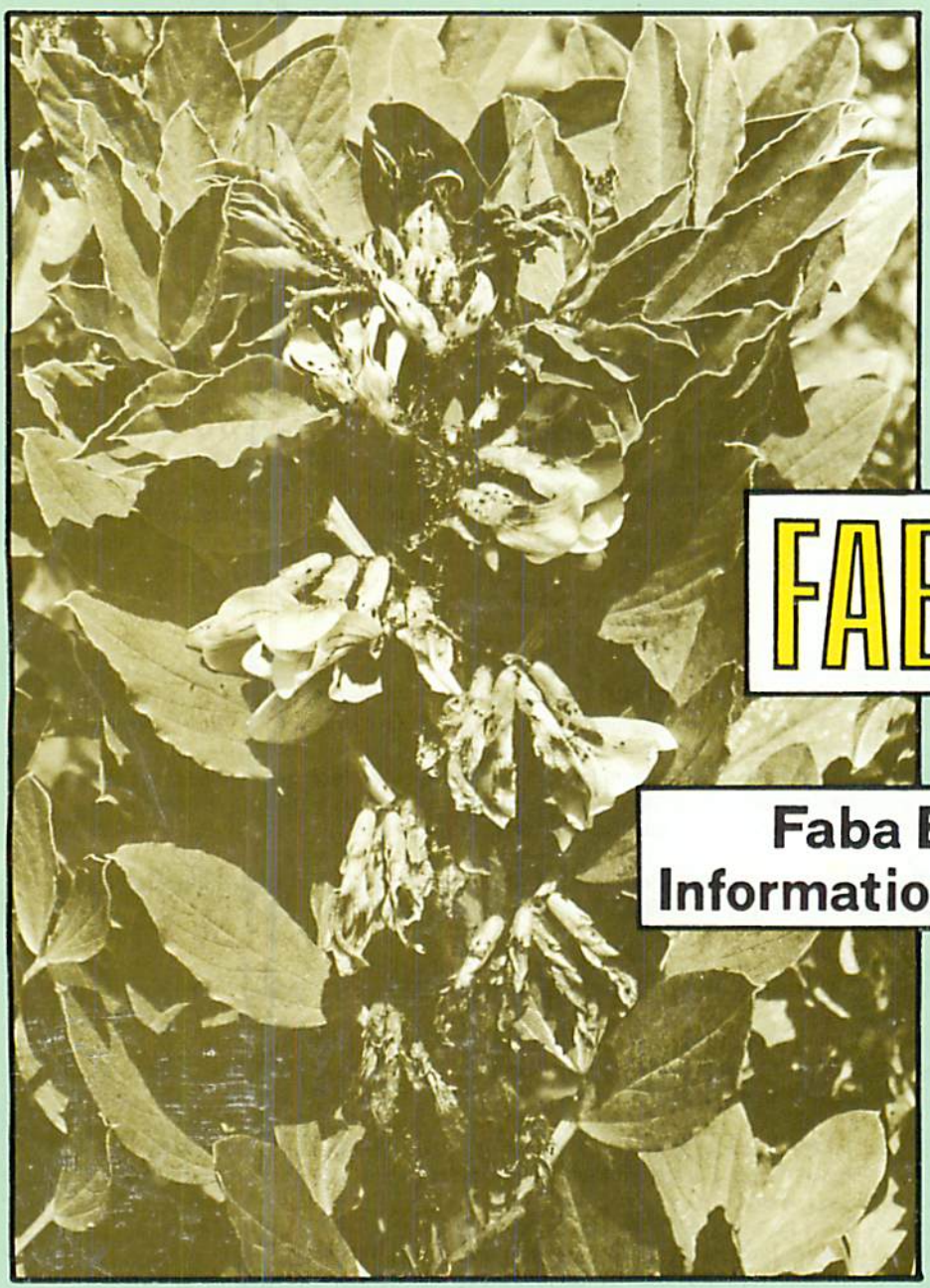

FABIS

Faba Bean Information Service

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INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS

(ICARDA)

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FABIS

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COVER PHOTO: Severe infestation of *Vicia faba* by aphids (*Aphis* spp.)

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Faba Bean Information Service

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التربية والوراثة

Yield Response to Mass Honeycomb Selection in Faba Bean (Vicia faba L.)

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GREECE

Abstract

Two cycles of mass honeycomb selection for yield within the faba bean cv 'Polycarpe', were investigated. The total gain was 12.1% for testing in the absence of competition, and 5%/year for testing under solid stand. This indicates that, in faba bean, genotypes selected without competition maintain their superiority when tested under solid stand.

Introduction

Faba bean is a promising annual leguminous crop for protein production as well as for nitrogen enrichment of soils in the rainfed areas of Mediterranean countries. Work on breeding methods in faba bean has been rather limited. Hawtin (1982) mentioned that mass selection is probably the most widely used breeding method in faba bean. Bond (1971) and Sjodin (1977) reported that mass selection has a small effect in increasing yield of faba bean populations. Gardner (1961) was the first to report that mass selection was effective when the grid system was applied in a corn population. He reported an annual yield gain of 3%. However, Hallauer and Sears (1969) reported only limited advances of 1.6%/cycle over six cycles in a corn population. Fasoulas (1981) suggested that the honeycomb mass selection scheme is applicable to both self-pollinated and cross-pollinated crops. Gogas (1981) applied the honeycomb mass selection in one corn population for four years and he reported an annual progress of 10%. When the same method was applied to a F_2 population of wheat for four cycles of selection the annual progress was 10% (Gouli-Vavdinoudi and Fasoulas 1987). Kyriakou and Fasoulas (1985) and Lungu *et al.* (1987) also reported that this method was effective in breeding for yield when it was applied to a rye population and an F_2 wheat generation respectively. This study was undertaken to investigate the yield response of a faba bean population to honeycomb mass selection.

Materials and Methods

The experiment was conducted at the University Farm, Thessaloniki, Greece during the seasons 1978 - 1981. 'Polycarpe' was the faba bean cultivar used. In 1978, 2484 plants were grown according to the unreplicated honeycomb design (Fasoulas 1981) (**Fig. 1**). The distance between the plants was 0.90 m. Each plant was harvested separately and the yield was determined. Honeycomb selection was applied and 47 plants were selected (intensity of selection was 2.6%). In the second season (1978), the progenies of the 47 selected plants were seeded according to the replicated honeycomb design (Fasoulas 1981). Each selected plant was represented by 73 progenies. In this test, 146 individual plants from the original cultivar were included as a control. Applying the honeycomb selection, 65 individual plants were selected (intensity of selection was 1.5%). Testing of the progenies of these plants was done during the following seasons under two cultural practices. In the first test, progenies of the best 47 plants were evaluated on an individual basis using the replicated honeycomb design. In this case, each selected plant was represented by 68 individual plants. In the second evaluation experiment, seeds of each of the 65 selected plants were mixed and sown along with the control in five rows 7 m long and 75 cm apart. Each row was seeded with 100 g of seed. A completely randomized block design was used with eight replications.

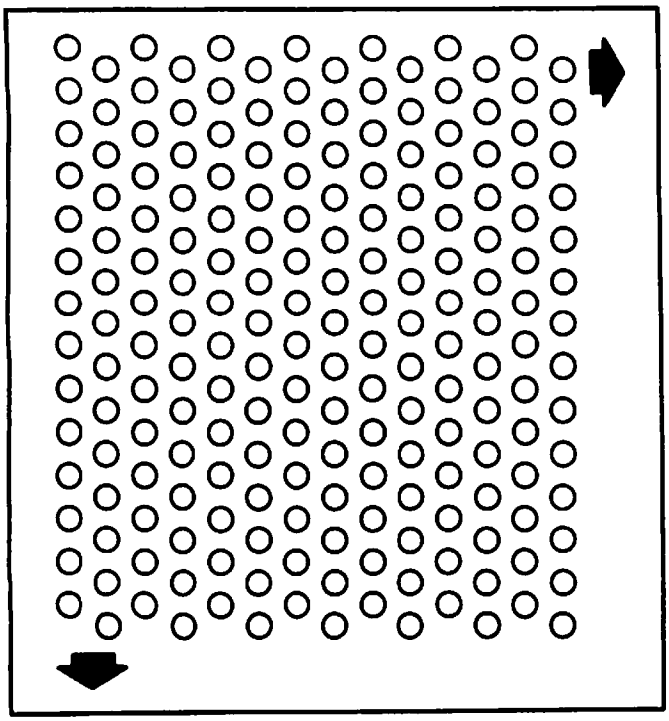

Fig. 1. Nonreplicated honeycomb design, NR-O (Fasoulas 1981).

Results and Discussion

When progenies of the selected plants were tested without competition, the yield progress was 7.14% after one cycle of honeycomb mass selection and 12.07% after two cycles of selection (**Table 1**). Thus, under testing without competition, the annual yield progress after two cycles of honeycomb mass selection was 6%. When the same material was tested under solid stand the annual yield progress was 5% (**Table 2**). This indicates that in faba bean, genotypes selected without competition could maintain their performance under solid stand.

Table 1. Mean individual progeny yield of the selected plants and the control and yield advance after one and two cycles of honeycomb mass selection without competition in one faba bean population.

Cycle of selection	Yield of selected plants (g)	Yield of control plants (g)	Yield advance (%)
1	215.01±1.52	200.68±6.19	7.14
2	148.82±1.53	132.79±6.73	12.07

Table 2. Mean yield of selected plants (after two cycles of honeycomb mass selection in a faba bean population) and the control tested in a solid stand in a completely randomized block design.

Population	Mean yield/ block (g)	Yield advance (%)
Selected	5098±0.24	9.9
Control	4638±0.25	

The results obtained from this study can not be directly compared with the results obtained from other breeding methods due to the variations in the breeding material and the environments. However, 5% annual progress in yield is larger than the one reported by Bond (1971) with respect to synthetic varieties and by Rowland (1987) when he applied a recurrent selection scheme. To determine which breeding method is more effective in breeding faba bean, further studies using more than one method in one population and under the same environment are needed.

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استجابة الغلة للانتخاب الاجمالي النخروبي honeycomb في الفول (Vicia faba L.)

ملخص

تمت دراسة دورتين للانتخاب الاجمالي النخروبي لتحديد الغلة في صنف الفول " Polycarpe " . وقد بلغت نسبة الزيادة الاجمالية 12.1 % عند الاختبار بغياب المنافسة ، و 5 % /سنة عند الاختبار تحت كثافة نباتية جيدة . وهذا يشير إلى أن طرز الفول الوراثية المنتخبة تحت ظروف غياب المنافسة تحافظ على تفوقها عند اختبارها تحت كثافة نباتية جيدة .

Genetic Mapping Using Trisomics in Vicia faba L.

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Abstract

Trisomic plants for all the subtelocentric chromosomes of *Vicia faba* were used in mapping nine mendelian traits. The red seed coat color locus (R/r) is located on chromosome IV. The terminal inflorescence locus (Tl/tl) is placed on chromosome V. The possible chromosome location of the sdp, yf, n, sc, dw, wl, and un-a[1] loci are discussed.

Introduction

Primary trisomics provide an excellent cytogenetic tool to localize genes on specific chromosomes, to test the independence of linkage groups, and also to assign linkage groups to particular chromosomes. The chromosomic complement of *Vicia faba* consists of six chromosome pairs. One of them is a metacentric chromosome which is about twice the length of each of the five subtelocentric chromosomes. Primary trisomics for all subtelocentric chromosomes were obtained with high frequency by Martin and Barcelo (1984) through crossing asynaptic with euploid plants. The five primary trisomics for the subtelocentric chromosomes can be classified in five phenotypic groups. The critical chromosome for each group has been identified by Barcelo (1987).

In this study, we present the results of mapping nine mendelian traits by using primary trisomics.

Materials and Methods

Diploid lines of faba bean differing in some morphological traits were selected from our collection in Cordoba. Lines used had at least five generations of selfing. Characters studied were: flower color, seed coat color, hilum color, determinate growth, short internodes, and unifoliate leaves. Seed coat color was evaluated before and after ripening because seed pigmentation can change through maturation.

Trisomic plants, which are homozygous for the "normal" alleles of the marker gene to be mapped, were crossed with disomics carrying their alleles. The F1 is expected to contain both disomics and trisomics. The seeds with 2n + 1 chromosomes were identified by studying the mitotic metaphases. Disomic and trisomic plants were selfed to produce F2 generations. The normal ratio

3:1 is expected to be found in all F2 populations except those involving a third chromosome carrying the gene to be localized. In this case the ratio is modified because of the presence of the extra chromosome.

The transmission of the extra chromosome in *Vicia faba* is always through the female parental. The mean female transmission (f) to F_2 generation in three consecutive years was 0.22. Thus, the frequency of recessives in the total population is 1/9 (1-f). This formula had been used to calculate the dominant: recessive expected ratio in the total F_2 population (Hermsen 1970; Khush 1973). With random chromosome association a ratio of 10 (dominant) to 1 (recessive) is expected.

Parentals, F_1, and F_2 were grown in a glasshouse. Mitotic and meiosis analyses were carried out using the Feulgen standard method.

Results and Discussion

The segregations for the marker genes tested in whole F_2 population (2n and 2n+1) are given in **Table 1**, following Michaelis and Rieger (1959) nomenclature.

Triplo II. Because of its low transmission rate and high sterility, triplo II could be tested only with the hilum color (n). The obtained segretation agrees with the expected disomic ratio.

Table 1. Progeny test of primary trisomics of faba bean.

Chromosome	Gene	Normal	Recessive	Expected ratio	X^2	P
Triplo II	n	10	3	3:1	0.02	0.9-0.7
Triplo II	yf	41	14	3:1	0.006	0.9-0.7
	sdp	32	11	3:1	0.008	0.9-0.7
	ti	27	13	3:1	1.12	0.3-0.1
	dw	33	14	3:1	0.57	0.5-0.3
	un-a^1	46	9	3:1	2.19	0.3-0.1
	sc	25	9	3:1	0.04	0.9-0.7
	r	27	6	3:1	0.49	0.5-0.3
Triplo IV	yf	9	4	3:1	0.02	0.9-0.7
	sdp	9	4	3:1	0.02	0.9-0.7
	sc	17	5	3:1	0.06	0.9-0.7
	n	16	4	3:1	0.07	0.9-0.7
	r	19	1	10:1	0.06	0.9-0.7
	r	18	2	10:1	0.06	0.9-0.7
Triplo V	sdp	31	15	3:1	1.42	0.3-0.1
	dw	26	10	3:1	0.04	0.9-0.7
	dw	65	15	3:1	1.67	0.3-0.1
	n	42	10	3:1	0.92	0.5-0.3
	sc	11	3	3:1	0.09	0.9-0.7
	ti	18	1	10:1	0.03	0.9-0.7
Triplo VI	w_1	19	6	3:1	0.013	0.9-0.7
	yf	19	4	3:1	0.36	0.7-0.5
	sdp	42	13	3:1	0.32	0.7-0.5
	ti	56	22	3:1	0.43	0.7-0.5
	dw	61	17	3:1	0.43	0.7-0.5
	n	35	9	3:1	0.18	0.7-0.5

Triplo III. Seven different marker genes have been tested with triplo III: yf, sdp, ti, dw, un-a[1], r, and sc. In all cases, the observed segregations are in agreement with the expected 3:1 disomic inheritance. These results indicated that the loci tested are not located on chromosome III.

Triplo IV. The segregation data for the red seed-coat marker gene agrees with the ratio of 10:1 expected on the basis of the 22% transmission of the extra chromosome. It is concluded that r locus is located on chromosome IV.

R and Y (green seed coat color) are known to be linked with a recombination frequency of $p = 0.29 \pm 0.11$ (Picard 1963). This fact, and the results of this study, allowed us to establish that the R-Y linkage group is placed on chromosome IV. on the other hand, Sjoedin (1971) mapped the locus y-2 on chromosome IV.

Limited data were obtained for the locus controlling yellow wings spots (yf) and for the locus controlling the solid distribution of the pigment on the flower (sdp). Thus, these results are not conclusive.

