometry; and Ca, Mg, Fe, Mn, Zn, and Cu by atomic absorption spectrophotometry.

## Results and discussion

The agronomical characteristics of the faba bean cv White Windsor are shown in **Table 1**. The harvest index (HI) in this study was half of that reported for faba bean harvested for mature seeds (Marcellos 1987). It is evident that about 80% of the plant biomass is left in the shoot when faba bean is harvested for green seeds only.

**Table 1** The agronomical traits of the faba bean cv White Windsor as recorded at the early-green seed stage and the green seed stage.

| Character | Early-green seed stage | Green seed stage |
|---|---|---|
| Plant hieght (cm) | 96.9 ± 09.0 | 101.5 ± 09.0 |
| Number of seeds/plant | 24.5 ± 06.0 | 24.0 ± 08.0 |
| Number of pods/plant | 07.5 ± 02.2 | 07.5 ± 01.8 |
| Number of stems/plant | 03.6 ± 00.7 | 03.0 ± 00.7 |
| Fresh weight of seeds/plant (g) | 68.9 ± 17.7 | 103.7 ± 33.8 |
| Fresh wieght of pods/plant (g) | 106.9 ± 32.8 | 137.3 ± 36.1 |
| Fresh weight of leaves/plant (g) | 89.0 ± 20.9 | 89.1 ± 24.6 |
| Fresh weight of stems/plant (g) | 137.4 ± 27.7 | 126.7 ± 18.4 |
| Dry weight of seeds/plant (g) | 11.7 ± 02.9 | 30.0 ± 10.1 |
| Dry wieght of pods/plant (g) | 13.7 ± 03.8 | 17.6 ± 04.7 |
| Dry weight of leaves/plant (g) | 13.2 ± 03.2 | 14.0 ± 05.6 |
| Dry weight of stems/plant (g) | 24.3 ± 04.7 | 22.8 ± 03.7 |
| Harvest index at fresh weight | 0.166 ± 0.020 | 0.223 ± 0.041 |
| Harvest index at dry weight | 0.185 ± 0.027 | 0.347 ± 0.069 |

**Table 2** The chemical composition of different faba bean plant parts at the early-green and green seed stages of growth.

| Plant part | Dry weight[1] | Crude protein[2] | Crude fiber[2] | Crude fat[2] | N-free extract[2] | Crude ash[2] |
|---|---|---|---|---|---|---|
| Early green seed stage | | | | | | |
| Seed | 169 | 370 | 136 | 18 | 424 | 52 |
| Pod | 128 | 208 | 176 | 8 | 537 | 71 |
| Leaf | 148 | 252 | 143 | 47 | 419 | 139 |
| Stem | 177 | 60 | 393 | 9 | 461 | 77 |
| Green seed stage | | | | | | |
| Seed | 289 | 313 | 146 | 22 | 474 | 45 |
| Pod | 128 | 142 | 255 | 13 | 521 | 69 |
| Leaf | 157 | 214 | 162 | 56 | 443 | 125 |
| Stem | 180 | 58 | 400 | 10 | 467 | 65 |

1 = g/kg fresh weight; 2 = g/kg dry weight.

The chemical composition of the different plant parts (i.e., seeds, pods, leaves, and stems) is presented in Tables 2 and 3. The chemical analysis of the remaining plant parts indicated that these parts can be used as fodder supplement (**Table 2**). In addition, the mineral composition suggests

high manurial value of these plant parts (Table 3) and they can be used to improve soil fertility. As about 80% of the nitrogen found in faba bean plants originates from the atmosphere (Huber *et al.* 1987), it would be advisable to use the remaining plant parts as a green manure, unless otherwise used as fodder.

The importance of the remaining plant parts after harvesting the green seeds was further verified by calculating the amounts of macro- and micro- elements accumulated and comparing it with that of seeds (Table 4). The results obtained from this study are similar to those reported by Redshaw and Gaudiel (1982).

**Table 3** The content of macro- and micro-elements in different faba bean plant parts at the early-green and green seed stage.

| Plant part | Macro-element (g/kg DW) | | | | | Micro-element (mg/kg DW) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | P | K | Ca | Mg | Fe | Mn | Zn | Cu |
| Early-green seed stage | | | | | | | | | |
| Seed | 54.32 | 5.59 | 19.75 | 3.28 | 1.95 | 212 | 23 | 85 | 12 |
| Pod | 30.95 | 2.89 | 43.39 | 5.65 | 2.82 | 220 | 43 | 57 | 11 |
| Leaf | 39.52 | 2.11 | 30.02 | 23.54 | 4.17 | 803 | 117 | 94 | 12 |
| Stem | 8.48 | 1.50 | 35.18 | 10.70 | 1.07 | 198 | 39 | 43 | 9 |
| Green seed stage | | | | | | | | | |
| Seed | 48.23 | 5.16 | 15.49 | 3.27 | 1.68 | 223 | 18 | 70 | 6 |
| Pod | 20.90 | 1.99 | 31.10 | 4.76 | 2.43 | 167 | 22 | 33 | 11 |
| Leaf | 32.61 | 1.77 | 28.92 | 20.42 | 3.57 | 766 | 98 | 83 | 10 |
| Stem | 6.16 | 0.68 | 21.23 | 8.14 | 0.91 | 316 | 25 | 29 | 8 |

**Table 4** The amount of macro- and micro-elements calculated on plant basis in different faba bean plant parts at the early-green and green seed stage.

