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Nassib A.M., Khalil S.A., Hussein A.H.A.

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Faba bean production and consumption in Egypt

A.M. NASSIB*
S.A. KHALIL**
A.H.A. HUSSEIN**
*AGRICULTURAL RESEARCH CENTER (ARC)
GIZA, EGYPT
**ARC, FOOD LEGUMES RESEARCH SECTION
FIELD CROPS RESEARCH INSTITUTE
P.O. BOX 12619, GIZA, EGYPT

SUMMARY - Faba bean is one of the most important winter pulse crops in Egypt, being cultivated from the North to the deep South. An active research has been carried out in order to achieve self-sufficiency in faba bean by solving problems related with new agronomical techniques, yield stability, and resistance to diseases (chocolate spot, rust) and parasitic weed (broomrape). Special emphasis has been placed on on-farm trials aiming to spread more efficient methods on fertilizer applications, weed and broomrape control and tillage. Even though satisfactory solutions to many problems have been found, more research efforts of multidisciplinary nature are needed to obtain more stable yielding cultivars with multiple resistance to pests and diseases.

*RESUME - "La production et consommation de fève en Egypte". La fève est l'un des légumes secs d'hiver les plus importants en Egypte, sa culture s'étendant depuis le Nord jusqu'à la limite Sud du pays. Des recherches actives ont été menées dans un but d'auto-suffisance en cherchant à résoudre les problèmes posés par les nouvelles techniques agronomiques, l'instabilité des rendements, les maladies (*Botrytis fabae, *rouille), et la résistance aux mauvaises herbes parasites (*Orobanche). *Nous insistons plus spécialement sur les essais au niveau des exploitations, ayant pour but la diffusion de méthodes plus efficaces pour l'épandage d'engrais, les travaux du sol et le contrôle des mauvaises herbes et d'*Orobanche. *Bien que de nombreux projets de recherche aient apporté des solutions satisfaisantes à plusieurs problèmes, une approche pluridisciplinaire est encore nécessaire afin d'obtenir des cultivars plus stables possédant une résistance multiple aux insectes ravageurs et aux maladies.*

Introduction

Faba bean (*Vicia faba* L.) is one of the main pulse crops grown for seed in Egypt. Due to its high nutritive value, it is a primary source of protein in the diet of masses. Average consumption of dry seeds was estimated at 5.9 kg/day/person between 1984-88. The fine by chopped straw of faba bean is fed to sheep and cattle. The protein content was estimated at 5.5 and 5.9% for green and dry straw, respectively.

The average cultivated area over the last five years (1984-1988) was 120,865 ha with an average yield of 2.52 t/ha. Total production increased substantially between 1981-1988 (Fig. 1), due to increasing interest of the farmers. The national self sufficiency rate increased by 28% between 1980 and 1985 (Table 1).

Per capita consumption of faba bean varied greatly between 1970 and 1985. The main factor seems to be availability of faba bean (Watson, 1981). Faba bean importation has stopped since 1983.

The role of faba bean in farming systems

Faba bean is a winter crop sown from mid October through November following the major summer crops, i.e., maize, rice, soybean and cotton. Harvesting starts in spring and early summer. In autumn-sown sugar-cane plots in Middle (Minia governorate) and Upper Egypt (Qena and Aswan gov.) farmers interplant faba bean between sugar-cane rows spaced at 90-100 cm. Crop competition is low since the rapid vegetative growth of legumes coincides with the slow growth of sugar-cane. Interplanted faba bean yields are close to the solid planted ones.

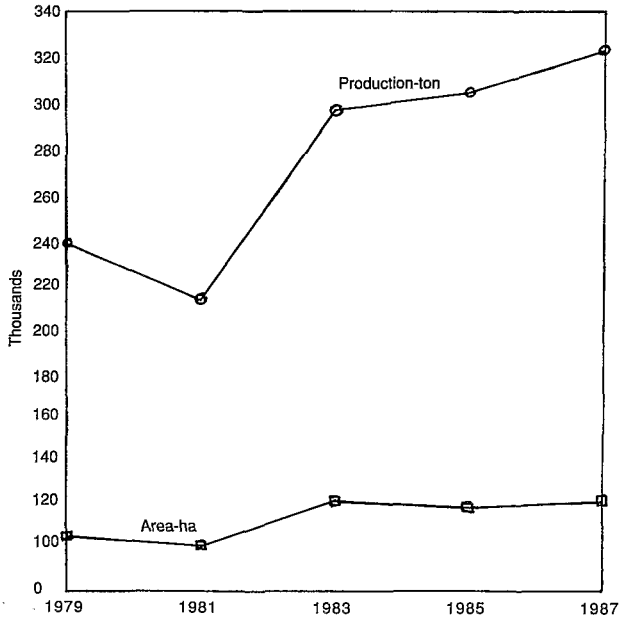

Fig. 1. Faba bean cultivated area and production.