Triplo V. F2 segregations for the ti marker gene fit the 10:1 expected ratio, indicating that locus ti is placed on chromosome V. Also, Sjoedin (see ICARDA 1986) placed ti locus on this chromosome. The rest of the tested marker genes (dw, sdp, and n) fit the disomic inheritance pattern.

Triplo VI. Five marker genes had been tested with triplo VI (wl, yf, sdp, dw, and n). All of them segregated following the disomic patern, indicating that the loci tested are not located on chromosome VI.

As it can be expected, the control crosses involving disomic individuals yielded a segregation close to 3:1 ratio. Trisomics with the recessive traits were never recovered in any F2.

Table I shows that sdp locus controlling solid distribution of pigment on the flower showed disomic segregation with triplo III, triplo IV, triplo V, and triplo VI. Therefore, this locus could be located on chromosome I or chromosome II. Similarly, locus N/n for hilum color which showed disomic inheritance with triplo II, triplo IV, triplo V, and triplo VI could be situated on chromosome I or III. Unfortunately, the low fertility of trisomics and the lack of the trisomic for chromosome I increased the difficulty to map genes in their respective chromosomes in faba bean.

Acknowledgments

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رسم الخرائط الوراثية باستخدام التثلث الصبغي Trisomics في الفول Vicia faba L.

ملخص

استخدمت نباتات ثلاثية الصبغة لجميع الكروموزومات شبه طرفية المركز (السنترومير) Subtelocentric في الفول لرسم خرائط تسع صفات مندلية . ويقع موضع locus غلاف البذرة الحمراء (R/r) على الكروموزوم IV ، أما موضع النورة الطرفية (Ti/ti) فعلى الكروموزوم V . ويتم بحث المواقع المحتملة للمواضع un-a1 ، wl ، dw ، sc ، n ، yf ، Sdp على الكروموزومات .

A New Faba Bean Cultivar for the Northern Province of the Sudan

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Abstract

Out of eight lines evaluated for yield and yield components during the four seasons (1982-1985) in the Silaim area, northern Sudan, the faba bean line SM-L proved the best. It gave the highest average yield and outyielded the standard checks, Hudeiba 72 and the local genotype, by 17.6% and 27.6%, respectively. SM-L also gave good quality seed as measured by the 100-seed weight, percent non-soaking seeds, percent protein content, and cooking time. Therefore, the line was released, under the name 'Silaim improved', and recommended for the Northern province of the Sudan.

Introduction

Faba bean is the most important food legume crop in the Sudan. The area under this crop in the country has increased more than three times during the past two decades: from 7600 ha in 1967 to 25000 ha in 1987. The major producing region is in the Northern province which accounts for about 77% of the total production area in the Sudan. The Nile Province, which accounts for nearly 21% of the total production area, is the second important region (Salih 1980). The cool and comparatively longer winter season in the Northern province favours the production of this crop when compared to the Nile province. Salkini *et al.* (1983) estimated the average yield/ha in the Northern province to be about 89% higher than that in the Nile province. Yet, the overall productivity of this crop in the Northern province is lower as compared to other countries because of several factors; the lack of suitable high yielding cultivars is one of them. Therefore, the objective of the present work was to identify a new faba bean genotype for the Northern province having higher yield potential than the local cultivated line with comparable or better seed quality.

Materials and Methods

In the past, the yield of hundreds of faba bean introductions were evaluated at Hudeiba, Sudan. However, none of the introductions proved better than the local cultivar. Hence research was directed towards improving the local material (i.e., land races) through transferring some of the desirable characteristics from certain introductions.

Recently, land races, collected from different parts of the Sudan, along with different crosses were evaluated at Hudeiba Research Station. Selection was mainly based on the number of pods/plant because this character was found to be highly correlated with seed yield (Kambal 1969; Yassin 1973). This work resulted in the selection of many promising lines out of which six along with two local cultivars (Hudeiba 72 and a local line) were tested for their yielding ability.

The experiment was conducted at Silaim which is the most important faba bean growing location in the Northern province of Sudan. The yield and some quality attributes of the eight lines were compared in a randomized complete block design, with four replicates, for four consecutive seasons (1981/82 - 1984/85). The attributes measured included yield, 100-seed weight, the percentage of non-soaking seeds, protein content, and cooking time.

Results and Discussion

Table 1 shows the data on seed yield for the eight lines during the four seasons of test. Although, the differences among the lines were not significant, the line SL-M secured the highest average seed yield (3005 kg/ha) and outyielded the cv Hudeiba 72 by 17.6% and the local line by 27.6%. However, the seed yield of the line SM-L was almost the same as the lines NEB 424 S and NEB 152 S except that the quality of its seeds was better than the other two lines (Table 2). It gave significantly larger seeds and lower percent of non-soaking seeds than the other two lines. The comparatively large seed size of such lines as SM-L is preferred by most consumers and fetches a high price in the market (Ali 1983). In addition, the line SM-L gave the highest protein content and it was the second lowest in cooking time among all genotypes.

Salih and Bushara (1987) assessed the level of autofertility of some promising faba bean inbred lines

Table 1. Seed yield of eight faba bean lines grown in Şilaim area during the seasons 1981/82 - 1984/85.

Faba bean line	Yield (kg/ha)					Relative mean yield (%)
	1981/82	1982/83	1983/84	1984/85	Mean	
SM-L	3173	3655	2824	2369	3005	127.6
NEB 424 S	3399	4063	2874	1680	3004	127.5
NEB 152 S	3211	4101	2844	1271	2857	121.3
Hudeiba 72	3013	3166	2383	1661	2556	108.5
BM 9/3	2928	2972	2572	1401	2468	104.8
188 x GI	2496	3475	2158	1457	2397	101.8
ZB-M	2628	3062	2208	1290	2297	97.5
Local	3008	3153	2238	1023	2356	100.0
Mean	2982	3456	2513	1519		
SE±	216.9	312.5	278.0	321.4		

Table 2. Some seed quality attributes for eight faba bean lines grown in Silaim area.

Faba bean line	Character			
	100-ssed[1] weight (g)	% Non[2] soaking seeds	Protein[3] content (%)	Cooking time (min)
SM-L	54.9	4.5	31.1	170
NEB 424 S	41.3	7.4	29.7	165
NEB 152 S	43.6	9.8	30.1	185
Hudeiba 72	42.5	13.1	29.6	185
BM 9/3	37.5	10.5	30.2	185
188 x GI	40.3	10.5	30.2	165
ZB-M	38.7	10.9	29.6	165
Local	55.4	3.6	30.8	235

1. Average of four seasons'data
2. Average of three seasons'data
3. Average of one season data.

and found that SM-L had the highest autofertility index among the tested lines. This is very important under the Sudan's comparatively warm and dry conditions where insect visitation to flowers is expected to be infrequent.

In Egypt, Khalil *et al.* (1987) investigated the reaction of a number of faba bean genotypes, including SM-L, to aphid infestation under natural field conditions. SM-L was found to record the lowest level of aphid infestation.

Conclusions

In comparison with the other lines, including the checks, the line SM-L had the highest average seed yield, better seed quality, high levels of autofertility, and an acceptable level of resistance to aphids. Therefore, the Variety Release Committee of the Agricultural Research Corporation approved the release of this line under the name of 'Selaim improved' for the Northern province of the Sudan.

Acknowledgments

This work was financed by the ICARDA/IFAD Nile Valley Project on Faba Bean. The protein content and the cooking time were determined at ICARDA, Aleppo, Syria.

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صنف جديد من الفول للمحافظة الشمالية في السودان

ملخص

ضمن ثماني سلالات جرى تقييمها على مدى أربعة مواسم (1982 - 1985) لتحديد الغلة ومكوناتها في منطقة السليم شمالي السودان ، برهنت السلالة SM-L انها الأفضل . إذ أعطت أعلى معدل غلة ، وتفوقت على صنفي الشاهد المعياريين،حديبة 72 والطراز الوراثي المحلي ، بنسبة 17.6 % و27.6 % على التوالي . كما أعطت تلك السلالة أيضا بذورا جيدة النوعية لدى مقارنتها على أساس وزن المائة حبة ، ونسبة البذور غير المتشربة بالماء ، والنسبة المئوية للمحتوى البروتيني ، ومدة الطهي ، وبناء على ذلك تم اعتمادها تحت اسم " سليم محسن " ، وأوصي بزراعتها في المحافظة الشمالية بالسودان .

Evaluation of Faba Bean (Vicia faba) Varieties in the Heavy Clay Soils of Central Sudan (Sennar Area)

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Abstract

Several small seeded faba bean genotypes were tested for their adaptability to the heavy clay soil (pH 7-8) areas of Central Sudan at the Sennar Research Station during the seasons 1984/85-1986/87. Plant growth, yield, and seed quality were encouraging and indicated the possibility of introducing the crop into this area. Faba bean lines RB 30 x G1, 353 x 348, IW x Selaim, 133 S x G2 and Baladi x Selaim showed the best performance.

Introduction

Current faba bean production in Sudan is largely restricted to the light, silty soils along the Nile in the Northern Region where the cool weather conditions are conducive to crop growth. Such a land area is, limited, however, which prevents further expansion of faba bean cultivation. To meet the increasing demand for faba bean for domestic consumption, more area is required to be brought under this crop. Attempts are being made to test the possibility of growing faba bean in the non-traditional areas in Sudan.

Research on faba bean in the past centered in the Northern Region where most of the work was carried out at Hudeiba Research Station (Heipko and Kaufmann 1965; Baghdadi and Khalifa 1968; Osman 1968; Abu Salih 1979; Ageeb 1979; Salih 1984). Very limited work was done in Central Sudan (Khashmelmous 1983, 85; Hassan 1984; Mohamed 1986). This study was, therefore, done at the Experimental Farm of the Sennar Research Station (lat. 13^{o} 33"N) where the soils are heavy clay (pH 7-8) and where the winter season is short. The aim was to study the adaptability of faba bean to this area and assess its potential as a new cash crop with a view to increasing the domestic supply of this important food crop and thus stabilize its price at a reasonably low level.

Materials and Methods

The experiment was conducted for three consecutive seasons (1985-87) at the Experimental Farm of Sennar Research Station. In the first season (1984/85), 20 small seeded faba bean lines obtained from Shambat Research Station were used. In the following seasons (1985-87) only 18 lines were used of which 17 were in common with the lines in the 1984/85 season. Sowing was done during the first week of November of each year.

Seeds were sown (2 - 3 seeds/hole) on both sides of an 80 cm ridge, at 20 cm spacing. Two weeks after sowing, urea was applied to provide 95 kg N/ha. Irrigation was done every 7-10 days depending on the weather conditions. Entries were arranged in a randomized complete block design with four replications.

Growth, yield, and yield components were measured and composite seed samples were analysed for protein content.

Results and Discussion

The results of the 1984/85 season showed significant variations among the different genotypes for total seed yield, 1000-seed weight, and plant height (**Table 1**). Among the 20 lines H 72 (Baladi x RB 30) gave the highest yield, RB 30 x G1 the heaviest seeds, and 345 x BM 9/3 the tallest plants. Protein content was highest in HSB 3.

In general, the values recorded during the second season of experimentation for plant growth, seed yield, number of pods/plant, and protein content were lower in all cultivars as compared to the 1984/85 season (**Table 1**). However, plants were taller than in the previous season, and the seeds of line NEB 69-A were significantly heavier.

Better plant performance was attained in the third season (1986/87). The crop was better podded and gave high seed yield (**Table 1**). There were significant variations in yield, which ranged from 970 for line G1 x BF 2/2 to 1572 kg/ha for line RB 30 x G1.

Although yields differed in the three seasons, they are comparable with those obtained in El-Rahad area (Mohamed 1986), which is also outside the region of traditional faba bean cultivation. The yield levels in the first two seasons were lower than in the third season because of the damage to crop from leafminer and aphids as no chemical control was adopted. Root rot and

Table 1. Evaluations of plant growth, yield, and yield components of different faba bean lines at Sennar (1985 - 87).

Cultivar	Seed yield (kg/ha)			1000-seed weight (g)			Plant-height (cm)			No. of pods/ plant			Protein (%)		
	1985	1986	1987	1985	1986	1987	1985	1986	1987	1985	1986	1987	1985	1986	1987
H 72 (Baladi x RB30)	1451			416			57.6			6.0			33.5		
353 x 348	1434	971	1392	376	404	393	58.7	68.0	67.5	6.0	4.3	12.4	34.7	25.9	32.3
RB 30 x G1	1432	1145	1572	420	416	421	61.4	67.6	72.6	6.0	3.6	10.2	26.2	26.6	25.0
IW x Selaim	1369	936	1464	372	364	409	55.7	63.4	63.5	6.0	3.7	10.9	34.7	27.5	28.1
133 S x G2	1354	887	1464	369	369	384	57.8	63.6	72.8	7.0	3.3	12.7	30.9	25.6	22.8
HSB 10	1345	922	1338	378	401	410	58.4	69.8	71.1	6.0	3.4	10.2	34.4	24.1	28.8
H 72 (Baladi x G2)	1317	768	1332	348	386	411	56.4	62.9	71.8	5.0	3.2	14.1	35.0	25.9	26.6
Baladi x Selaim	1304	1055	1326	402	392	408	57.9	69.2	73.7	5.0	4.2	11.6	36.2	25.9	30.0
BF 2/2 x G2	1271	880	1512	405	367	406	54.2	68.7	72.2	5.0	3.7	12.7	34.1	27.5	28.1
NEB 69-A	1244	824	1380	388	428	400	56.9	66.2	71.7	6.0	3.3	11.9	32.5	28.8	25.9
G1 x BF 2/2	1240	873	1110	390	404	414	56.3	70.7	71.6	6.0	3.4	11.0	26.2	27.5	25.6
HSB 3	1237	824	1314	366	394	389	56.0	62.5	71.1	6.0	4.0	12.7	40.6	29.4	25.0
BF 2/2	1218	866	1386	345	387	414	61.8	68.0	72.9	6.0	3.4	12.1	29.7	30.0	29.1
423 x BF 2/2	1170	754	1392	381	366	381	61.3	64.6	71.0	6.0	3.2	11.5	28.8	29.7	27.8
188 x G1	1170	908	970	408	404	404	58.0	70.3	71.8	6.0	3.4	9.5	30.0	27.8	26.6
345 x BM 9/3	1154	782	1164	346	382	400	63.2	71.2	72.1	7.0	4.2	10.1	33.8	29.4	27.5
RB 29/5	1141	796	1464	362	358	374	57.6	63.3	71.0	6.0	3.8	12.8	33.8	27.5	28.1
IW	1120	879	1332	348	358	413	51.5	65.5	66.6	6.0	3.1	10.4	30.0	28.1	27.2
BF 269 x RB30	938			330			59.2			6.0			31.6		
153 S x 425	905			396			58.5			6.0			28.7		
G2		810	1360		358	417		67.1	73.8		3.3	11.1		27.5	27.2
Mean	1241	882	1348	379	382	402	57.9	66.8	71.0	6.0	3.6	1.55	32.3	27.5	27.3
SE ±	68.37	NS	27.60	11.38	8.14	4.69	1.34	NS	NS	NS	NS	NS			

wilt diseases which are common in the traditional areas (Abu Salih 1979) were not observed at Sennar.

In spite of the climatic differences between the traditional faba bean producing areas in the Northern Region and Sennar area, the results obtained in Sennar appear very encouraging for the introduction of this crop in the central clay region of Sudan. There is a need to undertake further studies on the agronomy and plant protection of the crop to realise its full yield potential.

Conclusions

From the present study the following conclusions could be drawn:

1. The Sennar area is promising as a new area for faba bean production.
2. The lines RB 30 x G1, 353 x 348, IW x Selaim, 133 S x G2 and Baladi x Selaim seem to be more adapted to the Sennar area.
3. Cultural practices should be refined and pests, especially leafminer and aphids should be controlled for higher yields.