| Plant part | Macro-element (g/plant) | | | | | Micro-element (mg/plant) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | P | K | Ca | Mg | Fe | Mn | Zn | Cu |
| Early-green seed stage | | | | | | | | | |
| Seed | 0.635 | 0.065 | 0.231 | 0.038 | 0.023 | 2.480 | 0.269 | 0.994 | 0.140 |
| Pod | 0.424 | 0.035 | 0.594 | 0.077 | 0.039 | 3.014 | 0.589 | 0.781 | 0.150 |
| Leaf | 0.522 | 0.028 | 0.396 | 0.311 | 0.055 | 10.599 | 1.544 | 1.241 | 0.158 |
| Stem | 0.206 | 0.037 | 0.855 | 0.259 | 0.026 | 4.811 | 0.947 | 1.045 | 0.219 |
| Green seed stage | | | | | | | | | |
| Seed | 1.446 | 0.155 | 0.465 | 0.098 | 0.050 | 6.690 | 0.540 | 2.100 | 0.180 |
| Pod | 0.367 | 0.035 | 0.547 | 0.084 | 0.043 | 2.939 | 0.387 | 0.580 | 0.194 |
| Leaf | 0.456 | 0.025 | 0.405 | 0.338 | 0.049 | 10.724 | 1.372 | 1.162 | 0.140 |
| Stem | 0.140 | 0.015 | 0.484 | 0.186 | 0.021 | 7.205 | 0.570 | 0.661 | 0.182 |

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## التركيب الكيميائي لنباتات الفول في طوري الحبة الخضراء وبداية اخضرار الحبة

**الملخص**

تمت دراسة إنتاجية الكتلة الحيوية والتركيب الكيميائي لمختلف أجزاء نباتات الفول *Vicia faba L.* var *major* من الصنف "White Windsor" في طوري الحبة الخضراء وبداية اخضرار الحبة. وقد تم التوصل إلى أن أجزاء نباتات الفول المتبقية بعد حصاد الحبات الخضراء يمكن استخدامها إما كعلف تكميلي، أو إدخالها في الدورة المعدنية للنظام الزراعي.

# Pests and Diseases الآفات والأمراض

## Investigation on the Effect of Nabu (Sethoxydim) Herbicide on Growth of Faba Bean (*Vicia faba* L.) and Weeds

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### Abstract

**A field experiment was conducted during 1987 and 1988 to evaluate the effect of postemergence application of Nabu (Sethoxydim) herbicide {2[1-(ethoxyimino)butyl]-5-[2-(ethyl-thio)propyl]-3-hydroxy-2-cyclohexen- 1-one} at four rates (25, 50, 75, and 100 m/l spray solution) on the growth of crop and weeds in faba bean field. The monocotyledons weeds were effectively controlled even at the lowest concentration (25 ml/l), whereas only the highest concentration (100 ml/l) proved slightly effective in checking the growth of dicotyledon weeds. There was no inhibitory effect of the herbicide on faba bean.**

### Introduction

Weeds are considered a major constraint to the productivity of faba bean in Libya. Little work has been done on the chemical weed control under Libyan conditions. El Sharkawy and Sgaier (1976) reported that application of Treflan at the rate of 0.5 kg/ha decreased weed population by 40% and increased faba bean yield by about 30%. Most studies in other countries have shown Treflan, Imazaquin, 2,4-DB, Bentazon, Acifluorfen, and Chlorobromuron and related herbicides, used singly or mixed with Sethoxydim, to be effective in controlling grass and broadleaf weeds in faba bean and soybean fields (Bhan *et al.* 1972; Burnside 1972; Paxman *et al.* 1985; Renner *et al.* 1988; Buhler and Werling 1989; Defelice *et al.* 1989).

Sethoxydim{(2[1-(ethoxyimino)butyl]-5-[2-(ethyl-thio)propyl]-3-hydroxy-2-cyclohexen- 1-one} is a new selective post-emergence trans-located herbicide which can control grassy weeds at various stages of growth in a broad-leaf crop field.

This study was initiated to investigate the effectiveness of various rates of application of sethoxydim on weeds and faba bean under Libyan conditions.

### Materials and Methods

Field experiments were conducted at Al-Fateh University Farm, Tripoli in the 1987 and 1988 seasons using a randomized complete block design with four replications and four herbicidal treatments. The plot size was 9 $m^2$ (3X3 m). Sethoxydium was sprayed at 0, 25, 50, 75, and 100 ml/l of spray solution in the faba bean field when the crop was one month old.

Faba bean was sown in the middle of December in both years. Spacing between rows and hills was 30 cm. Two seeds were sown in each hill. Phosphorous fertilizer was applied preplanting at the rate of 100 kg/ha in the form of single superphosphate (20% $P_2O_5$). In addition to rainfall received during the growing seasons, supplementary sprinkler irrigation was carried out when needed. Data were collected on various growth parameters of faba bean and on weed counts before and 10 days after the application of herbicides.

### Results and Discussion

Crop growth was improved by application of the herbicide at all rates tested, but dry weight increase was only conspicuous when the rate of application was 50 ml/l or more (**Table 1**).

Sethoxydim effectively inhibited the monocotyledons weeds, which were killed completely after 10 days of treatment (**Table 1**). Low concentration (25 ml/l) was less effective. Dicotyledons weeds were not affected by the herbicide treatments.

Table 1 The effect of Nabu (Sethoxydim) herbicide on weeds and growth of faba bean plants.

| Concentration | Faba bean | | | | | | | | Weeds | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Plant height (cm) | | No of leaves | | No of nodules | | Shoot dry weight (g) | | Monocots (No) | | Dicots (No) | |
| | A[1] | B[2] | A | B | A | B | A | B | A | B | A | B |
| Control (0) | 41.0 | 49.2 | 32.5 | 32.5 | 120.8 | 121.8 | 3.5 | 3.8 | 135.2 | 136.8 | 40.6 | 40.6 |
| 25 ml/l | 45.6 | 50.1 | 25.2 | 30.4 | 125.6 | 125.8 | 3.6 | 4.0 | 128.2 | 6.6 | 35.4 | 34.8 |
| 50 ml/l | 48.6 | 51.8 | 29.4 | 35.3 | 118.3 | 119.6 | 3.8 | 4.5 | 139.4 | 0.0 | 30.2 | 30.0 |
| 75 ml/l | 48.2 | 52.6 | 38.6 | 46.0 | 120.4 | 123.2 | 4.6 | 5.6 | 120.6 | 0.0 | 42.6 | 40.6 |
| 100 ml/l | 50.4 | 57.4 | 40.8 | 49.6 | 119.8 | 121.8 | 4.8 | 5.8 | 160.8 | 0.0 | 46.2 | 40.2 |