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تقييم أصناف من الفول (Vicia faba L.) في تربة وسط السودان الغضارية الثقيلة (منطقة سنّار)

ملخص

تم اختبار عدة طرز وراثية من الفول الصغير الحبة لمدى تأقلمها في تربة غضارية ثقيلة (أس الحموضة pH 7 - 8) بمناطق وسط السودان ، وذلك في محطة بحوث سنار خلال المواسم الزراعية 85/1984 - 87/1986 . وكانت مؤشرات نمو النبات ، والغلة ، وجودة البذور مشجعة ، وتشير إلى إمكانية إدخال المحصول إلى هذه المنطقة . وقد أظهرت سلالات الفول RB 30 x G1 و 348 x 353 و IW x Salaim ، و 133 S x G1 ؛ وبلدى x سليم أفضل كفاءة إنتاجية .

Physiology and Microbiology

الفيزيولوجيا والأحياء الدقيقة

Yield and Nutrient Uptake in Different Faba Bean Genotypes in Northern Madhya Pradesh

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Abstract

Sixteen genotypes of faba bean were grown on an alluvial soil in Madhya Pradesh for studing their numeral nutrient uptake and yield performance. The highest grain yield of 1990 kg/ha was obtained in genotype JV-7. The maximum uptake of N and K was in variety JV-2 while that of P and S was in JV-10 and JV-7, respectively.

Introduction

In India, faba bean (*Vicia faba* L.) can be successfully cultivated in areas where other long-duration post-rainy season pulses do not perform well due to early recession of moisture in the soil or where monsoon retires early. In general, introduction of faba bean will be more useful in areas where yields of traditional leguminous crops are static. Therefore, several pilot trials on faba bean production were conducted on farmers' fields during the 1984-86 seasons (Shrivastava and Bansal 1988). The trials resulted in attracting the attention of the farmers to growing the crop. To recommend suitable variety, evaluation of genotypes for their agronomic performance and nutrient uptake is necessary. The present work was, therefore, undertaken to study the performance of 16 genotypes of faba bean and their nutrient removal so that varietal recommendations can be made for northern parts of Madhya Pradesh.

Materials and Methods

The trial was conducted at the Agriculture College Research Farm, Gwalior (lat. 26°N, long. 78°E, and altitude of 221.5 m) during *rabi* 1986/87. Soil of the site was alluvial, sandy loam in texture, having 0.4% organic carbon, 115 ppm of N (alkaline permangnate method), 8 ppm of Olsen's P, and 200 ppm of ammonium acetate extractable K. The soil pH was 8.3. The design was randomized complete blocks with four replications, and 16 genotypes of faba bean (*Vicia faba* L.) grown on 10 x 4 m^2 plots. Diammonium phosphate (100 kg/ha) and muriate of potash (20 kg) were applied. After harvest, the grain were dried at 105°C and analysed for N using the Kjeldahl method (AOAC 1960); using the nitric perchloric acid digest (Piper 1950) P was determined by vanadomolybdate colorimetric method (Jackson 1967), K by flame photometric,and S by turbidometric methods (Bardsley and Lancaster 1960).

Results and Discussion

The genotype JV-7 produced signifiantly higher grain yield than all the other genotypes (**Table 1**), except for JV-2, JV-1, JV-10, K-1, VH 131, and VH 82-1, suggesting that any of these genotypes can be adopted for bean production in the region.

Table 1 shows that the 16 genotypes of faba bean varied significantly in their demands for N, P, and K and the highest uptakes of the three nutrients were by the high yielding genotypes. Genotype JV-2 took up the highest amounts of N (95.8 kg/ha) and K (28.8 kg/ha), while JV-10 had the highest amount of P (5.0 kg/ha). On the other hand, the lowest uptake of these nutrients (51.8, 2.6, and 14.2 kg/ha of N, P, and K, respectively) were by the local, which among the 16 genotypes tested, was the lowest yielding line.

In general the uptake of nutrients by JV group of genotypes was higher than that of other genotypes. This may be because of better adaptation of these genotypes for the northern Madhya Pradesh region.

The difference in the uptake of S by different genotypes was small, however, the highest uptake was by JV-7, which was significantly higher than that of the other genotypes except VH 131, VH 82-1, and JV-10 (Table 1).

Table 1. Yield and nutrient uptake by different genotypes of faba bean.

Genotype	Yield (kg/ha)	Nutrient uptake (kg/ha)			
		N	P	K	S
K-1	17.00	74.0	5.0	21.2	2.8
JV-1	16.80	83.5	4.3	24.1	2.7
JV-2	18.60	95.8	3.8	28.8	3.2
JV-130	15.90	70.8	4.0	22.7	2.5
VH 131	16.30	80.0	3.5	23.7	3.3
VH 133	14.20	67.2	2.8	21.4	2.2
VH 82-1	17.10	82.1	3.1	25.9	3.5
JV-7	19.90	93.2	4.5	25.7	4.0
JV-33	15.00	68.8	2.9	18.3	2.6
JV-10	19.60	95.0	5.1	22.8	3.6
AS-2	12.80	63.2	3.0	15.5	2.5
VH 137	14.20	68.3	3.5	18.4	2.9
JV-70-81	13.50	68.1	2.9	17.0	2.7
DHB-1	14.30	64.0	3.6	19.5	3.2
DHB-2	12.80	54.6	3.0	16.5	2.2
Local	12.00	51.8	2.6	14.2	2.4
SE±	1.40	6.1	0.3	1.8	0.2
LSD(5%)	3.88	17.1	0.9	5.1	0.6

Based on the results of this study, it can be concluded that any of the faba bean genotypes JV-1, JV-2, JV-10, K-1, VH 131, and VH 82-1 can be recommended for bean production in the northern parts of Madhya Pradesh.

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الغلة وامتصاص العناصر الغذائية عند طرز وراثية مختلفة من الفول في شمالي مدهايا برادش

ملخص

زرع ستة عشر طرازا وراثيا من الفول في تربة طمية بمدهايا برادش ، لدراسة مقدار امتصاص العناصر الغذائية ، والغلة فيها . وقد تم الحصول على أعلى غلة حبية (1990 كغ / هـ) من الطراز الوراثي JV - 7 . أما أعلى امتصاص لـ N و K فكان في الصنف JV - 2 ، ولـ P و S في الصنفين JV-10 و JV-7 على التوالي .

Agronomy and Mechanization

المعاملات الزراعية والمكننة

Effect of Sowing Date and Plant Population per Hill on Faba Bean (Vicia faba) Yield

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Abstract

The effects of three plant densities (16.6, 33.3 and, 49.9 plants/m^2 corresponding to one, two, and three seeds/hill, respectively) and three sowing dates (20 Oct, 30 Oct, and 10 Nov) on faba bean (cv BF 2/2) yield and its components were investigated for two seasons (1982 and 1983) at Shambat Research Station. In both seasons, sowing date and plant density had a significant effect on seed yield/ha: the highest yields were obtained from the crop sown on 30 Oct, and yield increased linearly with increasing number of plants/hill. The highest seed yield was obtained from a population density of three seeds/hill which is recommended for growing faba bean at Shambat locality in Sudan.

Introduction

In Sudan, the growing season of the faba bean crop is short. It is limited by heat and disease stress. Also, the high day temperatures during the season tend to set an upper limit to potential maximum yields. Under such conditions, timely sowing of the crop is of paramount importance.

At Shambat, Last and Nour (1961) found that faba bean sown in early Nov gave the highest yields, and that an earlier sown crop tended to be seriously damaged by insects, especially *Helicothrips* spp.

Salih (1988) reported that the seed yield of beans sown on 30 Oct exceeded the yield of crops sown on 10 and 20 Oct by 28% and 9%, respectively. This was in agreement with the results of Salih and Khalafalla (1982), and Taha (1983) who found that the optimum sowing date for faba bean at Shambat is between 25 Oct - 10 Nov.

At Shambat, Salih and Ageeb (1988) obtained a significant increase in faba bean (cv BF 2/2) yield when sowing was delayed from 13 Oct to 4 Nov. This was attributed to a significant improvement in plant stand.

Faba bean is known to show small changes in yield with large variations in the plant population. Ishag (1978) found that grain yield did not significantly change when plant spacing varied between 10 and 30 cm or when 2 or 3 plants/hole were used, but yield was significantly decreased when plant population further decreased by adopting a 40 cm plant spacing or by having one plant/hill. Ageeb (1981) showed that variation in row spacing (60, 40, and 20 cm), plant spacing (20, 10, and 5 cm), and number of plants/hole (1 or 2) had no effect on the grain yield of the cultivar Hudeiba 72.

At Zeidab, Salih (1983) found that at a hill spacing of 20 x 60 cm, the seed yield of crops with two, three, and four seeds/hill was greater than the yield at one seed/hill by 25, 34, and 39%, respectively. Similarly at Gezira, Ageeb (1987) reported that the grain yield of beans was significantly increased by decreasing the spacing from 20 to 10 cm and increasing the number of plants from one to two or three/hole.

Recently, Salih (1987) reported that there was a linear increase in seed yield with increasing the number of plants/hill from one to three. The highest yield was obtained from sowing three seeds/hill.

The objective of this experiment was to explore the possibility of reducing the seeding rate of faba bean without sustaining yield losses and to find the optimum plant population for different sowing dates.

Materials and Methods

Three dates of sowing (20 Oct, 30 Oct, and 10 Nov) and three levels of plant population (16.6, 33.3, and 49.9 plants/m^2) were tested for two seasons (1982 and 1983) in a split-plot design with four replications. Sowing dates were in the main plots, while plant population was in the sub-plots. Sub-plots were 4.6 x 6.0 m of which 3.6 x 5.2 m was harvested for seed yield.

The different plant densities were obtained by sowing one, two, or three seeds/hill at 10 cm hill to hill spacing in single rows/60 cm wide ridges. Each experiment was irrigated at intervals of 7 - 10 days. The cultivar used was BF 2/2. Total seed yield was recorded for each plot, and the number of pods/plant, 1000-seed weight, and plant height were determined from 20 randomly selected plants/plot.

Results and Discussion

The over-all mean yield of the 1982 experiment exceeded that of the 1983 season by 6%. Even though both experiments were sown at the same dates and had the same treatments, the plant stand/m^2 at harvest was higher in 1982 than 1983 by 7.6%. This was because of some water stagnation that occurred in the 1983 experiment.

At harvests of the two experiments, the actual plant stand counted for the three plant population treatments was less than the desired plant density because of mortality of the plants.

The percentages of plant stand actually obtained at one, two, and three seeds/hill were 79.7, 59.8, and 44.0 respectively, of the theoretical population in the 1982 experiment and 51.6, 56.2, and 47.6, respectively, in the 1983 experiment. In both seasons, plant stand increased with delayed sowings, it being 58.9, 60.2, and 64.4, respectively, of the theoretical population for the first, second and third sowing dates in 1982 and, 49.5, 52.6, and 53.3, respectively, in 1983.

Table 1 shows that increasing the number of seeds/hill increased the seed yield/ha in both years of test, but the effect was significant only in 1983. In 1982, the highest seed yield (2287 kg/ha) was recorded at a density of three seeds/hill (49.9 plants/m^2). This exceeded the seed yields at one and two seeds/hill by 12.2% and 5.7%, respectively. Similarly in 1983, the yield of plants at three seeds/hill surpassed the yield at one and at two seeds/hill by 18.3% and 6.6%,

Table 1. Effect of plant population and sowing date on seed yield and some yield components of faba bean (cv BF 2/2) during the 1982 and 1983 seasons.

	Seed yield (kg/ha)		No. of seeds/pod		No. of plants/m^2		Plant height (cm)	
	1982	1983	1982	1983	1982	1983	1982	1983
Plant population (plants/m^2)								
16.6	2009	1799	2.48	2.69	13.30	8.57	82.40	64.30
33.3	2156	2057	2.42	2.33	19.90	18.69	84.30	63.00
49.9	2287	2202	2.54	2.38	22.00	23.80	82.30	65.30
SE ±	62	45	0.05	0.05	0.69	0.55	0.79	1.36
Mean	2150	2019	2.48	2.46	18.40	17.00	83.00	64.20
Sowing date								
20 Oct (S1)	2322	1913	2.47	2.22	17.70	15.70	82.40	64.70
30 Oct (S2)	2972	2344	2.47	2.58	17.70	17.20	84.30	63.70
10 Nov (S3)	1157	1800	2.51	2.60	19.80	18.10	82.30	64.30
SE ±	112	39	0.04	0.05	1.56	0.51	2.32	1.71
Mean	2150	2019	2.48	2.46	18.40	17.00	83.00	64.30

Table 2. Number of pods/plant of faba bean (cv BF 2/2) as affected by plant population and sowing date at Shambat during the 1982 and 1983 seasons.

Plant population (plants/m^2)	Sowing date							
	1982				1983			
	20 Oct	30 Oct	10 Nov	Mean	20 Oct	30 Oct	10 Nov	Mean
16.6	37.2	26.8	21.0	28.3	19.6	17.8	15.7	17.7
33.3	14.6	14.3	9.7	12.9	11.4	12.6	11.1	11.7
49.9	14.3	14.0	7.0	11.8	12.3	11.4	9.1	10.9
Mean	22.0	18.4	12.6	17.7	14.4	13.9	12.0	13.4
SE ±								
Date		0.84				0.16		
Population		0.75				0.30		
Date x population		1.56				0.53		

respectively. This result is in line with the findings of Salih (1987).

Taha (1983) reported that sowing at the rate of two seeds/hole on 60-cm ridges at 10 cm spacing (33.3 plants/m^2) at both Selaim and Hudeiba and at the rate of three seeds/hole (49.9 plants/m^2) at Zeidab was optimum. Murinda and Saxena (1985) found that in Northern Syria, increasing the plant population from 16.7 to 33.3 plants/m^2 increased the seed yield by 22.7%. The lack of a proportionate increase in seed yield with increasing plant population levels reflects a high degree of plasticity in the local cultivars. This behaviour has been well documented by (Hodgson and Blackman (1956).

Seed yield was significantly affected by time of sowing in both seasons. The highest seed yield was obtained from the second sowing date (30 Oct) which outyielded the third and the first sowings by 61% and 22% respectively, in the 1982 experiment and by 30% and 22% respectively, in the 1983 experiment. The seed yields obtained from the third sowing date (10 Nov) were lower in comparison to earlier sowings due to fewer number of pods/plant and smaller seed size (**Table 1**).

In both seasons, the number of pods/plant and 1000-seed weight decreased with both increased number of seeds/hill and with delayed sowings (**Tables 2 and 3**). However, the number of seeds/pod and plant height were not very much influenced by sowing date and crop density (**Table 1**).

Sowing date had a significant effect on number of pods/plant in both seasons. The number of pods/plant was highest for the 20 Oct-sown plants due to the low plant stand and the high degree of branching (**Table 2**). However, among the three plant densities for all sowing dates, the highest number of pods/plant was recorded when the plant density was 16.6 plants/m^2 (**Table 2**).

In both seasons, the density of one seed/hill (16.6 plants/m^2) gave significantly greater seed weight/plant than the other two higher plant densities (33.3 and 49.9 plants/m^2). The difference between the last two population densities was not significant (**Table 4**). For all the three plant densities, the lowest yields were recorded for the Nov sowing.

In the two experiments, the interactions of sowing date x plant population densities were highly significant for 1000-seed weight (**Table 3**), number of pods/plant (**Table 2**), and seed yield/plant (**Table 4**).

The seed yield/plant was significantly higher for the 30 Oct-sown beans than for the 20 Oct- and 10 Nov-sowings. Also, sowing on 20 Oct gave yields higher than those obtained from sowing on 10 Nov by 53.6% in the 1982 experiment and by 12.6% in the 1983 experiment (**Table 4**).

In conclusion, the results of this study revealed that for high seed yield, at Shambat, Khartoum North, faba bean should be sown during the last week of October at 3 seeds/hill in single row at 10 cm hill to hill distance on ridges 60 cm apart.

Table 3. Weight of 1000-seeds (g) of faba bean (cv BF 2/2) as affected by plant population and sowing date at Shambat during the 1982 and 1983 seasons.

Plant population (Plants/m^2)	Sowing date							
	1982				1983			
	20 Oct	30 Oct	10 Nov	Mean	20 Oct	30 Oct	10 Nov	Mean
16.6	453	445	368	422	450	457	403	437
33.3	451	421	376	416	448	424	408	427
49.9	463	428	347	413	435	425	396	419
Mean	456	431	364	417	444	435	402	427
SE ±								
Date		7.24				8.57		
Population		3.87				8.76		
Date x population		6.71				15.18		

Table 4. Seed yield/plant (g) of faba bean (cv BF 2/2) as affected by plant population and sowing date at Shambat during the 1982 and 1983 seasons.

Plant population (plants/m^2)	Sowing date							
	1982				1983			
	20 Oct	30 Oct	10 Nov	Mean	20 Oct	30 Oct	10 Nov	Mean
16.6	18.5	21.1	7.1	15.6	21.7	30.0	17.7	23.1
33.3	11.4	16.9	6.6	11.6	14.8	17.0	12.2	14.7
49.9	11.3	16.8	5.4	11.2	11.2	14.4	11.7	12.4
Mean	13.8	18.3	6.4	12.8	15.9	20.5	13.9	16.7
SE ±								
Date		0.60				0.64		
Population		0.50				0.30		
Date x population		0.86				0.53		

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تأثير موعد الزراعة وعدد النباتات في الجورة على غلة الفول (*Vicia faba* L.)

ملخص

تمت على مدى موسمي 1982 و 1983 في محطة بحوث شمبات دراسة ثلاث كثافات نباتية (16.6 و 33.3 و 49.9 نباتات/م^2 تعادل حبة وحبتان وثلاث حبات/ الجورة على التوالي) ، وثلاثة مواعيد زراعة (20 تشرين الاول/اكتوبر ، 30 تشرين الاول/اكتوبر و 10 تشرين الثاني/نوفمبر) وتأثيراتها على الغلة ومكوناتها في الفول (صنف BF 2/2) . وقد كان لموعد الزراعة والكثافة النباتية في كلا الموسمين تأثير معنوى على الغلة البذرية/هـ ؛ حيث تم الحصول على أعلى غلال من المحصول المزروع في 30 تشرين الاول/اكتوبر . وازدادت الغلة طردا مع زيادة عدد النباتات/الجورة ، حيث تم الحصول على أعلى غلة حبية من كثافة نباتية تعادل ثلاث حبات/الجورة ، لذا فينصح بها عند زراعة الفول في منطقة شمبات بالسودان .

Pests and Diseases

الآفات والأمراض

The Susceptibility of Faba Bean and Other Seed Legumes to Infestation by Bruchidius incarnatus (BOH.) and Callosobruchus maculatus (F.) (Coleoptera: Bruchidae).

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Abstract

Oviposition and development of *Bruchidius incarnatus* (Boh.) and *Callosobruchus maculatus* (F.) on eight seed legumes were studied in a thermostatically controlled Kotterman cooled incubator at 30°C and 70% relative humidity. The number of eggs laid on the different seeds varied significantly ($P<0.01$), although the potential fecundity of the two species was about the same. *B. incarnatus* oviposited its highest number of eggs on faba bean (*Vicia faba* L.), whereas *C. maculatus* laid its maximum number of eggs on pigeon pea (*Cajanus cajan* L.). The percentage eggs hatched was significantly ($P<0.05$) affected by host seeds. Percentage of adult emergence was not significantly different between the two species of insects. However, the effect of host and the interaction between host and insect species were highly significant ($P<0.001$). Chickpea (*Cicer arietinum* L.) was the most susceptible host to both insects, whereas cowpea (*Vigna unguiculata* L.) and garden pea (*Pisum sativum* L.) were the most resistant to *B. incarnatus* and *C. maculatus*, respectively. The insects completely failed to develop in either lupin (*Lupinus termis* L.) or in haricot bean (*Phaseolus vulgaris* L.). There was evidence that this reaction may be related to seed coat hardness in haricot bean and to the seed chemical composition in lupin.

Introduction

The Egyptian broad bean weevil, *Bruchidius incarnatus* (Boh.) and the cowpea seed bettle, *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae) are among the most destructive storage pests of pulses in the Sudan. The females glue their eggs to the seed and within 3-4 days (Shazali 1985) the larvae hatch and burrow into the seed cotyledons where they develop and pupate (El-Sawaf 1956; Booker 1967). In addition to weight losses caused by the feeding activity of the larvae, bruchids attack reduces the nutritional and marketing values of the grain and also their viability (Caswell 1981). However, bruchids damage to seed legumes varies according to the insect pest, seed type, and environmental conditions. The preference of bruchids to host seeds was noted at two levels: selection of the host (this is sensory to a large extent) and the ability to complete development in the selected host (Applebaum 1964).

The objective of the present study was to evaluate the susceptibility of faba bean and other seed legumes, commonly grown in Sudan, to both *B. incarnatus* and *C. maculatus*.

Materials and Methods

The experiment was carried out at the Shambat Research Station during the 1986 season, in a thermostatically controlled Kotterman cooled incubator adjusted to 30°C. The relative humidity was maintained at 70% by using large dessicators containing sodium acetate solution (Solomon 1951). Seeds of each of faba bean (*Vicia faba* L.), chickpea (*Cicer arietinum* L.), cowpea (*Vigna unguiculata* L.), garden pea (*Pisum sativum* L.), pigeon pea (*Cajanus cajan L.*), lupin (*Lupinus termis* L.), and haricot bean (*Phaseolus vulgaris* L.) were purchased from the local market and used in this study. The faba bean samples consisted of large seeded type (cv Silaim) and small seeded type (local).

The seeds were first disinfested by freezing for seven days and, then left to equilibrate with the

experimental conditions for three weeks. The equilibrium moisture contents of the different seeds, on fresh - weight basis, were determined by the air-oven method: measuring the change in weight of a ground-seed sample in an air-circulated oven at 130°C for 1 h.

B. incarnatus was obtained from stock cultures that had been maintained on faba bean, whereas *C. maculatus* cultures were bred on chickpea.

The seeds were infested by randomly placing two pairs of newly emerged adults (0-24 h old), of each species, in glass vials (10 x 2.5 cm) containing 10 g of healthy equilibrated seeds. The vials were closed with perforated plastic lids and the adults were left to lay eggs. The number of eggs laid on each seed and the number of hatched eggs were counted when all the adults had died (i.e., 14 days after inoculation). The seeds were then returned to their respective vials and the insects were allowed to develop. When emergence windows were observed on the seeds, the vials were checked daily for adult emergence. The experiment was terminated when no adults emerged in five consecutive days.

To investigate the causes of developmental incompatibility in lupin and haricot bean, the two insect species were allowed to oviposit on seeds with and without seed coat. The seeds were dissected and examined after four weeks, to determine the stage at which mortality occurred. Susceptibility indices were calculated according to the following equation: (Howe 1971; Dobie 1974).

$$\text{Susceptibility index} = \frac{\text{Log S} \times 100}{\text{T}}$$

where S = percentage adult survival, and T = average development period (days).

Results

Average seed weight and percentage moisture contents are given in **Table 1**. Seed weight ranged from 0.096 g for pigeon pea to 1.125 g for faba bean (cv Silaim). The moisture contents of the seeds were in the range of 8.2 - 9.7%.

The oviposition and development data are presented in **Table 2**. Although the potential fecundity of the two species was about the same, the ovipositional response varied significantly ($P<0.05$) between the two species.

Table 1. Average seed weight (g) and moisture content on freshweight basis of different seed legumes.

Seed legume	Seed weight (g/seed)	Moisture content (%)
Faba bean (cv Silaim)	1.123	9.4
Faba bean (local)	0.482	9.7
Chickpea	0.125	8.9
Cowpea	0.188	8.9
Garden pea	0.306	9.1
Pigeon pea	0.096	9.3
Lupin	0.437	8.2
Haricot bean	0.252	8.9

The interaction between insect species and seed type was also significant ($P<0.05$). The number of eggs by *B. incarnatus* was highest on faba bean cv local (60.8) and lowest on chickpea (35.7), whereas *C. maculatus* laid its maximum number of eggs on pigeon pea (60.0) and its minimum on faba bean cv Silaim (37.5). There seems to be no direct relationship between the oviposition preference of the adult and seed size. This is evident from the fact that *C. maculatus* oviposited significantly more on pigeon pea than on the large seeded faba bean (cv Silaim). The two insects also reacted differently to the relatively smooth surface of haricot bean.

The percentage of hatched eggs ranged from 72.5 to 93.3% and therefore no transformation of the data was necessary. **Table 2** shows that egg survival was significantly ($P<0.001$) affected by legume seed type. However, differences between insect species and the interaction between the insect and host was not significant. Maximum egg hatch of *B. incarnatus* occurred on faba bean cv local (93.3%), whereas maximum hatch of *C. maculatus* occurred on chickpea (93.0%). The egg hatch of both species was lowest on lupin and haricot bean.

When lupin and haricot bean data were excluded, the percentage of adult emergence ranged from 6.5 - 90.8 and therefore, the data was transformed into angular transformation (arcsine). **Table 2** shows that the survival of both insect species was significantly ($P<0.001$) influenced by the host. The interaction between insect species and host species type was also highly significant ($P<0.001$).

Based on the susceptibility index, chickpea was the most susceptible host to both insects, whereas cowpea and garden pea were the most resistant to *B. incarnatus*

Table 2. Susceptibility of seed legumes to infestation by *B. incarnatus* and *C. maculatus*.

Insect species	Seed legume	Eggs/ female	Eggs hatched (%)	Adults emerged (%)	Development period (days)	Susceptibility index
B. incarnatus	Faba bean (cv Silaim)	54.3	91.3	48.0 (43.9)[a]	27.4	6.2
	Faba bean (local)	60.8	93.3	57.3 (49.1)	26.6	6.6
	Chickpea	35.7	89.8	70.7 (56.8)	27.3	6.8
	Cowpea	45.7	90.3	16.5 (23.6)	34.1	3.6
	Garden pea	48.5	91.0	55.3 (47.9)	35.0	5.0
	Pigeon pea	40.9	88.8	51.5 (45.9)	29.3	5.8
	Lupin	52.5	86.3	0		
	Haricot bean	41.9	72.5	0		
C. maculatus	Faba bean (cv Silaim)	37.5	90.0	30.0 (33.2)	28.9	5.1
	Faba bean (local)	44.4	89.3	37.8 (37.4)	28.2	5.6
	Chickpea	52.0	93.0	90.8 (72.5)	24.1	8.1
	Cowpea	54.8	90.3	25.3 (30.0)	25.8	5.4
	Garden pea	40.9	88.0	6.5 (14.5)	27.8	2.9
	Pigeon pea	60.0	92.5	90.0 (71.6)	24.6	7.9
	Lupin	50.5	82.0	0		
	Haricot bean	57.5	75.3	0		
	SE±	5.5	4.0	4.8[b]	0.9	

a. Arcsine transformation in parenthesis.

b. Lupin and haricot bean data not included in the analysis.

and to *C. maculatus*, respectively. Faba bean was more susceptible to *B. incarnatus* than to *C. maculatus*. Variations in the susceptibility index were due to differences in the percentage of adult emergence as well as the development period, which was generally longer for *B. incarnatus* (**Table 2**).

Following dissection, all of the newly hatched larvae were found dead before penetrating either the seed coat or the cotyledons of the decorticated haricot bean. The embryonic development was completed but the young larvae died while still inside their egg-shells. The seed coat and the cotyledons of the decorticated haricot bean were slightly dented but never penetrated. In lupin, both species were equally able to penetrate the seed coat and the decorticated cotyledons. When seeds were dissected, early instar larvae were found inside at different depths, indicating that they had fed for sometime. However, these larvae did not develop any further and eventually died.

Discussion

The results presented here indicate that the oviposition preference, in both species, is not always governed by either seed size or seed coat smoothness. There seem to be some other factors than these physical characteristics suggested by Booker (1967). Nevertheless the mean number of eggs laid per grain, in general, may be comparatively more on large seeds due to the larger surface area. The developmental incompatibility in lupin and haricot bean, clearly showed that preference for oviposition does not necessarily imply suitability for larvae development. Howe and Currie (1964) have extensively reviewed other factors affecting oviposition in bruchids.

The development of *C. maculatus* in garden pea, with only 6.5% adult emergence, is in agreement with the findings of Singh *et al.* (1977),who rated it as a poor host, but contrasts with those of Gokhale (1973). Such inconsistencies may be due to differences in the physical and nutritional composition of pea varieties or to different physiological strains of the insect. The suitability of faba bean to *B. incarnatus* compared to *C. maculatus* might partly explain its host specificity, which is restricted mainly but not exclusively to faba bean in the Sudan. The role of population interactions in such host specificity remains to be investigated.

Gatehouse *et al.* (1979) suggested that the presence of physical resistance to *C. maculatus* in cowpeas would have to be expressed in terms of repulsion of oviposition or of failure of larvae to enter the seed. Hence, it is a realistic probability to assume that physical resistance (seed coat hardness) was the cause of immunity in haricot bean. In lupin, the seed coat seems to have no role as a physical barrier: the larvae of both species were able to penetrate into the cotyledons and to feed for some time before their death. Thus it could be inferred that in lupin the cotyledons are either nutritionally deficient or toxic to the larvae. Applebaum *et al.* (1965) explained the resistance of soya bean to *Callosobruchus chinensis* (L.) by the presence of soya bean saponins which cannot be hydrolyzed by the larvae. On the other hand, resistance in cowpea against *C. maculatus* was attributed to the high levels of trypsin inhibitors (Gatehouse *et al.* 1979). The antimetabolic activity of trypsin inhibitors was due to direct inhibition of larvae proteolysis, and thus utilization of protein. Trypsin inhibitors from different sources showed marked species specificity in their inhibitory activity against trypsin-like enzymes (Laskowski and Scalock 1971). For example, cowpea trypsin inhibitors are effective antimetabolites of *C. maculatus* but soya bean inhibitors are not (Gatehouse *et al.* 1979). These and other factors are probably involved in the resistance of lupin to *B. incarnatus* and *C. maculatus*.

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Dura Antad (Agonoscelis pubescens) (Pentatomidae) as a Pest on Faba Bean in El-Rahad, Sudan

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Abstract

Dura antad *(Agonoscelis pubescens)*, a primary pest of sorghum, was recorded on faba bean plants late in January 1987 at El-Rahad (14°N, 34°E) which is one of the new areas for expansion of faba bean production in the Sudan. The relative abundance of this pest on four faba bean lines grown at the Rahad Research Station Farm varied: faba bean lines 0075 (H 72 x G1) and 00634 (RB 30 x G1) attracted higher numbers of the insect than lines 0071 (G2 x G1) and BF 2/2. Further studies are needed to determine the extent and magnitude of damage and the economic losses inflicted by this pest.

Introduction

Faba bean is a staple food for many people in the Sudan. Local supply from the traditional producing areas is insufficient to meet the demand. Therefore the possibility of expanding faba bean cultivation in new areas of Sudan is being explored to help bridge the gap. One of these areas is El-Rahad (14°N, 34°E).

Surveys in EL-Rahad revealed that the crop is subject to attack by different species of insect pests. namely leafminer (*Liriomyza trifolii* Burgess), aphids (*Aphis craccivora* Koch), and thrips (*Caliothrips sudanensis*). These insect pests are regarded as one of the main constraints to increased bean production.

In season 1986/87, the crop was attacked by the Dura antad *(Agonoscelis pubescens*, Pentatomidae) towards late January and the attack continued until harvest. No former record of the presence of this pest on faba bean was available. The present assessment summarized the time of occurrence and relative distribution of this insect on 4 lines of faba bean, namely 0075 (H 72 x G1), 00634 (RB 30 x G1), 0071 (G2 x G1), and BF 2/2.