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## دراسة على تأثير المبيد العشبي نابو (Sethoxydim) في نمو الفول والأعشاب

الملخص :

أجريت خلال عامي 1987 و 1988 تجربة حقلية لدراسة الرش بعد الإنبات بالمبيد العشبي نابو (Sethoxydim) (2 [ 1- (ethoxyimino ) bytyl] - 5 - [ 2- (ethyl - thio)†propyl] - 3 - hydroxy - 2 - cyclohexen - 1- one) باستعمال أربع جرعات ( 25، 50، 75، 100 مل/ل محلول رش )، وتأثير ذلك في نمو المحصول والأعشاب ضمن حقل مزروع بالفول. وتمت مكافحة الأعشاب الوحيدة الفلقة بشكل فعال حتى عند أدنى التراكيز (25 مل/ل )، في حين أثبّت التركيز الأعلى ( 100 مل/ل ) أنه فعال قليلا في وقف نمو الأعشاب الثنائية الفلقة. ولم يظهر للمبيد العشبي تأثير كابح لنمو الفول.

# Seed Quality and Nutrition جودة البذور والتغذية

## Body and Tissue Growth in Mice Fed on a Zinc Supplemented Faba Bean Diet

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### Abstract

**An impairment in growth rate has been observed in faba bean fed mice, which was accompanied by changes in tissue growth. Some of the adverse effects found in muscle were partially improved after zinc supplementation, suggesting that phytate and other chelating agents may be involved in the antinutritional outcome of diets containing *Vicia faba* as source of protein.**

### Introduction

Faba beans are commonly included in human and animal diets as sources of protein, particularly in the Mediterranean area (Cubero and Moreno 1983; Teixeira 1986). In addition to protein, the legumes contain starch, and lipids, as well as some minerals and vitamins (Askar 1986), which also account for the nutitional value of this seeds.

However, feeding animals with diets containing faba beans brings about some undesirable physiological and biochemical alterations, which have been attributed to the deficiency in sulphur aminoacids and to the occurrence of a number of antinutritional factors such as hemagglutinins, polyphenols, saponins, etc. (Eggum 1986; Gupta 1987). In this context, fiber, phytates and other organic compounds can reduce mineral availability in diets with legumes as source of protein, affecting nutritional status (Harland 1989; Lonnerdal *et al.* 1989). Thus, it has been reported that intestinal absorption of zinc was reduced in legume fed animals, which could have serious nutritional implications with changes in several enzyme systems, immunocompetence; and metabolism (Giugliano and Millward 1987; Sutte and Jones 1989).

The purpose of this experiment was to evaluate, in a zinc sensitive model, the influence of diets containing *Vicia faba* as source of protein on animal growth and tissue nucleic acid content along with the study of the possible involvement of zinc bioavailability in cell growth patterns.

### Materials and Methods

Male Swiss 4-weeks old mice, weighing initially about 20±22 g, were randomly assigned to three dietary groups with 8 animals/group. The animals were housed in a temperature-regulated room at 22±1°C and fed *ad libitum* during 28 days on diets containing casein (C), *Vicia faba* (Vf) or *Vicia faba* supplemented with zinc (Vf+Zn) as sources of protein, whose zinc contents were 30, 30, and 60 ppm, respectively (**Table 1**). The animals were killed by decapitation and liver and gastrocnemius muscle were removed and stored at -20°C before analysis.

Muscle and liver protein contents were determinated according to the method of Lowry *et al.* (1951), and the analyses of DNA and RNA by the technique of Munro and Fleck (1966) as described by Eisemann *et al.* (1989). Zinc contents were determinated by atomic absorption spectroscopy subsequent to wet washing in nitric acid. Absorption values were measured in triplicate at 214nm and compared to a zinc standard (75 ug/dl)(Smith *et al.* 1979).

All data are expressed as mean ±SEM. Data were evaluated statistically by analysis of variance with probability values determined by Duncan's test (Tallarida and Marray 1986). In all instances, $p<0.05$ was considered significant.

### Results and Discussion

An impairment in growth performance have been repeatedly observed in either farm or laboratory animals fed on diets containing legumes as the main source of protein (Larralde 1982; Martinez and Larralde 1984; Pontif et al.

1987). Therefore, different approaches have been taken into consideration in order to improve the nutritional utilization of these pulses such as physico-chemical removal of antinutritional factors, genetic selection of seeds, technological treatments, amino acid supplementation, etc., with variable results (Kabbara *et al.* 1987; Singh 1988).

**Table 1** Diet composition (%).

| | Casein diet (C) | *Vicia faba* diets (Vf and Vf+Zn) |
|---|---|---|
| Casein[1] | 20.8 | |
| Vicia faba | | 70.0 |
| Saccharose | 31.2 | 10.0 |
| Starch | 31.2 | 10.0 |
| Olive oil | 5.0 | 5.0 |
| Cellulose | 6.0 | |
| Mineral mix[2,3] | 4.5 | 4.0 |
| Vitamin mix[4] | 1.0 | 1.0 |
| Diet crude protein (N x 6,25) | 19.3 | 19.3 |
| Energy (kcal/100g) | 372 | 363 |

[1]Methionine 1% was added to casein diet.
[2]Harper mixture containing the following percentages of salts: NaCl 13.93, KI 0.08, $K_2HPO_4$ 38.91, $MgSO_4.7H_2O$ 5.73, $CaCO_3$ 38.14, $FeSO_4.7H_2O$ 2.70, $MnSO_4.H_2O$ 0.40, $CuSO_4.5H_2O$ 0.05, $CoCl_2.6H_2O$ 0.002.
[3]Supplemented with 12.4, 7.7, and 20.9 mg $ZnSO_4.7H_2O$/100 g diet to obtain diets with 30 (C), 30 (Vf) and 60 (Vf+Zn), respectively.
[4]Harper mixture containing the following vitamins per gram: vitamin A 2,000 IU, vitamin D 375 IU, vitamin E 3.0 mg, vitamin K 1.5 mg, Choline chloride 330.0 mg, p-aminobenzoic acid 145.0 mg, inositol 32.5 mg, niacin 15.0 mg, calcium pantothenate 5.7 mg, riboflavin 1.5 mg, cyanocobalamin 6.0 mg, biotin 63.0 mg, excipient sufficient quantity for 1 g.