حساسية الفول والبقوليات الحبية الأخرى للاصابة بخنفساء الفول الصغيرة Bruchidus incarnatus (BOH.) وخنفساء اللوبياء Callosobruchus maculatus (F.) (Coleoptera : Bruchidae)

ملخص

تمت دراسة وضع البيض (تغريز) وتطور خنفساء الفول الصغيرة ، وخنفساء اللوبياء على ثمانية بقوليات حبية في حاضنة Kotterman مبردة ومحكمة الحرارة على 30 م° و 70 % رطوبة نسبية . وقد تباينت أعداد البيوض الموضوعة على مختلف البذور بشكل معنوى (بمستوى 1 %) بالرغم من أن طاقة الإخصاب عند النوعين كانت واحدة تقريبا . وقد وضعت خنفساء الفول الصغيرة أكبر عدد من بيوضها على الفول (Vicia faba L.) ، في حين فعلت خنفساء اللوبياء مثل ذلك على البسلة الهندية (Cajanus cajan L.) . كما تأثرت النسبة المئوية للبيوض الفاقسة بنوعية البذور المضيفة بشكل معنوى (بمستوى 5 %) . ولم تختلف الحشرتان معنويا في النسبة المئوية لظهور الحشرات الكاملة ، إلا أن تأثير العائل والتفاعل فيما بينه وبين نوع الحشرة كانا معنويين جدا (بمستوى 1 بالالف) . وكان الحمص (Cicer arietinum L.) من أكثر العوائل حساسية للإصابة بالحشرتين، اما اللوبياء (Vigna unguiculata L.) والبازلاء (Pisum sativum L.) فكانتا أكثر مقاومة لكل من الحشرتين على الترتيب . وقد أخفقت الحشرتان تماما من التطور سواء على الترمس (Lupinus termis) أو الفاصولياء (Phaseolus vulgaris L.) . وكان هناك ثمة دليل على أن رد الفعل هذا قد يعود إلى صلادة غلاف البذرة في الفاصولياء ، والى التركيب الكيماوى للبذرة في الترمس.

Table 1. Population of *A. pubescens* on four lines of faba bean in El-Rahad, Sudan during the 1986/87 season.

Line No.	Pedigree	Date of count[1]					Mean
		27 Jan	8 Feb	15 Feb	23 Feb	28 Feb	
0075	(H.72 x G1)	52	89	148	70	66	85
00634	(RB.30 x G1)	37	52	181	67	80.5	83.5
00562	(BF 2/2)	41	96.5	103	61	75.5	75.4
0071	(G2 x G1)	30	57	91.5	71.5	58.5	61.7

1 = Total number of the insect/20 plants.

Materials and Methods

The experiment was conducted at the Research Farm, Rahad Research Station during the 1986/87 season. Seeds were sown during the last week of October by hand at a rate of 2 seeds/hole on both sides of a ridge. Subplot size was 7 x 3 m, with 60 cm spacing between ridges and 20 cm between holes. Danitol-S was used to control the leaf miner. Other cultural practices conformed with those recommended for faba bean production in El-Rahad. Periodical counts of *A. pubescens* adults were determined from 20 randomly selected plants.

Results and Discussion

The results of this study showed that the infestation started at late January, and the insect population increased steadily until mid-February decreasing thereafter (**Table 1**). The pest presence was concentrated on the floral part of the plant. The four lines tested showed a differential response to the pest attack. Higher counts of the insect populations were recorded on lines 0075 (H 72 x G1) and 00634 (RB 30 x G1) than on 0071 (G2 x G1) and BF 2/2 (**Table 1**).

The absence of the suitable primary host plant - sorghum - may have contributed to the abundance of the pest at this particular time of the season. Besides, the geographical proximity of the Rahad Scheme to the rainfed area - where sorghum is the traditional crop - may in part explain the presence of this pest on faba bean.

Future investigations are needed to determine the degree of infestation, the extent of damage, and the economic losses inflicted by *A. pubescens* to the faba bean crop.

(Agonoscelis pubescens, Pentatomidae)

آفة حشرية على الفول في الرّهَد بالسودان

ملخص

سجلت الإصابة بحشرة (Agonoscelis pubescens) ـ وهي آفة رئيسية تصيب الذرة البيضاء ـ على نباتات الفول في أواخر كانون الثاني/يناير 1987 في الرهد (14 درجة شمال ، 34 درجة شرق) ، التي تعتبر إحدى مناطق التوسع الجديدة بزراعة الفول في السودان . وقد تباينت الغزارة النسبية بأعداد هذه الافة على أربع سلالات فول زرعت في محطة بحوث الرهد ، فقد اجتذبت سلالتا الفول 0075 (H72 x G1) و00634 (RB30 x G1) أعدادا من الحشرة أكبر مما اجتذبته السلالتان 0071 (G2 x G1) و BF 2/2 . وثمة حاجة للمزيد من الدراسات لتحديد مدى وحجم الضرر ، والخسارات الاقتصادية التي يمكن أن تسببها هذه الافة .

Use of Dazomet for Broomrape Control in Faba Bean

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Abstract

Two pot-culture experiments and two field trials were conducted at Giza, Egypt to study the potential of Dazomet to control broomrape *(Orobanche crenata* Forsk.) in faba bean *(Vicia faba* L.) during 1982-1986. Faba bean genotypes Rebaya 40, Giza 402, and Giza 2 could tolerate Dazomet upto 50 kg/ha. Pre-plant incorporation of Dazomet at 25 kg/ha gave excellent control of *Orobanche crenata* while post-emergence and post-sowing applications gave relatively lesser control. Seed yield of faba bean increased with the application of Dazomet, the increase being particularly conspicuous with pre-planting incorporation of the chemical.

Introduction

Orobanche crenata Forsk. is an important root parasite of faba bean in Egypt. Its damage to crop plants is sometimes so severe that a complete crop failure can occur. Because of the very heavy infestation of fields with the parasite in middle Egypt, several farmers have stopped growing faba bean. Research has, therefore, been conducted at the Agriculture Research Center, Giza to control this parasite. As a result, Glyphosate was identified as an effective herbicide for use in faba bean fields. However, because of the very narrow margin between the safe and toxic concentrations of this chemical for the host plant, its field-use has been rather limited. Efforts have, therefore, been made to identify alternative chemicals that may control the parasite effectively without causing any phytotoxicity to the host plant.

Dazomet, a partial soil sterilant, has been used by several workers as a herbicide because of its effect on the weed seeds (Bianco 1971; Unterladstater and Fuents 1978; Issa 1979; Bond and White 1983; Lawson 1984; Nestby 1985). Murthy and Lal (1982) reported that Dazomet markedly decreased the infestation of tobacco crop with *Orobanche cernua*. It was, therefore, thought worthwhile to test the potential of this chemical in controlling broomrape in faba bean. The results of these studies are described in this paper.

Materials and Methods

Four different experiments were conducted at Giza, Egypt. The first two, conducted in 1982/83 and 1983/84, were pot-culture studies, while the last two conducted in 1984/85 and 1985/86 were field trials.

In the pot-culture study during 1982/83, 50cm^2 size pots were used with Giza soil naturally infested with *Orobanche crenata*. Five plants of 'Rebaya 40' faba bean were grown per pot. Dazomet was applied at 25, 37.5, and 50 kg/ha 63 days after sowing (post-emergent). The required amount of chemical was dissolved in water and poured on the soil surface under the faba bean plants. More water was then applied to ensure that the whole pot was completely wetted to ensure distribution of the herbicide. Each treatment was replicated six times. Treatment effect was evaluated at the physiological maturity of the crop which was reached 133 days after sowing.

In 1983/84, pot-culture was set up with 'Giza 3' faba bean in the same way as in 1982/83. However, only one dose of Dazomet (25 kg/ha) was tested as a pre-plant incorporated herbicide against untreated check. Also, in this trial artificial infestation of *Orobanche crenata* was done by applying 2 g seeds of the parasite per pot before the application of the herbicide. There were six replications and the treatment effect was evaluated at physiological maturity of the crop, 147 days after sowing.

In the field trial in 1984/85, five different rates (0, 12, 24, 36 and 48 kg/ha) of Dazomet were tested as a post-sowing application at Giza, where the soil is naturally infested with *O. crenata*. Plot size was 5.4 m^2 and there were four replications. Two cultivars of faba bean ('Giza 402' and 'Giza 2') were used as main plots and the five rates of Dazomet application as sub-plots in a single-split plot design. The required quantity of herbicide for each sub-plot was mixed with 0.5 kg sand and spread evenly on the soil surface of the sub-plot immediately after the sowing. The plot was then irrigated. Treatment effect was evaluated at physiological maturity of the crop, 126 days after sowing.

Table 1. Effect of post-emergence application of Dazomet on broomrape infestation and faba bean (Rebaya 40) plant height and yield.

Rate of Dazomet (kg/ha)	Bromrape/pot*				Faba bean		
	Tubercles		Spikes				
	No.	D W (g)	No.	D W (g)	Height (cm)	Pods/ pot	Seed yield (g/pot)
25.0	1.00	1.00	1.00	1.00	69	11.7	6.45
37.5	1.29	1.17	1.00	1.00	71	10.8	6.45
50.0	1.86	1.41	1.50	1.62	59	7.8	6.30
00.0	4.55	2.75	3.16	3.29	68	7.1	5.70
LSD (P<0.05)	0.80	0.58	0.40	0.62	7.8	3.36	0.17

* Relative values log transformed.

Table 2. Effect of pre-plant incorporation of 25 kg/ha Dazomet on broomrape infestation and faba bean (Giza 3) yield.

Dazomet	Broomrape spikes/pot		Pods/ plant	100-seed weight (g)	Seed yield (g/pot)
	No.	D W (g)			
+	4.50	4.00	13.8	69.36	24.67
-	12.50	12.52	6.7	62.63	9.18
LSD (P<0.05)	2.51	2.62	1.1	3.56	2.65

The field experiment was repeated in 1985/86 using the same experimental details as in 1984/85 with the except that the sub-plot size was increased to 10.8 m^2 and each plot received 200 g seeds of *Orobanche crenata* before the sowing of the crop.

Results and Discussion

Post-emergence application of Dazomet at 25 kg/ha in 1982/83 gave an excellent control of *Orobanche crenata* both in terms of subterranean tubercles as well as the emerged spikes (**Table 1**). Increasing the dose of Dazomet above 25 kg/ha gave no additional advantage. Plant height of faba bean was not affected by 25 and 37.5 kg/ha rates but was slightly reduced with 50 kg/ha dose in comparison to untreated check.

Pre-plant incorporation of 25 kg Dazomet/ha in 1983/84 resulted in a significant reduction in the number and dry weight of emerged spikes of the broomrape (**Table 2**). The number of pods/plant was doubled, the 100-seed weight increased by about 11%, and the seed yield increased by nearly 160% with Dazomet application when compared to untreated check (**Table 2**).

Because of the promising effect of Dazomet in controlling broomrape and increasing yield of faba bean in the pot studies in 1982/83 - 1983/84, it was thought worthwhile to evaluate the performance of this herbicide in the field. This was done in 1985-86 using *Orobanche*-tolerant (Giza 402) and susceptible (Giza 2) genotypes of faba bean. A post-sowing application was adopted. Giza 402 showed less broomrape infestation than Giza 2 in both the years and gave significantly higher yields (**Table 3**). This result is consistent with the earlier observations on the lesser susceptibility of Giza 402 to infestation with broomrape as compared to the genotype Giza 2 (Nassib *et al.* 1979; Saxena and Stewart 1983; Nassib *et al.* 1984).

Post-sowing application of 12 to 24 kg Dazomet/ha caused, on an average of the two seasons, a significant

Table 3. Varietal differences in broomrape infestation and yield of faba bean in field at Giza, 1984-86. Data are means over all the five rates of Dazomet application.

Variety	Broomrape spikes/m^2		Pods/ plant	Seed yield	
	No.	D W (g)		g/plant	t/ha
1984/85					
Giza 402	11.15	35.07	11.2	21.02	2.93
Giza 2	16.55	44.90	8.9	19.98	1.96
F. test	Sig.	Sig.	Sig.	NS	Sig.
1985/86					
Giza 402	9.00	23.88	12.4	21.74	3.40
Giza 2	10.60	32.29	9.7	18.99	2.79
F. test	NS	Sig.	Sig.	NS	Sig.

Table 4. Effect of post-sowing application of different rates of Dazomet on broomrape infestation and yield of faba bean (mean of Giza 402 and Giza 2) at Giza, 1984-86.

Dazomet rate (kg/ha)	Broomrape spikes/m^2						Seed yield (t/ha)		
	No.			D W (g)					
	1984/85	1985/86	Mean	1984/85	1985/86	Mean	1984/85	1985/86	Mean
0	16.5	12.0	14.2	44.68	38.75	41.72	2.00	2.51	2.26
12	13.0	9.0	11.0	32.30	25.04	28.68	2.86	3.40	3.13
24	12.1	8.9	10.5	39.99	24.44	32.22	2.63	3.24	2.94
36	13.4	9.6	11.5	38.34	25.64	31.99	2.35	3.17	2.76
48	14.3	9.5	11.9	44.63	26.56	35.60	2.37	3.14	2.76
LSD (P<0.05)	NS	1.42	1.88	NS	6.27	5.60	NS	2.51	0.30

(P<0.05) reduction in the broomrape infestation and a significant (P<0.05) increase in the yield of faba bean over the untreated check. Although the correlation between the number of broomrape spikes and their dry weight with seed yield of faba bean was significant, the respective correlation coefficients being r= -0.663** and r= 0.527** (**Fig. 1**), the improvement in the yield obtained with Dazomet may not necessarily be all due to the control of parasite. Being a soil sterilant, Dazomet's effect on the performance of faba bean crop might be a net result of its effect on various beneficial and harmful microorganisms in the soil.

The study has shown that the efficiency of the chemical in controlling the parasite and increase faba bean yield was greater in the pot-culture experiments than in the field trials. Perhaps the pot-culture provided better soil conditions, particularly the moisture content, for the chemical to become effective in damaging the germinating broomrape seeds. Issa (1979) showed that Dazomet, at 50 ppm, controlled *Cyperus rotundus* better when the soil moisture was maintained at 30% as against a moisture regime of 15%.

Also, pre-plant incorporation of Dazomet proved more effective than either the post-emergence or post-sowing application. It would, therefore, be worthwhile to study the effect of pre-plant incorporation of Dazomet at various moisture regimes in field conditions. The results of these studies have shown that there is no need to try application of Dazomet at rates higher than 25 kg/ha and it may be useful to test doses even lower than 12 kg/ha.

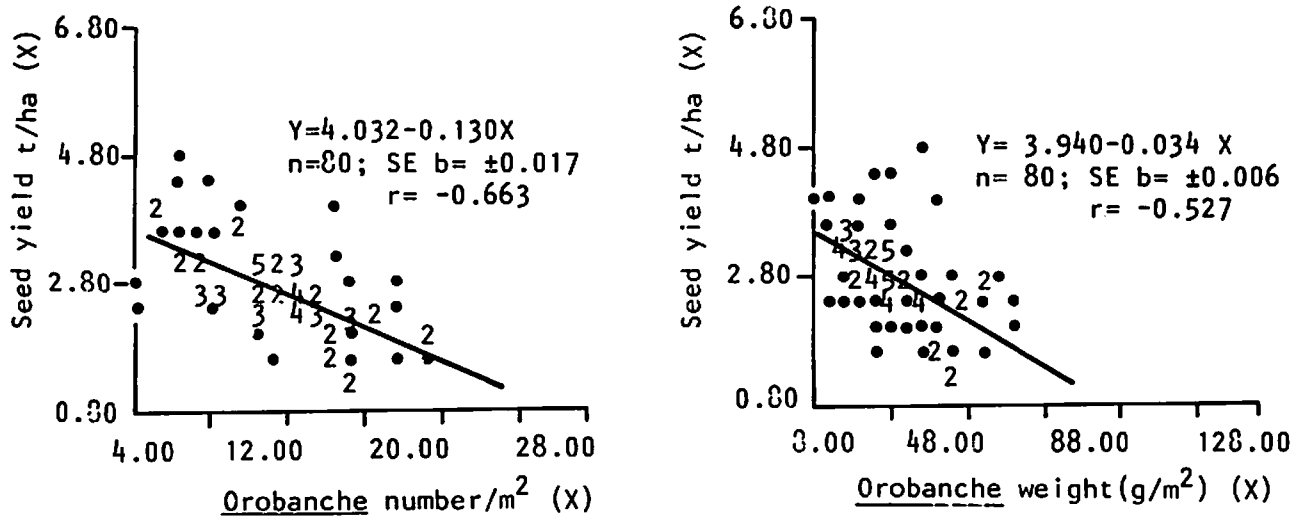

Fig. 1. Relationship between the number of broomrape shoots or broomrape shoot dry weight and seed yield of faba bean; data from 1984/85 and 1985/86 seasons. Numbers on the scatter diagram show actual number of points at that location.

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استعمال الدازوميت (Dazomet) لمكافحة الهالوك في الفول

ملخص

أجريت خلال المدة من 1982 - 1986 تجربتان في أصص ، وتجربتان حقليتان في الجيزة بمصر ، وذلك لدراسة كفاءة الدازوميت في مكافحة الهالوك المفرض Orobanche (crenata Forsk.) على الفول (Vicia faba L.). وتبين أنه يمكن لطرز الفول الوراثية Rebaya 40 وجيزة 402 وجيزة 2 أن تتحمل حتى 50 كغ /هـ من الدازوميت ، وقد أدت المعاملة قبل الزراعة بجرعة تعادل 25 كغ /هـ منه إلى تحقيق مكافحة ممتازة للهالوك المذكور ، في حين حققت المعاملتان : بعد ظهور البادرات وبعد البذر مكافحة أقل نسبيا . وقد ازدادت الغلة البذرية للفول مع استخدام الدازوميت ، وكانت الزيادة أكثر وضوحا عند المعاملة بهذا الكيماوى قبل الزراعة .

A Simple Method for Mass Spore Production of Botrytis fabae, the Causal Fungus of Chocolate Spot of Faba Bean

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Abstract

Simple methods for spore production of *Botrytis fabae* Sardina were investigated by comparing two media containing chrysanthemum (*Chrysanthemum sinense* Sabine) flowers (CHSF) or marigold (*Tagetes signata*) flowers (MGF) supplemented with 3% dextrose (w/w) with the commonly used faba bean dextrose agar (FDA) medium. The UV light irradiation was a prerequisite for mass sporulation of *B. fabae* on MGF and FDA media while on the CHSF medium a high level of sporulation occurred even under the normal laboratory conditions (18-25°C) without UV irradiation. The use of the CHSF medium for mass spore production of *B. fabae* is, therefore, simple and efficient, and is recommended for use elsewhere especially in the developing world.

Introduction

Several field and laboratory techniques for screening of faba bean (*Vicia faba* L.) for resistance to chocolate spot (*Botrytis fabae* Sardina) are now available for use (Hanounik 1986). However, mass production of *B. fabae* spores is a prerequisite for the use of these techniques, the failure of which may become a limiting factor, especially in the field screening. *B. fabae* requires such treatments for its sporulation on artificial media as exposure to a temperature of 15 - 20°C (Harrison 1984), irradiation for 12 h/day by fluorescent lamps (Hanounik 1986) or UV lamps (IAR 1987), and special nutritional requirements (Dereje 1986). In addition, special facilities are required for these treatments which are not always easily available in developing countries. Therefore, work to explore some simpler and less expensive methods for mass spore production of *B. fabae* was initiated at the Holetta Agricultural Research Center (HARC) of the Institute of Agricultural Research.

Materials and Methods

Three growth media, *viz.*, chrysanthemum (*Chrysanthemum sinense* Sabine) flowers (CHSF), marigold (*Tagetes signata*) flowers (MGF), and faba bean dextrose agar (FDA) were tested in replicated and repeated laboratory tests. For the preparation of the first two media, 25 g of flower petals and 15 ml of 5% dextrose solution were added in each 250 ml flask and autoclaved at 15 psi for 30 min. The petals were collected after thoroughly washing the flowers of both the species in tap water for few min. The FDA medium was prepared according to Hanounik (1986). A 7-mm disk from the pure culture of the Holetta isolate of *B. fabae* grown on FDA was used to inoculate each flask containing the growth medium. The inoculated flasks were incubated under the following conditions: (i) 15 ± 2^{o}C with UV irradiation, (ii) 20 ± 2^{o}C with UV irradiation, (iii) 20 ± 2^{o}C and 24 h darkness, (iv) 15 ± 2^{o}C and 24 h darkness, and (v) on the laboratory bench without UV irradiation (18-25°C with about 12 h day light through glass windows). After two weeks of incubation, the fungus growth from half of the flasks from each treatment was blended in 0.5 l of tap water and strained through a four-layer cheesecloth. Number of spores/ml in each treatment was determined by placing 30 µl of spore suspension on a glass slide and covering it with 18x18 mm glass coverslip without allowing any overflow. The spore numbers were calculated by considering the area of the glass coverslip and the volume of spore suspension, and were expressed in number of spores/cm^2. The number of sclerotia/flask was determined from the other half of the flasks that were incubated for one month.

Results and Discussion

High spore production was obtained in all the three test media (FDA, CHSF, and MGF) when the fungus-inoculated flasks were irradiated with UV light for 12 h/day (Table 1). The highest sporulation (1.8 million spores/cm^2) was obtained in CHSF incubated at 20 ± 2^{o}C and irradiated with UV light for 12 h. This was followed by MGF with 1 million spores/cm^2 and then FDA with 0.5 million spores/cm^2. In the absence of UV light (darkness treatment) either no or very low sporulation

Table 1. Sporulation and sclerotia formation in *Botrytis fabae* Sard. on three growth media incubated under different light and temperature treatments[1].

Growth medium	24 h darkness		12 h UV light		Lab bench natural light
	15±2°C	20±2°C	15±2°C	20±2°C	18-25°C
	Sporulation[2]				
Faba bean-dextrose agar	0	0	1,000	500	0.1
Chrysanthemum flowers	0.1	0	1,000	1,800	1,800
Marigold flowers	0	0	1,000	1,000	0.1
	Sclerotia formation[3]				
Faba bean-dextrose agar	M	M	F	M	M
Chrysanthemum flower	M	M	O	O	O
Marigold flower	M	M	M	M	M

1. Average of five replicated tests conducted in 1987.
2. Number of spores (x 1000).
3. Sclerotia number were graded as: 0= no sclerotia formed; F= few, about 50 sclerotia/flask; and M= many, about 100 sclerotia/flask.

occurred (100 spores/cm^2) in CHSF incubated at 15±2°C. This UV irradiation requirement for *B. fabae* sporulation is in accordance with reports by other workers (Harrison 1978, 1984; Epton and Richmond 1980; Hanounik 1986). Interestingly, a high sporulation (1.8 million spores/cm^2) also occurred in CHSF under the normal laboratory conditions (18-25°C) without UV irradiation which was as good as in flasks with CHSF incubated at 20±2°C with UV irradiation. In contrast, very few spores (100 spores/cm^2) were produced in FDA and MGF media under the same incubation conditions. Although FDA is a commonly used medium for *B. fabae* propagation (Hanounik 1986), these results show that it can be effectively used only at lower temperatures with UV irradiation. The abundant sporulation of *B. fabae* in CHSF medium was consistent under the normal laboratory conditions throughout the one-year study period.

Abundant sclerotial production (100 sclerotia/flask) occurred in FDA and MGF media almost under all the conditions of incubation (**Table 1**). Also, abundant sclerotia developed in CHSF medium when incubated at 15±2°C and 20±2°C in darkness; no sclerotia developed in any of the other treatments. Although sclerotia formation seemed to be high in treatments with no spore production, it was not consistent enough to make any generalizations.

In the past, the growth medium containing marigold flowers supplemented with 2% dextrose has been successfully used for mass spore production of *B. cinerea*, the causal agent of gray mold of chickpea (Chaubey *et al.* 1983). In the present study, although the MGF medium was not as effective as the CHSF medium for *B. fabae* sporulation, it proved to be as good as FDA. This is the first report on the use of chrysanthemum flowers for mass production of *B. fabae* spores.

In conclusion, chrysanthemum flowers with 3% dextrose provided an excellent growth medium for the sporulation of *B. fabae* without production of sclerotia. By using it we were able to obtain large amount of *B. fabae* spores in two weeks under the normal laboratory conditions without UV irradiation. As a result, this enabled us to inoculate the chocolate spot screening nurseries at Holetta Agricultural Research Center. The disease development was severe (15-30 spots/leaflet) in a susceptible faba bean cv PGRC/E 27316 after 5 days of inoculation. Thus, the new medium using dextrose-supplemented chrysanthemum flowers has proved a simple, inexpensive, and effective method for large-scale spore production of *B. fabae*. The method is useful, especially for developing countries where sophisticated laboratory equipment are not always available.

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طريقة بسيطة لإنتاج الأبواغ على نطاق كبير للفطر Botrytis fabae المسبب لمرض التبقع الشوكولاتي على الفول

ملخص

تمت دراسة طرائق بسيطة لإنتاج أبواغ الفطر Botrytis fabae Sardina ، وذلك بعقد مقارنة بين بيئتين غذائيتين تحتويان على أزهار نبات الاقحوان الصيني Chrysanthemum sinensis Sabine (CHSF) أو أزهار نبات المخملية البقعاء Tagetes singnata (MGF) ، مع اضافة 3 % دكستروز (w/w) على بيئة أجار دكستروز الفول الشائعة الاستعمال (FDA) . وكانت الأشعة فوق البنفسجية UV متطلبا أساسيا لتشكل أبواغ الفطر المذكور على البيئتين MGF و FDA ، في حين حدثت نسبة عالية من التبوغ على بيئة CHSF حتى تحت ظروف المختبر الطبيعية (18 - 25 م°) ، وبغياب الأشعة فوق البنفسجية . وهكذا نجد أن استعمال البيئة CHSF لإنتاج أبواغ الفطر B. Fabae على نطاق كبير أمر بسيط وفعال ، لذا فينصح باستعمالها في أماكن أخرى وخاصة البلدان النامية .

Seed Quality and Nutrition

جودة البذور والتغذية

Effect of the Raw Legume Faba Bean (Vicia faba L.) on the Rate of Muscle and Liver Protein Metabolism in Rats

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Abstract

Body weight gain (BWG), food efficiency rate (FER), protein efficiency rate (PER), gastrocnemius muscle and liver weight, protein content, and RNA:DNA ratio as well as protein synthesis capacity (PSC) along with other metabolic parameters, of both gastrocnemius muscle and liver were measured in rats (80 - 90 g initial body weight) fed *ad libitum* for 12 days on 18.8% protein diets containing either casein (5% of methionine added; control) or the raw faba bean (*Vicia faba* L.) as the sole sources of protein. It was found that, as compared to casein-fed rats, those fed the legume diet exhibited a significant reduction ($P < 0.05$) in BWG, FER, PER, liver RNA:DNA, and muscle and liver PSC. These results indicated that feeding growing rats a raw faba diet brings about a significant reduction in the rate of protein synthesis both in muscle and liver.

Introduction

In many European countries legumes are widely cultivated for use in both animal and human nutrition: their relatively good and inexpensive protein content make these plants very useful in the production of mixed feeds (Young and Scrimshaw 1979; Duke 1981). However, several undesirable biochemical and physiological effects are observed in growing animals when raw legumes account for the sole or major source of protein in their diets diets (Jaffe and Brucher 1974; Tobin and Carpenter 1978; Marquardt *et al.* 1983). Among these effects, increased liver and skeletal muscle protein catabolism (Cenarruzabeitia *et al.* 1979; Santidrian *et al.* 1987), as well as alterations in the protein composition - increased non protein nitrogenous fraction and decreased sarcoplasmic nitrogenous fraction (Santidrian 1980; Santidrian *et al.* 1980) - both in rats and birds, are especially relevant. Sulphur amino acid deficiency of the legume protein (Marquardt and Campbell 1974; Bond 1980; Sarwar and Peace 1986) and the presence of antinutritive factors (Liener 1980; Mitaru *et al.* 1984; Nakata and Kimura 1981), along with the relatively low digestibility of such proteins (Bender and Mohammadiha 1981; Sarwar and Peace 1986), are thought to be main causes of the aforementioned effects.

The aim of this study was to further investigate muscle and liver protein metabolism in growing rats fed a diet in which the raw faba bean ((*Vicia faba* L.) was used as the only source of protein.

Materials and Methods

Twenty Wistar male rats, 40 days old and weighing about 80-90 g were randomly assigned into two dietary groups of 10 animals each. Rats were housed in cages with wire floors in a room maintained at 23°C. One group was fed a diet containing casein (Merck) as the sole source of protein; in order to compensate for the relatively low sulphur amino acid content of this protein (Sarwar and Peace 1986), methionine (5% of the total diet) (Sigma Chemical Co., St. Louis, MO) was added; this diet was taken as control. The other group was fed a diet in which flour of the raw faba bean (*Vicia faba* L.) was used as the sole source of protein. Diets were prepared according to the AOAC (1980) recommendations. They were isocaloric and contained about 18.8% of protein (N x 6.25). Composition of diets, as well as that of the legume seeds, is given in **Table 1**. Both food and water were supplied *ad libitum* to the experimental animals over a period of 12 days. Body weight changes, food intake, food efficiency rate (FER: food intake/ weight gain and protein efficiency rate (PER: weight gain/protein consumed) were recorded every day for each rat.

At the end of the 12-day feeding period, rats were killed by decapitation, and immediately after bleeding, gastrocnemius muscles from rear limbs and livers were carefully excised and weighed. Total protein content of both muscle and liver was determined according to the method of Lowry *et al.* (1951). Total muscle and liver DNA was measured by the diphenylalanine method of Burton (1956) as modified by Giles and Myers (1965). Total RNA content of both organs was evaluated according to the method described by Millward *et al.* (1974). These determinations allow for the calculation of the following parameters: (i) RNA (mg/g of tissue):DNA (mg/g of tissue) ratio indicative of the intracellular concentration of RNA that may be in direct correlation with an organ protein synthesis rate (Millward *et al.* 1973; De Benoist *et al.* 1984); (ii) cell size, parameter commonly used in experiments carried out in protein turnover studies (Heard *et al.* 1977; Palmer *et al.* 1983) that indicates the amount of protein in tissue cells (indicative of cell mass) and that is determined by the ratio protein (mg): DNA (mg), (iii) protein synthesis capacity (Preddy and Garlick 1983), which is the ratio between the two former parameters (RNA/DNA and cell size, and will therefore have mg of RNA/mg of protein as units) and represents the capacity of RNA to build up proteins (Waterlow *et al.* 1978); and (iv) number of nuclei, like the former parameters is relatively used in metabolic studies (Enesco and Leblond 1962; Enesco and Puddy 1964; Marcos et al. 1984), and is determined by calculating the ratio DNA (mg/g of tissue)/6.2 x 103 expressing directly, in millions, the number of nuclei of the corresponding organ.

Statistical analysis was carried out by conventional Student 't' test. Comparison with the animals fed the casein diet were made.

Results and Discussion

Results of the experiments are summarized in **Tables 2, 3, and 4. Table 2** shows that, as compared to casein-fed rats, those fed the *Vicia faba* diet exhibited a significant reduction in the rate of growth ($P<0.01$), food efficiency rate (FER) ($P < 0.05$) and protein efficiency rate (PER) ($P < 0.01$). These findings correlate with previously reported data (Marquardt\ *et al.* 1983; Santidrian *et al.* 1986) and show the outstanding growth inhibitory effect on growing rats when fed raw faba bean diets. This growth inhibition is accompanied by a poor food and dietary protein utilization by the experimental animals, which agrees with similar results previously published (Bender and Mohammadiha 1981). It is not completely understood why faba bean protein is not efficiently transformed into body protein. Nevertheless, the low digestibility of such proteins (Bender and Mohammadiha, 1981) as well as the sulphur amino acid deficiency (Marquardt and Campbell 1974; Bond 1980) might explain, at least in part, these effects. There were no significant differences in the amount of food intake when expressed per unit of body mass, between the two experimental groups (**Table 1**). This agrees with previous work carried out on chickens fed raw faba bean diets (Santidrian *et al.* 1984) and shows once more that the

Table 1. Ingredients of the experimental diets (%).