This experiment was conducted in mice fed on diets with *Vicia faba* as source of protein, at two different levels of zinc in order to evaluate the possible role of a reduced bioavailability of this mineral because of faba bean as a source of protein. Mice were chosen because they are particularly suitable to measure dietary zinc utilization through growth rates (Record *et al.* 1987), and their tissue content of this mineral is a good indicator of cell bioavailability (Cousins 1986). Zinc levels in muscle were similar in all dietary groups (**Table 3**), whereas they remained low in the liver of the faba bean fed animals even after zinc addition (**Table 2**).

Postnatal development of muscle and liver follows different patterns (Martinez *et al.* 1986; Waterlow *et al.* 1978). Thus, liver growth is mainly associated to changes in cell number (hyperplasia), while muscle growth is mostly due to an increase in fiber size (hypertrophy). Our results show that both tissues are depleted under the dietary intake of *Vicia faba* (Barcina *et al.* 1986; Santidrian *et al.* 1989); however, liver zinc levels are low in those animals fed on the legume diet with no changes attributable to zinc supplementation, whereas values of muscle zinc remained unaltered, which could explain, at least in part, some of the differences found in the response of both tissues.

Legume fed animals had a reduced growth rate as compared with controls (**Fig. 1**), which was only slightly improved after zinc supplementation. Gastrocnemius muscle and liver weights showed a similar trend, although the liver was more affected, suggesting that the stunting in growth affect both tissues, which has been previously reported in rats fed on a faba bean diet (Barcina *et al.* 1986). On the

**Table 2** Liver weight, protein, DNA, RNA, and zinc content in mice fed for 28 days on the experimental diets[1].

| | Casein diet | *V.faba* diet | *V.faba* +Zn diet |
|---|---|---|---|
| Weight (g) | 2.19 ± 0.09a | 1.41 ± 0.06b | 1.54 ± 0.09b |
| Relative weight (%BW) | 6.20 ± 0.25a | 5.06 ± 0.15b | 5.22 ± 0.16b |
| Protein (mg/g liver) | 145.00 ± 5.10a | 152.60 ± 8.60a | 155.90 ± 4.60a |
| Total Protein (mg/liver) | 317.20 ± 17.80a | 209.50 ± 8.20b | 239.50 ± 14.50b |
| Total DNA (mg/liver) | 7.43 ± 0.52a | 5.90 ± 0.54b | 6.98 ± 0.59ab |
| Total RNA (mg/liver) | 14.01 ± 0.70a | 8.02 ± 0.77b | 8.31 ± 0.82b |
| Protein/DNA (mg/mg) | 43.06 ± 1.62a | 35.58 ± 2.89b | 34.94 ± 1.43b |
| Zinc (ppm) | 26.60 ± 1.30a | 19.50 ± 0.40b | 18.50 ± 0.3b |

[1]Values with the same letter are not significantly different ($p<0.05$) among dietary treatments.

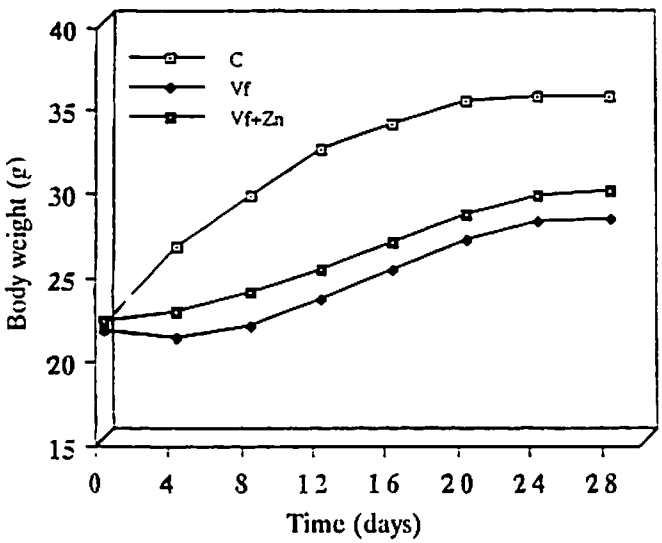


Fig. 1. Growth curves of mice fed on different diets: casein (C), *Vicia faba* (Vf), and *V. faba* supplemented with zinc (Vf + Zn) as sources of protein.

other hand, zinc supplementation also lead to positive results in the gastrocnemius muscle of mice. Protein content was increased in both tissues on a relative basis (**Tables 2 and 3**). Total RNA and DNA contents were reduced in muscle and liver as a consequence of the impairment on growth, although adverse effects were partially overcome by zinc supplementation in both tissues. However, it is noteworthy that zinc supplementation increased muscle cell size, as assessed by the protein:DNA ratio (**Table 3**), whereas no changes were found in liver (**Table 2**), pointing out that both tissues follow again different patterns under the dietary treatment.

In a previous experiment, where rats were fed on zinc supplemented diets containing Vicia faba as source of protein, a remarkable improvement in growth rate and organ weights were observed (Martinez et al. 1985). This differential behavior could be explained partly because a much higher zinc fortification was supplied, and partly because of difference in the age, period of feeding, and animal specie.