Diet	Casein[1]	Faba bean[2]
Casein	20.80	
Raw faba bean		76.00
Saccharose	31.25	8.00
Potato starch	31.25	8.00
Olive oil	4.50	4.00
Cellulose	6.00	
Mineral mixture[3]	4.50	2.50
Vitamin mixture[4]	1.65	1.60
Total protein (N x 6.25)	18.80	18.6

1. Methionine (5%) was added to the casein diet.
2. Faba bean composition (%): protein, 23.5; ether extract, 0.9; ash, 2.8; crude fiber, 6.9; moisture, 10.8; and total carbohydrate, 44.9.
3. Mineral mixture (%): NaCl, 13.92; KI, 0.079; KH_2PO_4, 38.91; $MgSO_47H_2O$, 5.73; $CaCO_3$, 38.14; $FeSO_47H_2O$, 2.7; $MnSO_4H_2O$, 0.4; $ZnSO_47H_2O$, 0.055; $CuSO_45H_2O$, 0.048; $CoCl_26H_2O$, 0.002.
4. Vitamin mixture (mg/g): vitamin K, 0.15; choline, 200; niacin, 4; calcium pantothenate, 4; riboflavin, 0.8; thiamin hydrochloride, 0.5; pyridoxine hydrochloride, 0.5; folic acid, 0.2; biotin, 0.04; and (in IU): vitamin A, 2,000; vitamin D, 200; vitamin E, 10.

Table 2. Body weight gain, food intake, food efficiency rate (FER), and protein efficiency rate (PER) of rats fed *ad libitum* over a period of 12 days on 18.8 % protein diets, containing either casein (control) or raw faba bean as the sole source of protein.

Diet	Casein	Faba bean
Body weight gain (g/day)	71.00±0.4	4.6±0.5**
Food intake, (g)/100g body weight	11.20±0.7	11.7±0.3
FER	1.69±0.0	1.5±0.06*
PER	2.80±0.2	1.8±0.2**

Figures are mean values (±SEM) from 10 rats in each group.
* $P<0.05$; ** $P<0.01$ (Student's t test), as compared to casein-fed rats.

growth inhibition and poor nutrient utilization - as well as the metabolic effects discussed later - cannot be attributed to differences in the amount of energy or protein consumed by the experimental animals. It seems, therefore, that the organoleptic properties (which in principle could be related to the palatability, smell, texture, etc. of the legume diet) do not influence the nutritional and metabolic effects reported in this study.

Table 3 shows that there were no significant differences either in weight or in protein content, expressed per unit of body mass, both in gastrocnemius muscle and liver. This means that the reduction of body mass caused by the raw legume paralleled the reduction of these organ weights. Nevertheless, a tendency to reduce muscle protein is observed in the legume-fed rats. Muscle DNA and RNA were significantly ($P < 0.05$ reduced, whereas liver DNA increased ($P < 0.05$) in the legume-fed animals as compared to the control ones. No significant differences were observed in liver RNA.

Finally, **Table 4** shows that, as compared to the control rats, a significant reduction in the number of nuclei was found both in muscle ($P < 0.05$) and liver ($P < 0.01$), which indicates a reduction in the cell

Table 3. Weight, protein content, total DNA, and total RNA of gastrocnemius muscle and liver of rats fed *ad libitum* over a period of 12 days on 18.8% protein diets, containing either casein or raw faba bean as the sole source of protein.

Diet		Casein	Faba bean
Weight (g)/100 g body weight	Gastrocnemius	0.53±0.02	0.52±0.02
	Liver	4.00±0.25	4.39±0.25
Protein (g)/100 g body weight	Gastrocnemius	18.40±0.8	16.70± 0.1
	Liver	16.00±2.9	16.90±4.2
DNA (mg)/g weight	Gastrocnemius	1.12±0.06	0.90±0.04*
	Liver	1.59+0.10	2.51+0.16**
RNA (mg)/g weight	Gastrocnemius	2.68±0.15	1.89±0.19**
	Liver	6.95±0.31	6.21±0.19

Figures are mean values (±SEM) from 10 rats in each group.
* P< 0.05; ** P< 0.01 (Student's t test), as compared to casein-fed rats.

Table 4. RNA:DNA ratio, cell size, protein synthesis capacity (PSC), and number of nuclei (NN) of gastrocnemius muscle and liver of rats fed *ad libitum* over a period of 12 days on 18.8% protein diets, containing either casein (control) or raw faba bean as the sole source of protein.

Diet		Casein	Faba bean
RNA:DNA	Gastrocnemius	2.40±0.09	2.12±0.10
	Liver	4.50±0.52	2.50±0.10**
Cell size, protein (mg)/DNA (mg)	Gastrocnemius	165.30±7.20	187.10±11.4*
	Liver	102.00+7.50	66.10+3.5**
PSC, RNA (mg)/protein (mg)	Gastrocnemius	14.66±1.03	11.39±0.27*
	Liver	43.80±1.90	37.90±1.10*
NN, DNA (mg/g)/6.2 x10^3	Gastrocnemius	130.60±6.10	005.00±5.2*
	Liver	459.00±68	132.00±180**

Entries are mean values (±SEM) from 10 rats in each group.
* P< 0.05; ** P<0.05 (Student's t test), as compared to casein-fed rats.

population of these organs. This agrees with the results of Marcos *et al.* (1984). Liver RNA:DAN ratio (**Table 4**) was significantly smaller ($P < 0.01$) in the legume-fed rats. Muscle RNA:DNA ratio tended to be insignificantly reduced as a consequence of feeding growing rats the raw faba bean.

Besides, protein synthesis capacity - which as already said is the ratio between RNA:DNA and cell size (i.e., cell mass, in terms of protein) - was significantly reduced ($P < 0.05$) both in liver and muscle in the raw legume-fed rats as compared to the control ones. This fact correlates with previous investigations (Goena *et al.* 1984) and shows the antianabolic effect caused by the raw legume. Taking into account that as already published, both rats and chickens fed different raw legume diets displayed an increase in muscle and liver protein catabolism (Cenarruzabeitia *et al.* 1979 ; Santidrian *et al.* 1984, 1987), it can be assumed that such nutritional conditions give rise to an outstanding impairment of protein metabolism in the experimental animals. These results might explain, perhaps only in part, the reduction in the sarcoplasmic nitrogenous fraction of the skeletal musculature observed in growing rats and birds fed this and other legume diets (Santidrian *et al.* 1980). The intrinsic mechanism by which this catabolic effect takes place is not as yet completely understood, although several hypotheses may be put forward. Among them, the aforementioned low sulphur amino acid content of the legume protein, and especially, the presence in the raw legume seeds of a variety of substances known as antinutritive could account for these effects.

In conclusion, the results of this experiment showed that, in comparison to control casein-fed growing rats, those fed a raw faba bean diet (*Vicia faba* L.) exhibited a marked reduction in the rate of growth, food and protein efficiency rates, liver RNA:DNA as well as in muscle and liver protein synthesis capacity.

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تأثير قرون الفول (Vicia faba L.) غير الناضجة على معدل أيض بروتين العضلات والكبد في الجرذان

ملخص

جرى قياس زيادة وزن الجسم (BWG) ، ومعدل فعالية الغذاء (FER) ، ومعدل فعالية البروتين (PER) ، ووزن العضلة التوأمية البطن والكبد ، والمحتوى البروتيني ، ونسبة DNA : RNA ، وأيضا قدرة تركيب البروتين (PSC) ، بالإضافة إلى معايير الأيض الأخرى لكل من العضلة التوأمية البطن والكبد . وذلك على الجرذان (وزن الجسم المبدئي 80 - 90 غ) التي تغذت لاثني عشر يوما بشكل اختيارى على أغذية تحوى على 18.8 % من البروتين سواء الكازين (5 % من الميثيونين المضاف ، كشاهد) ، أو فول غير ناضج (Vicia faba L.) كمصدر وحيد للبروتين . وبنتيجة المقارنة مع الجرذان التي غذيت بالكازين ، تبين أن الجرذان التي تغذت على قرون الفول قد أظهرت انخفاضا معنويا (بمستوى 5 %) في الـ BWG و FER و PER ونسبة DNA : RNA في الكبد ، و PSC في العضلات والكبد . وقد أشارت هذه النتائج إلى أن إطعام الجرذان الفتية فولا غير ناضج يؤدى إلى تقليل معدل تركيب البروتين في كل من العضلات والكبد بشكل معنوى .

Effect of Time of Harvest and Cooking on the In Vitro Digestibility of Faba Bean Proteins

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Abstract

The *in vitro* protein digestibility of faba bean cultivar BF 2/2 harvested from New Halfa and Shambat locations was investigated with respect to plant age at harvest and cooking process. At both localities, the protein content decreased significantly as the harvest was delayed. However, there was an increase in the water soluble proteins (albumin). Cooked Shambat and New Halfa beans gave the highest values of protein digestibility, 93% and 91%, when harvest was at 110 and 120 days after sowing, respectively. Although delayed harvest reduced the protein content, it improved the nutritive value.

Introduction

In Sudan, faba bean is an important food crop (FABIS 1986). The dietary role of the bean was investigated earlier (Ali *et al.* 1982,1983). The high lysine content (Marquardt 1984) has encouraged the use of the bean as a protein supplement to cereal foods (Patel and Johnson 1974), in dairy products (Abou Donia and Salam 1981,1982), and in weaning foods (Ali *et al.* 1982). Recently, the effect of time of harvest on the bean yield and quality was reported (Salih and Ali 1986). In this paper, the work of Salih and Ali (1986) is complemented by studying the effect of time of harvest and cooking on the *in vitro* digestibility of faba bean proteins.

Materials and Methods

A faba bean cultivar (BF 2/2) was grown during the 1985/1986 season on the research fields of New Halfa and Shambat at Sudan. Harvesting was done at different intervals: 90, 100, 110, 120, and 130 days. Each sample was divided into two halves. The first half was cooked and prepared according to the procedure of Ali (1987). Cooked seeds were drained and dried at low temperature (45 ± 2°C) after which they were ground into fine powder using a 60 mesh screen, and stored for further analysis.

Moisture and protein contents were determined according to AOAC (1975).

Pepsin-pancreatin digestion was measured by the method of Saunders *et al.* (1973): each sample (250 mg) was placed in a 50 ml centrifuge tube and suspended in 15 ml of 0.1N HCL containing 1.5 mg pepsin (activity 3200-3800 Units/mg protein). After incubation at 37°C for 3h the suspension was then neutralized with 0.5N NaOH and treated with 4 mg pancreatin (activity equivalent to USP specifications) in 7.5 ml of 0.2M phosphate buffer (pH 8.0) containing drops of toluene. The mixture was gently shaken and incubated at 37° C for 24h. After incubation, each sample was treated with 10 ml of 10% TCA and centrifuged at 5000 rpm for 20 min at room temperature. Nitrogen in the supernatant was estimated by the Kjeldahl method (AOAC 1975). Controls with and without enzymes were treated at zero hours with 10% TCA to subtract non-protein nitrogen from total nitrogen. Pepsin digestibility was estimated separately in samples treated with pepsin alone and soluble nitrogen was determined at the end of the first incubation period.

Water soluble proteins (albumin fraction) were determined in 2 g material extracted with known volumes of distilled water.

Results and Discussion

Table 1 shows the protein content, before and after cooking, of New Halfa and Shambat beans harvested at different stages. The increase in plant age beyond 120 days gave a significant ($P > 0.001$) decrease in protein content. The decrease in total proteins towards maturation came at the expense of the globulin fraction since the water soluble proteins (albumin) increased towards maturity (**Table 1**). Cooking slightly reduced the protein content of the samples. This was because some of the water soluble proteins leached out during cooking. The decrease in protein content on cooking has no correlation with stage of harvest.

The *in vitro* protein digestibility of beans of both localities (New Halfa and Shambat), before and after

Table 1. Protein content and water soluble proteins (albumin) of cooked and uncooked faba bean (cv BF 2/2) seeds grown at New Halfa and Shambat localities. Sudan, and harvested at different ages of plant growth.[1]

Plant age (days)	New Halfa beans			Shambat beans		
	Uncooked		Cooked	Uncooked		Cooked
	Protein content (%)	Water soluble protein (%)	Protein content (%)	Protein content (%)	Water soluble protein (%)	Protein content (%)
90	32.2[a]	15.5[a]	29.0	31.3[a]	14.1[a]	30.0
100	32.5[a]	17.0[a]	28.3	31.7[a]	15.0[b]	29.3
110	33.0[b]	22.8[b]	26.8	33.0[b]	15.5[b]	29.4
120	29.9[c]	29.4[c]	27.2	32.6[b]	18.5[c]	28.3
130	29.0[d]	32.2[d]	27.9	32.0[c]	22.7[d]	28.6

1. Figures followed by different letter(s) are significantly different at 5% level of probability.

Table 2. *In vitro* digestibility of proteins of cooked and uncooked faba bean (cv BF 2/2) harvested at different ages of plant growth.[1]

Plant age (days)	New Halfa beans				Shambat beans			
	Uncooked		Cooked		Uncooked		Cooked	
	Pepsin digest	Pepsin pancreatin digest	Pepsin digest	Pepsin pancreatin digest	Pepsin digest	Pepsin pancreatin digest	Pepsin digest	Pepsin pancreatin digest
90	61.3[a]	92.4[a]	58.9[a]	76.8[a]	60.7[a]	82.8[a]	41.1[a]	82.6[a]
100	62.3[a]	91.6[a]	60.8[a]	79.0[a]	62.3[a]	83.3[b]	41.4[a]	92.4[b]
110	63.8[a]	90.0[b]	68.0[b]	83.9[c]	68.9[b]	83.1[b]	48.5[b]	93.3[b]
120	75.4[b]	90.5[b]	77.0[c]	90.9[d]	70.2[b]	83.9[c]	59.1[c]	89.2[c]
130	81.6[c]	87.8[c]	77.4[c]	89.3[e]	76.0[c]	85.3[d]	61.8[d]	86.4[d]

1. Figures followed by different letter(s) are significantly different at 5% level of probability.

cooking, is shown in **Table 2**. Although the pepsin - pancreatin digestibility of New Halfa samples decreased with plant age, it remained higher than the values reported for Shambat ones. The latter values agreed with protein digestibility of faba bean meal reported by Bhatty and Christison (1984). The cooking process gave a significant ($P > 0.05$) improvement in protein digestibility of the New Halfa beans harvested at 120 days from sowing. However, it significantly ($P > 0.05$) reduced the digestible proteins of Shambat beans harvested after 110 days from sowing. This my be due to variation in the tannin content which was reported to affect digestibility of the non-tannin components in faba bean (Marquardt and Ward 1984). The highest digestibility (93%) was recorded with cooked Shambat beans harvested at 110 days as compared to 91% recorded for cooked New Halfa beans harvested 10 days later (120 days old plants).

The pepsin digest (**Table 2**) clearly reflected the susceptibility of faba bean proteins to the different enzymatic systems used in this study. It increased with plant age. This may be attributed to the increase in the albumin fraction (**Table 1**). The cooking process substantially reduced the pepsin digestion of proteins of Shambat beans. Proteins of fully matured New Halfa beans (> 120 days old) were found more susceptible to pepsin than proteins of fully matured Shambat beans.

In faba bean, the destruction of trypsin inhibitors by heat treatment (cooking) is essential for improving pancreatic digestion (Marquardt *et al.* 1977). Therefore, it should be noted that the improvement in protein digestibility does not necessarily mean improvement in the biological value (nitrogen retention), although it enhances the absorption (net protein utilization) through more available soluble nitrogen.

In general, it can be concluded that although delaying harvest to 120 days or more from sowing resulted in reduced protein content, it did significantly improve the nutritive value of the cooked bean as evidenced by a better protein digestion. The same plant age (110-120 days) was reported earlier by Salih and Ali (1986) to have reduced hard seed percentage and hence a better seed quality could be obtained.

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تأثير موعد الحصاد والطهي على هضم بروتينات الفول في المختبر

ملخص

تمت في المختبر دراسة هضم بروتين صنف الفول BF2/2 المحصود من حلفا الجديدة وشمبات ، فيما يتعلق بعمر النبات عند الحصاد ، ومراحل الطهي . وفي كلا الموقعين انخفض المحتوى البروتيني بشكل كبير عند تأخير الحصاد . مع أنه كانت هناك زيادة في البروتينات الذوابة بالماء (كالالبومين) وقد أعطت بذور الفول،المزروع في شمبات وحلفا الجديدة ، المطبوخة اعلى قيم من حيث قابلية البروتين على الهضم ، هي 93 % و 91 % ـ وذلك عندما تم الحصاد بعد 110 و 120 يوما من الزراعة على التوالي . و مع أن تأخير الحصاد قد قلل المحتوى البروتيني ، إلا أنه أدى إلى تحسين القيم الغذائية .