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Table 3 Muscle weight[1], protein, DNA, RNA, and zinc content in mice fed for 28 days on the experimental diets[2].

| | Casein diet | *V.faba* diet | *V.faba* + Zn diet |
|---|---|---|---|
| Weight (g) | 0.33 ± 0.02a | 0.21 ± 0.01b | 0.25 ± 0.02c |
| Relative weight (%BW) | 0.85 ± 0.02a | 0.72 ± 0.03b | 0.80 ± 0.03a |
| Protein (mg/g muscles) | 175.80 ± 5.70a | 180.80 ± 3.80a | 183.60 ± 5.50a |
| Total Protein (mg/muscles) | 58.60 ± 1.30a | 37.70 ± 2.60b | 46.40 ± 3.10c |
| Total DNA (mg/muscles) | 0.44 ± 0.03a | 0.32 ± 0.02b | 0.36 ± 0.02b |
| Total RNA (mg/muscles) | 0.39 ± 0.02a | 0.29 ± 0.02b | 0.34 ± 0.01c |
| Protein/DNA (mg/mg) | 137.50 ± 7.50a | 117.00 ± 5.50b | 124.40 ± 6.70ab |
| Zinc (ppm) | 9.60 ± 0.50a | 11.00 ± 0.50a | 10.70 ± 0.30a |

1= Both gastrocnemius muscles.
2= Values followed by the same letter(s) are not significantly different ($P<0.05$) among dietary treatments.

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## نمو جسم ونُسُج الفئران المتغذية على وجبة من الفول أضيف إليها الزنك

**الملخص :**

لوحظ ضعف في معدل نمو الفئران المتغذية على الفول، مترافق مع تغييرات في نمو أنسجتها. وقد وجدت بعض التأثيرات العكسية في العضلات التي تحسنت جزئيا بعد إضافة الزنك، مما يوحي بأن الفيتاز أو أز النبات وعوامل الاستخلاب ( مركبات عضوية تشكل ذراتها أكثر من رابطة إحدائية واحدة مع الفلزات في المحلول ) الأخرى قد تكون مسؤولة عن حاصل التضاد الغذائي للوجبات الحاوية على الفول كمصدر للبروتين فيها.

# Variation in Testa Fraction with Some Other Seed Quality Attributes of Faba Bean Grown in the New Production Areas in The Sudan

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## Abstract

**Analysis of 10 breeding lines of faba bean, grown at four locations in the new areas of the Sudan during the 1986/87 season, revealed significant differences in 100-seed weight, hard-seed, and tannic acid content due to lines and locations. The breeding lines were inconsistent in their performance according to the measured characters from location to another. The testa fraction showed a significant positive correlation with hard-seed percent (r = 0.63), and positive but not significant correlation with protein content (r = 0.54).**

## Introduction

Recent experimentation clearly demonstrated that faba bean (*Vicia faba* L.) can produce reasonable and economic yields in Shambat and the new areas (south of Khartoum), in the Sudan. Grain yields of more than 2/ha were obtained in farmers fields.

However, the cooking quality of the seed in some cases was comparatively inferior to that produced in the traditional areas and that created some marketing difficulties. The consumer criticized the faba bean seed of the new areas because of its high percentage of hard seed, which reaches up to 25%. Moreover, the seed coat (testa) is leathery and does not become tender with increased cooking time. McEwen *et al.* (1974) reported possible variation in seed coat thickness in faba bean.

The main faba bean cultivars grown in The Sudan are small seeded types and weigh of about 40-45 g, but the local consumer prefers eating the large seeded types, which have a high testa fraction and this is considered as undesirable character. Therefore, a breeding program involving selection and hybridization to combine such characters as large seed with light testa color and less hard seed percentage into high yielding genotypes has started, and promising results are expected.

This work was initiated with the aim to study the association of the available variation in the testa fraction, hard seed percentage, protein content, tannic acid percent, and 100-seed weight in 10-genotypes of faba bean planted at four locations in the new production areas of faba bean (south of Khartoum).

## Materials and Methods

The 10 breeding lines under study were in an advanced yield trail and grown during the 1986/87 season in Shambat, Wad Medani, El Rahad, and New Halfa in a randomized complete blocks design. Seed samples of the 10 genotypes, from each location, were evaluated for 100-seed weight, percentage of non-soaker seeds, and testa fraction percent. For each genotype a sample of 100 g replicated four times were selected at random and soaked in tap water for nearly 40h. After which, the hard seeds (non-soakers) were separated, left to dry at the lab temperature for 2 weeks, weighed, and recorded as percentage. After the separation of the non-soaker seeds of each replicate of each breeding line, the testa were peeled off from the cotyledons of each soaker seed, oven-dried at 80°C, and weighed.

A seed sample from each breeding line of each location was ground and analyzed for protein content using the Kjeldahl method and tannic acid content.

## Results and Discussion

### *Testa Fraction*

Significant differences in testa fractions were found among the genotypes in Shambat, Wad Medani, El Tahad, and in the combined analysis of the four locations (**Table 1**). The over all mean of the testa fraction of the 10 breeding lines at the four locations ranged from 14.4% in line 00198 to 16.6% in Hudeiba 72. Among the locations Wad Medani and New Halfa had the highest percentages of testa fractions (17.8% and 17.5%, respectively). Shambat had the lowest testa fraction 12.1% and El Rahad was 14.2%. All the genotypes in Wad Medani and New Halfa had higher testa fractions than those at Shambat and El Rahad. These values are similar to those reported by Marcellos (1987).

### *100-Seed weight*

Differences among the genotypes at all the locations and in the combined analysis of the four locations, as well as between locations, were highly significant (**Table 1**). Shambat had the highest seed weights, followed by New Halfa and El Rahad, whereas Wad Medani had the lowest seed weights. The overall mean of the breeding lines at the four locations showed that 100-seed weight ranged between 39.6 g for line 317/99/81 and 43.5 g for line 0094.