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.

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Submission of articles
Contributions should be sent to FABIS, ICARDA, P.O. Box 5466, Aleppo, Syria.

تعليمات النشر باللغة العربية

سياسة النشر :

تهدف هذه النشرة العلمية الى نشر نتائج البحوث الجديدة بالسرعة الممكنة . والغاية من هذه التعليمات مساعدة الباحثين على صياغة بحوثهم بالشكل الذى يسهل تبادل المعلومات فيما بينهم على اختلاف امصارهم ومشاربهم العلمية . وهذه المطبوعة تعني بنشر الاوراق العلمية والبحوث المختصرة والمقالات المكتوبة بلغة واضحة واسلوب علمي ، والمطبوعة بمسافات مزدوجة بين السطور على ورق أطواله 21 x 28 سم على وجه واحد فقط . ترسل نسخة أصلية عن البحث وتعنون جميع المراسلات الى عنوان النشرة . ويشترط في المادة المرسلة للنشر الا تقدم الى أى جهة أخرى . ولا تعبر نتائج البحوث المنشورة الا عن وجهة نظر أصحابها . كما أن استعمال الاسماء التجارية لا يعني بالضرورة أن ايكاردا تحبذ استعمال أى 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 يتالف من فقرة واحدة لا تزيد على 200 كلمة توجز العمل ، والنتائج المتوصل اليها ، بأقصر وأوضح طريقة ممكنة . 3) مقدمة وتبرز أهمية موضوع البحث وتستعرض بشكل نقدى الاعمال والبحوث السابقة المتعلقة بذلك . 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 ان وجدت فتكتب بفقرات محددة ومرقمة . 7) كلمة الشكر عند اللزوم . 8) ملخص بالانكليزية مترجم عن العربية بأسلوب علمي ينسجم مع روح اللغة الانكليزية . 9) المراجع ويتم العزو اليها في النص بكتابة كنية المو ٔلف وعام النشر بين قوسين ، واذا كان للمرجع أكثر من ثلاثة مو ٔلفين تكتب كنية الاول وتضاف اليها كلمة "وآخرون " اذا كان المرجع بالعربية أو et al. اذا كان المرجع بالاجنبية . أما عن ترتيب المراجع في نهاية المطبوعة فيتم هجائيا وبصورة مستقلة لكل من المراجع العربية والاجنبية . تستثنى المقالات من الترتيب السابق : مقدمة ومواد وطرق ... انما يكتفى بوضع ملخص لها بالعربية وآخر بالانكليزية ، يضاف الى ذلك ضرورة تقسيمها الى فقرات تحمل كل منها عنوانا مناسبا . وينصح هنا بالرجوع الى آخر أعداد هذه النشرة للتعرف الى طريقة اعداد المخطوطة وترتيب المراجع .

الجداول والاشكال والصور :

تفضل الجداول الصغيرة على الكبيرة ، والبسيطة على المعقدة . ويجب أن يحمل كل جدول رقما معينا حسب وروده في النص ، مع عنوان مناسب . وتستعمل الصور (الابيض والاسود فقط) والاشكال والرسوم الاصلية وليس صورا عنها ، على أن تكون في عمود واحد (8.8 سم) أو عمودين (17.7 سم) ويشار الى مكانها المناسب في النص ، ويراعى فيها أن تكون واضحة المعالم ، وتحمل عنوانا وأرقاما متسلسلة حسب ورودها في البحث .

الارقام ووحدات القياس :

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

الاختصارات والرموز :

5 غ ، 325 مم ، 300 م^2 ، عام 1983 ، موسم 89/1988 ، موسما 1987-1989 ، مواسم 1986 - 1989 ، 20 م^2 ، الجدول 1 ، الشكل 5 ، الفاو (منظمة الاغذية والزراعة) ، ف م ع (الفرق المعوّل عليه LSD) .

NEWS

أخبار

Announcements

إعلانات

International Workshop on Orobanche Research

This workshop will be held in Obermarchtal, FRG, 19-22 Aug 1989. Topics of the meeting will cover: all aspects of biology and biochemistry of the *Orobanche*-host systems, with special emphasis on the fundamentals of germination induction, haustorial initiation and host specificity; *Orobanche* genetics: and crop plant resistance to *Orobanche*. There will be contributed papers and poster/oral presentations.

For further information please write to:
Prof. Dr. Klaus Wegmann,
Institute of Chemical Plant Physiology,
University of Tuebingen,
Correnssstraβe 41,
Tuebingen D-7400,
Federal Republic of Germany

The XIXth Stadler Genetic Symposium on Gene Manipulation in Plant Improvement II

This symposium will be held at the University of Missouri-Columbia campus from 13 to 16 Mar 1989. Speakers from around the world will be presenting lectures on the following topics: plant breeding concepts, physiological concepts, pathological concepts (viruses), quantitative principles, chromosome and gene manipulation, tissue culture, plant transformation systems, gene mapping systems, gene expression, genome organization, and anther culture and haploid systems. Participants will be allowed to present posters in their area of research.

For more information please write to:
J.P. Gustafson,
208 Cutis Hall,
University of Missouri, Columbia,
Missouri 65211, USA.

The Second International Symposium on Plant-Soil Interactions at Low pH

This symposium will be held in the Pipestem Resort State Park in southeastern West Virginia, USA, 24-29 June 1990. The symposium will provide an opportunity for participants to exchange information and ideas on solving problems of plant growth in acid soils. Papers and posters will be presented in the following areas: chemistry and fertility of acid soils, biology and biochemistry of acid soils, physiological and biochemical basis of acid stress tolerance in plants, identification of plants adaptable to low pH conditions, genetics and breeding of acid tolerant plants, and management of acid soils. Internationally recognized speakers will be invited to head the program in each of the major topic areas.

For additional information please contact:
Dr. R. Paul Murrman,
Conference Chairman,
USDA-ARS,
Appalachian Soil and Water Conservation,
Research Laboratory, P.O. Box 1061,
Beckley, West Virginia 25802-1061, USA

Training Course on Agroforestry Research for Development

The International Council for Research in Agroforestry is organizing a 3-week training course, 8-26 May 1989, with the support of the "Direct Aid to Educational Institutions/Organizations (DSO)" Program funded by the Royal Netherlands Government. The course aims at enhancing the professional capabilities of research scientists and development planners from developing countries so they can initiate and implement agro-forestry (i.e., land use systems and practices based on the integration of woody perenials with crops and/or animals) research leading to the development of systems and technologies that are suited to local conditions and adoptable by farmers.

The course will consist of lectures, group work/discussions, group practicals, field exercises, and independent study.

For further information please write to:
James Wahome or Emmanuel Torquebiau,
Human Resource Development Unit,
ICRAF, P.O. BOX 30677, Nairobi,
Kenya
Telex: 22048 ICRAF Nairobi. Telefax: 521001.
Tel: 521450.

International Congress of Seed Science and Technology

The congress organized by the Indian Society of Seed Technology will be held in New Delhi, India, 21-25 Feb 1990. There will be symposia on the following topics:(i) seed production (including stand establishment under stress conditions), seed genetics, and quality control; (ii) varietal identification;(iii) seed drying, processing, packaging, and storage; and (iv) seed production.

For more information please contact:
Dr. P.K. Agrawal,
Secretary,
Indian Society of Seed Technology,
Division of Seed Science and Technology,
Indian Agricultural Research Institute,
New Delhi 110012, India

Erratum

Lang Li-juan, 1988. A summary on production of faba bean in China. FABIS Newsletter 21: 3-6.

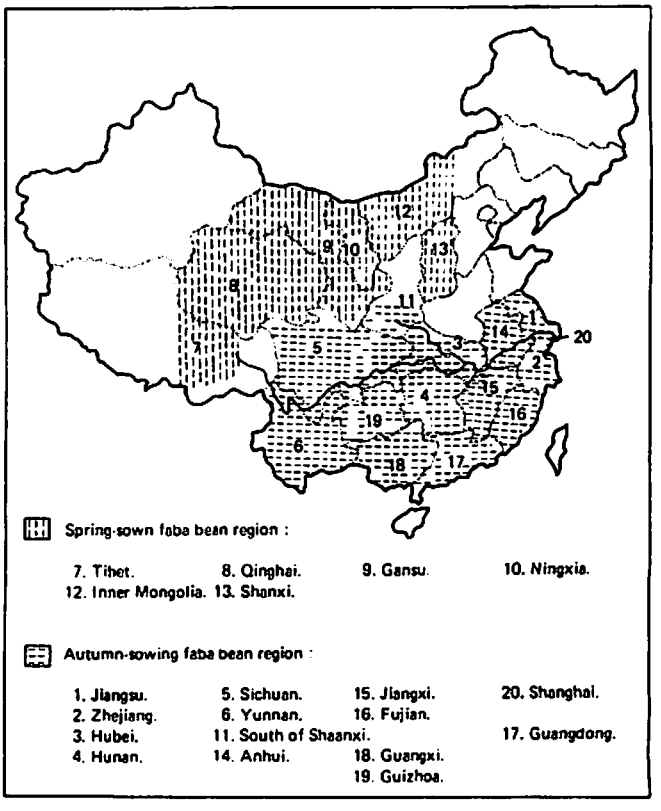

Fig. 2. Two main regions for faba bean cultivation in China.

ICARDA publications deposited at AGLINET libraries

ICARDA is inviting many of the AGLINET libraries to accept all its publications in English and French and to make these available to other libraries under normal inter-library loan and photocopy procedures.

Libraries that have accepted to do so are listed here:

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Book Reviews

مطالعات في الكتب

The Honeycomb Methodology of Plant Breeding

By A.C. Fasoulas
Published by A.C. Fasoulas, Thessaloniki, Greece
ISBN 960-220-000-6
Softcover price 20.00 USD, postage included
167pp.

This book outlines new principles of man-conditioned plant evolution, leading to the development of a breeding methodology, generally described as honeycomb methodology. Honeycomb breeding emerged as a result of systematic studies over a period of about two decades on the factors affecting response to selection. Application of the new principles to cultivar development, deepens our understanding of the biological basis of efficiency and revolutionizes plant breeding by improving traditional breeding approaches and techniques.

The supplement to the book "The Honeycomb Field Designs" which is published in 1989, aims to add some improvements in establishing honeycomb field trials together with the improvements in the presentation and handling of designs. These designs by being nonreplicated or replicated provide a mean for evaluating either single plants, or single plants plus progeny, respectively.

Minerals in Soil Environments

Edited by J.B. Dixon and S.B. Weed
Published by the Soil Science Society of America, USA, 1989 (Second edition)
Number 1 *in* the Soil Science Society of America Book Series
Hardcover price 90.00 USD, postage not included
1264pp.

This edition, replaces the first edition published in 1977. Chapters from the first edition have been rewritten and several new chapters have been added. The text is aimed at advanced and graduate students and a basic knowledge of soil mineralogy.

The first five chapters provide general coverage of introductory mineralogy, surface chemistry, mineral equilibria, soil organic matter, and mineral occurrence. The remaining chapters are devoted to minerals in various chemical and structural groups. One of the new chapters addresses the surface chemistry of minerals ion a modern analytical way. The chapter on organic matter is included because of the ubiquitous occurrence of this important soil component in association with minerals in surface horizons.

Coverage of soil organic matter is more thorough, and results from new methods of organic matter analyses are discussed . The chapter on mineral equilibria is more rigorous and detailed than in the previous edition. In addition, it includes new material on mineral equilibria in relation to radioactive elements in the soil environment. Mineralogy and soil taxonomy are interfaced in a rewritten chapter which serves as a valuable reference on mineral occurrence in soils of the world. Other modifications include new chapters on pyrophyllite and talc, palygorskite and sepiolite, zeolites, and titanium and zirconium minerals.

Persistence of Forage Legumes

Edited by G.C. Marten et. al.
Published by ASA, CSSA, and SSSA, USA, 1989
ISBN 0-89118-089-2
Softcover price 19.00 USD, postage not included
596 pp.

This book arose from a trilateral workshop held recently in Hawai. The purpose of the workshop was to discuss the problem of poor persistene of forage legumes and to define research priorities for its solution. The publication covers the following topics: overview of problems with legumes, development and growth characteristics of legumes, major edaphic and climatic stresses, cultural practices and plant competition, plant-animal interface, major pests and diseases, genetics and breeding for persistence, and areas of collaborative work. The book also contains an executive summary and recommendations for collaborative research projects or exchanges among scientists from Australia, New Zealand, and the United States.

Selenium in Agriculture and the Environment

Edited by L.W. Taylor
Published by the Soil Science Sociey of America and American Society of Agronomy. USA. 1989
ISBN 0-89118-789-8
Softcover price 24.00 USD. postage not included
233pp.

This book provides an up-to-date account of the geochemistry. chemical reactions. and factors affecting the bioavailability of selenium in various ecosystems. It also contains information on recent selenium research on soils and groundwaters of the San Joaquin Valley. While the puplication does not attempt to review selenium in animal nutrition. it does provide a perspective of how the presence of selenium in our environment relates to the plant and soil sciences. animal nutrition. and wildlife.

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

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

RACHIS (Barley, 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.

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

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 STIP.

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

Opportunities for Training and Post-Graduate Research at ICARDA
ICARDA has active training courses on the development and improvement of food legumes, cereals, and forages with ICARDA's research scientists, trained instructors, and proven programs. For a complete brochure of the training opportunities at ICARDA, 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.

DOCUMENT COLLECTION

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

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

FABIS
ICARDA, Box 5466
Aleppo, SYRIA

If you have any

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

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ICARDA, Box 5466
Aleppo, SYRIA

اعلان الى العلماء والباحثين العرب الكرام

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

وبمزيد من السرور تعلن اسرة تحرير " FABIS " للباحثين العرب العاملين في مجال تحسين محصول الفول أنها تصدر نشرتها العلمية باللغتين العربية والانكليزية . لذا فيرجى من الاخوة العلماء الراغبين في نشر بحوثهم باللغة العربية التفضل بارسالها الى العنوان التالي : نشرة " فابس " ، ايكاردا ـ قسم التوثيق ، ص.ب. 5466 حلب ـ سورية .

ملاحظة :

تتم كتابة البحث بلغة عربية واضحة ، وفق الترتيب التالي :

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

المعاملات الزراعية والمكننة

الفيزيولوجيا والأحياء الدقيقة

التربية والوراثة

فابس

مشروع المعلومات المتخصصة عن الفول

فابس ، نشرة علمية 23 ، نيسان/ابريل 1989

المحتويات

ايكاردا والمجموعة الاستشارية للبحوث الزراعية الدولية

يتمثل الهدف العام للمركز الدولي للبحوث الزراعية في المناطق الجافة (ايكاردا) في زيادة الانتاجية الزراعية والموارد الغذائية المتاحة في المناطق الريفية والحضرية بهدف تحسين الوضع الاجتماعي والاقتصادي لشعوب البلدان النامية وخاصة في شمال أفريقيا وغرب آسيا . وتركز ايكاردا اهتماماتها بصوره رئيسيه على المناطق التي يعتمد في زراعتها على الامطار الشتويه التي تتراوح من 200-600 مم سنويا . وعندما تستدعي الضرورة يمتد دائره بحوثها ليغطي مناطق بيئية مروية او ذات أمطار موسمية .

ويضطلع المركز بمسؤوليه عالمية في تحسين الشعير والعدس والفول . ومسؤوليه اقليمية في تحسين القمح والحمص والنظم الزراعية والثروة الحيوانيه والمراعي والمحاصيل العلفية . كما ويعتبر تدريب وتأهيل الباحثين الزراعيين في البلدان النامية . وتبادل نتائج البحوث معهم أحد أهم الانشطه التي تقوم بها ايكاردا .

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

فابس

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

الاشتراكات

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

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

هيئة التنسيق

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صورة الغلاف : اصابة شديدة بالمن Aphis spp. على الفول .

فابس

نشـرة علميـة متخصصة بالفول

العدد 23 نيسان/ابريل 1989

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