*Hard seed percent*

The 10 genotypes varied considerably with respect to hard seed percent. The overall mean of the four locations showed that the hard seed percent ranged from 5.1 to 11.6 in lines 00198 and 557/80, respectively (Table 1).

The overall means of the 10 breeding lines in the four locations showed that hard seed percent ranged from 4.7 at New Halfa to 15.1 at Shambat. The 10 breeding lines were inconsistent in their hard seed percent from location to location. All the tested breeding lines at Shambat had the highest hard seed percentage.

Incidence of hard seeds has been related with low air humidity and fluctuations in air temperatures during the development of seeds (Quinlivan 1968, 1970; Baciu - Miclaus 1970).

*Protein content*

Significant differences in protein content of the tested genotypes were observed in Shambat, New Halfa, and in the combined analysis of the four locations, but not in Wad Medani and El Rahad (Table 1). Differences between locations in protein content were highly significant. Both El Rahad and Shambat had the highest protein content of 28.49% and 28.26%, respectively, followed by New Halfa (27.21%), and then Wad Medani (25.79%). The overall means of the 10 breeding lines in the four locations showed that the protein percentage ranged from 26.10 to 28.71% in lines 317/99/81 and 00281, respectively.

*Tannic acid content*

Differences among the tested lines at each of the four locations and in the combined analysis of the four locations in tannic acid content were highly significant (Table 1). The highest tannic acid content was in seeds of Wad Medani, followed by El Rahad, Shambat, and then New Halfa. From the overall mean of the four locations it was noticed that tannic acid content ranged between 0.038% for Mass Selection Giza 1 to 0.061% for the line 00198. About six lines had tannic acids of more than 0.056%.

Testa fraction of the 10 breeding lines was significantly correlated with hard seed percentage (r = 0.63) (Table 2). Also it was positively but nonsignificantly correlated with protein content (r = 0.54). Rowland and Fowler (1977) reported that seed thickness was negatively correlated with seed-protein content (r = -0.60). The association of testa fraction with 100-seed weight was negative and nonsignificant (r = -0.27). Rowland (1977) and Rowland and Fowler (1977) showed positive but nonsignificant correlation when differences among seeds within cultivar were considered. However, Marcellos (1987) reported that the testa fraction increased as seed weight decreased with 30 faba bean cultivars of diverse origin.

100-seed weight was positively but nonsignificantly related to tannic content (r = 0.56), protein content (r = 0.08), and hard seed percent (r = 0.004). Seed tannic acid content was negatively and nonsignificantly correlated with seed protein content (r = -0.16) and testa fraction (r = -0.60). Hard seed percent was positively associated with protein content (r = 0.23) and tannic acid content (r = 0.17).

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## تباين في القَصْرَة ( الغلاف البذري ) مع بعض الصفات النوعية الأخرى للحبة في الفول المزروع بمناطق الاستزراع الجديدة في السودان

**الملخص :**

خلال الموسم 87/1986 كشفت التحاليل على 10 سلالات تربية من الفول زرعت في أربع مناطق استزراع جديدة في السودان عن وجود فروق معنوية بين السلالات والمواقع في : وزن المائة حبة، وصلادة البذور، والمحتوى من حمض العفص. وكانت سلالات التربية غير متشابهة في كفاءتها من حيث الخصائص المدروسة بين موقع وآخر. وظهر للقصرة ارتباط معنوي موجب بالنسبة المئوية للحبوب الصلدة (معامل الارتباط، ر = 0.63)، وارتباط موجب أيضا لكنه غير معنوي بالمحتوى البروتيني ( ر = 0.53 ).

# 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, g, 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**
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*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. *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, ICARDA, P.O. Box 5466, Aleppo, Syria.

# NEWS

# اخبار

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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, and Wheat 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 and durum wheat 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.

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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.

**Introduction to Food Legume Physiology**
This comprehensive 105-page technical manual is designed for food legume scientists and their support staff. It covers several areas of food legume physiology in a practical way, with examples whenever possible. The book contains four chapters covering the following: plant structure and physiological functions; mineral nutrition; photoperiodism, vernalization, crop

canopy and radiation, and growth analysis; and physiology and crop improvement. For your copy, write Training Coordination Unit.

**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 Coordination Unit.

**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 CODI.

**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.

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

**TO OBTAIN PUBLICATIONS:**
Address requests for publications to the specific department or service cited above, at: ICARDA, P.O. Box 5466, Aleppo, Syria.

**Reprints**

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

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

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Mailing List

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

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

# Forthcoming Events أحداث مُرتقبة

1991

**December**

Fourth Arab Conference for Plant Protection Science Cairo, Egypt, Dec.
Contact: Dr. Zeidan Hendi Abdul Hamid, Department of Plant Protection, Faculty of Agriculture, Ain Shams University, Shebra Al Kheima, Egypt.

1992

**June**

1st European Conference on Grain Legumes
Angers, France, 1-3 June
Contact: Secretariat, First European Conference on Grain Legumes, UNIP, 12, Avenue George V, 75008 Paris, France.

The conference will cover the following legume species: field pea, faba bean, white lupin, chickpea, and lentil. Oral presentations and posters will be grouped into the following nine areas of interest: Genetic resources and breeding, molecular biology and biotechnology, plant physiology, agronomy, pathology, seed composition, use for animal feed, use for human feed, and economics.

## ANNOUNCEMENT

## FABA BEAN DATABASE IN LIBRARY

CODIS of ICARDA acquired and installed the Faba Bean Database in a series created in the Library's Personal Computer.

This database, extracted from the AGRIS 1975-1990 database, enhanced by regular updates from AGRIS as well as addition of data related to documents not cited in AGRIS, gives a wealth of information and reflects the work of agricultural scientists on faba bean around the world. It contains about 5000 references published worldwide. The records of the faba bean database are categorized in the following main groups: (1) agriculture in general, (2) geography and history, (3) agricultural economics, (4) plant science and production, (5) plant protection, (6) post harvest technology, (7) agricultural machinery and engineering, (8) natural resources and environment, (9)processing of agricultural products, (10) human nutrition, and (11) methodology.

**This database is available for scientists working on faba bean to carry out literature searches, to provide them with a printout of bibliographic records for document selection, and to supply them with the documents.**

## Second International Food Legume Research Conference
## 12 - 16 April 1992, Cairo, Egypt

The First International Food Legume Research Conference (IFLRC-I) on pea (*Pisum sativum*), lentil (*Lens culinaris*), faba bean (*Vicia faba*), and chickpea (*Cicer arietinum*) was held at Spokane, Washington, U.S.A. in 1986. It was a resounding success with over 500 registrants from 50 countries. The program consisted of 91 papers coauthored by 202 contributors from 40 countries. The Conference Proceedings were published as: Summerfield, R.J. (ed.). World Crops: Cool Season Food Legumes, 1988. Kluwer Academic Publishers, Dordrecht, The Netherlands.

The success of IFLRC-I has promoted development of the Second International Food Legumes Research Conference (IFLRC-II), which will be held 12 -16 April 1992 in Cairo, Egypt. Recent success in development of low neurotoxin lines of grass pea (*Lathyrus sativus*) has resulted in the addition of this promising cool season food legume to the list of species covered.

The objectives of IFLRC-II are to 1) review and assess recent results from national and international research programs on cool season food legumes and 2) develop strategies for increasing production per unit area and increasing use of these cool season food legumes in various cropping systems. Both basic and applied research will be addressed and multidisciplinary research efforts will be emphasized.

For further information please contact:

Dr. A.E. Slinkard
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Canada

## Editors' Note

FABIS Newsletter has published many articles which use data from variety trial grown at only one location and in one year. The data are usually analyzed for genetic and phenotypic variation, heritability, genetic advance and correlations between characters. We, the Editors, feel that there is little merit in adding to the literature more articles of this type. To this end we will only consider publishing articles which discuss the results of a variety trial sown in a single environment under exceptional circumstances (i.e. when the number of entries or genetic diversity is particularly high or when an unusual trait is discussed).

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ICARDA is building up its decument 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:

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# تعليمات النشر باللغة العربية

## سياسة النشر :

تهدف هذه النشرة العلمية إلى نشر نتائج البحوث الجديدة بالسرعة الممكنة . والغاية من هذه التعليمات مساعدة الباحثين على صياغة بحوثهم بالشكل الذي يسهل تبادل المعلومات فيما بينهم على اختلاف أمصارهم ومشاربهم العلمية . وهذه المطبوعة تُعنى بنشر الأوراق العلمية والبحوث المختصرة والمقالات المكتوبة بلغة واضحة وأسلوب علمي، والمطبوعة أيضاً بمسافات مزدوجة بين السطور على ورق أطواله 21 x 28 سم على وجه واحد فقط . ترسل نسخة أصلية عن البحث، وتُعنوَن جميع المراسلات إلى عنوان النشرة . ويشترط في المادة المرسلة للنشر ألا تقدم إلى أي جهة أخرى . ولا تعبِّر نتائج البحوث المنشورة إلا عن وجهة نظر أصحابها . كما أن استعمال أسماء تجارية لا يعني بالضرورة أن ايكاردا تحبذ استعمال أي من هذه المنتجات مقارنة بمثيلاتها التجارية .

## منهج الكتابة :

تكتب وترتب البحوث بالشكل التالي : 1) عنوان مناسب لا يزيد على 70 حرفا، يليه اسم وعنوان الباحث/ الباحثين . 2) ملخص بالعربية يتألف من فقرة واحدة لا تزيد على 200 كلمة توجز العمل والنتائج المتوصل اليها بأقصر وأوضح طريقة ممكنة . 3) مقدمة تبرز أهمية موضوع البحث، وتستعرض بشكل نقدي الأعمال والبحوث السابقة المتعلقة بالموضوع المدروس . 4) المواد والطرق وتشمل المعلومات الخاصة بموقع تنفيذ التجربة، والمواد والطرق المستعملة، مع تحديد تصميم التجربة المتبع . 5) النتائج والمناقشة، وتظهر المعلومات والبيانات التي حصل عليها الباحث، ومدى أهميتها . 6) التوصيات إن وجدت وتُكتب بفقرات محددة ومُرقمة . 7) كلمة الشكر عند اللزوم . 8) ملخص بالإنكليزية مترجم عن العربية بأسلوب علمي ينسجم وروح اللغة الإنكليزية . 9) المراجع ويتم العزو إليها في النص بكتابة كنية المؤلف وعام النشر بين قوسين. وإذا كان للمرجع أكثر من ثلاثة مؤلفين تكتب كنية الأول وتضاف إليها كلمة "وآخرون" إذا كان المرجع بالعربية أو *et al.* إذا كان المرجع بالأجنبية . أما عن ترتيب المراجع في نهاية المطبوعة فيتم هجائيا وبصورة مستقلة، ولكل من المراجع العربية والأجنبية . تستثنى المقالات من الترتيب السابق : مقدمة ومواد وطرق ... إنما يكتفى بوضع ملخص لها بالعربية وآخر بالإنكليزية، يضاف إلى ذلك ضرورة تقسيمها إلى فقرات تحمل كل منها عنوانا مناسبا. وينصح هنا بالرجوع إلى آخر أعداد هذه النشرة للتعرف إلى طريقة إعداد المخطوطة، وترتيب المراجع .

## الجداول والأشكال والصور :

تفضل الجداول الصغيرة على الكبيرة، والبسيطة على المعقدة . ويجب أن يحمل كل جدول رقما معيناً حسب وروده في النص، مع عنوان مناسب . وتستعمل الصور ( الأبيض والأسود فقط ) والأشكال والرسوم الأصلية وليس صوراً عنها، على أن تكون بعرض عمود واحد ( 8.8 سم ) أو عمودين ( 17.7 سم )، ويشار إلى مكانها المناسب في النص، ويراعى فيها أن تكون واضحة المعالم، وتحمل عنوانا وأرقاما متسلسلة حسب ورودها في النص .

## الأرقام ووحدات القياس :

تستعمل في جميع مطبوعات ايكاردا الأرقام العربية Arabic figures ( 1، 2، 3، .... 9 ) ، ووحدات القياس الدولية SI Unites مثل : مان/هـ، كغ، غ، م، كم، مم، $م^2$ .

## الاختصارات والرموز :

5 غ، 325 مم، عام 1983، موسم 89/1988، موسما 1987 - 1989، مواسم 1986 - 1989، 20 $م^2$ ، الجدول 1، الشكل 5، الفاو ( منظمة الأغذية والزراعة )، ف م ع ( الفرق المعوّل عليه LSD ) .

# إلى العلماء العرب الكرام

تعلمون أن إدراج اللغة العربية ضمن هذه النشرة كان أحد أهم أهداف مشروع "فابس"، الذي كان يدعمه مركز بحوث التنمية الدولية IDRC . وبمزيد من السرور تعلن أسرة تحرير " فابس " عن وصول بعض الأوراق العلمية المكتوبة باللغة العربية . والتي أخذت تظهر على صفحات هذه النشرة بدءا من العدد 26 . لذا يرجى من الباحثين العرب، العاملين في مجال تحسين محصول الفول، الراغبين في نشر بحوثهم باللغة العربية إرسالها إلى العنوان التالي :

نشرة " فابس "
قسم التوثيق
ايكاردا
ص.ب. 5466، حلب، سورية .

## المعاملات الزراعية والمكننة



## الفيزيولوجيا والأحياء الدقيقة



## التربية والوراثة

# فابس

## مشروع المعلومات المتخصصة عن الفول

فابس، نشرة علمية 27، كانون الأول 1990

## المحتويات

# ايكاردا والمجموعة الاستشارية للبحوث الزراعية الدولية

يتمثل الهدف العام للمركز الدولي للبحوث الزراعية في المناطق الجافة (ايكاردا) في زيادة الإنتاجية الزراعية، والموارد الغذائية المتاحة، في المناطق الريفية والحضرية، بهدف تحسين الوضع الاجتماعي والاقتصادي لشعوب البلدان النامية وخاصة في شمالي إفريقيا وغربي آسيا. وتُركز ايكاردا اهتماماتها بصورة رئيسية في المناطق التي تعتمد في زراعتها على الأمطار الشتوية التي تتراوح من 200-600 مم سنوياً. وعندما تستدعي الضرورة ستمتد دائرة بحوثها لتغطي مناطق بيئية مَرويّة أو ذات أمطار موسمية.

ويضطلع المركز الدولي بمسؤولية عالمية عن تحسين الشعير والعدس والفول، وبمسؤولية إقليمية عن تحسين القمح والحمص والنُظم الزراعية ومحاصيل المراعي والأعلاف والثروة الحيوانية . كما ويُعتبر تدريب وتأهيل الباحثين الزراعيين في البلدان النامية، وتبادل نتائج البحوث معهم أحد أهم الأنشطة التي تقوم بها ايكاردا.

وقد ساهمت المجموعة الاستشارية للبحوث الزراعية الدولية (CGIAR) بتأسيس ايكاردا في سورية عام 1977، كمركز للبحوث لا يتوخى الربح. أما المجموعة الاستشارية للبحوث الزراعية الدولية فهي هيئة غير رسمية من المتبرعين، تضم حكومات ومنظمات ومؤسسات خاصة، وتدعم البحوث الزراعية في جميع أنحاء العالم، بهدف تحسين الإنتاج الغذائي في البلدان النامية، وذلك من خلال شبكة مؤلفة من ثلاثة عشر مركزا دوليا للبحوث من بينها ايكاردا. وتغطي أعمال الشبكة بحوثاً على أنظمة المحاصيل والثروة الحيوانية، التي تسهم بتأمين ثلاثة أرباع الغذاء في البلدان النامية.

## فابس

تُصدر ايكاردا نشرة "فابس FABIS" العلمية مرتين في السنة. وهي نشرة علمية متخصصة بالفول، وتعتبر وسيلة اتصال لتبادل نتائج البحوث حول هذا النبات. وتضم النشرة بحوثا مختصرة تهدف إلى إيصال المعلومات بسرعة، إضافةً إلى بعض المقالات العامة التي تدعو إليها أسرة التحرير بشكلٍ منتظم، وتتناول مجالات معينة من بحوث الفول، كما تضم النشرة بعض الإعلانات. وهذه النشرة تُقدِّم المعلومات حول بحوث الفول دون مقابل من خلال قسائم الاستجواب، والتصوير النسخي (الفوتوكوبي)، وجمع الوثائق العلمية المتعلقة بالفول.

## الاشتراكات

توزع نشرة "فابس" العلمية دون مقابل على الباحثين المعنيين بنبات الفول. وللإشتراك فيها يُرجى الكتابة إلى:
نشرة فابس / قسم التوثيق / ايكاردا، ص.ب 5466، حلب، سوريا

## هيئة التنسيق



## هيئة التحرير في ايكاردا:



صورة الغلاف : فول (*Vicia faba* L.) من الصنف السوري المحلي الكبير الحبة وهو مزروع بموقع لإيكاردا في تل حديا ، حلب ، سورية .


ICARDA-240/1400/Oct 1991

# فابِس

نشـرة علميـة متخصصة بالفول

العدد 27

ك1 /ديسمبر 1990

المركز الدولي للبحوث الزراعية في المناطق الجافة
ايكاردا
ص. ب. 5466 ، حلب، سورية