Faba bean farmers in rice, cotton, soybean and maize cropping areas adopt 'zero-tillage' to shorten turnaround time between crops and save the cost of land preparation by planting faba bean on flat soil following rice harvest or on old ridges following the harvest of cotton, soybean and maize. Little or no seed yield differences were detected, in on farm trials, between conventional and 'zero-tillage' on practices (Nassib and Basheer, 1983).

Research activities

Though much has been achieved in yield improvement and production stabilization in faba bean at the national level, research is yet needed in breeding for more stable varieties which are less sensitive to environmental changes. In the field of developing disease resistant varieties, a breakthrough was achieved when sources of resistance to chocolate spot and rust diseases were identified (Ibrahim and Nassib, 1979; Khalil *et al.*, 1984). Breeding material was raised and seed increase of some disease resistant high yielding lines is underway. Studies on pathogen virulence and genotype x pathogen interaction warrant further research in order to control disease break out.

Orobanche control packages were developed, on-farm tested, and recommended to farmers (Nassib *et al.*, 1987). Higher levels of resistance to parasite than those found in 'Giza 402' should be targeted by searching material with different mechanisms for resistance, combining them with that existing in 'Giza 402'. New chemicals for *Orobanche* control should be developed and tested.

Table 1. National and per capita consumption, imports and self-suficiency rate of dry faba beans 1970-1978.

Year	National consumption (000 t)	Per capita consumption (kg/year)	Imports (000 t)	Self-sufficiency (%)
1970/71	206	6.2	2	115
1975	312	8.7	110	80
1980/81	251	6.0	70	68
1984/85	284	6.2	0	87
1985/86	258	–	0	–
1986/87	228	–	0	–

Some variability in resistance to aphids was detected in laboratory and field screening. Standardization of techniques and evaluation methods in both is needed so as to maximize association between the results obtained. This is necessary for an effective breeding program for resistance to aphids.

In order to increase national faba bean acreage, production costs should be reduced by investigating in a multidisciplinary way, the effects of 'zero-' and 'minimum'-tillage systems. Semi-mechanization for such operations as planting, harvesting and threshing should be developed to reduce turnaround time between faba bean and the following cotton crop. This, together with the development of early maturing varieties, could help small farmers increase cropping intensity and the efficiency of use of their limited resources.

The magnitude of faba bean green-pod production calls for strengthening research in breeding and development of agronomic packages to improve yield and quality of green faba bean.

On-farm research

Justification

An increase of about 40% in the national average yield/ha was achieved during the period 1950-1975. This was mainly due to substantial seed distribution to farmers and wide application of fertilizers and irrigation in crop production. However, comparing the potential farm yield estimated at 4.8 t/ha in Middle Egypt with actual farm yield at 2.6 t/ha in same area (Fig. 2), it is observed that a yield gap of 2.2 t/ha does exist. Gómez (1977) ascribed a similar yield gap in rice to biological and socio- economic constraints. Thus, a study at the farm level to

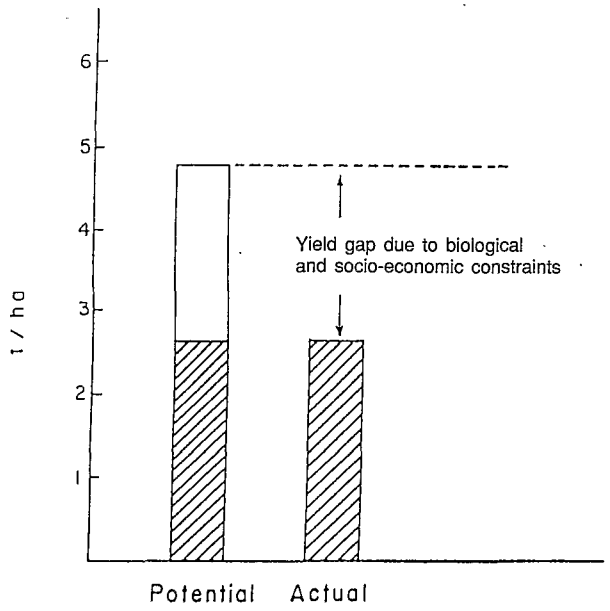

Fig. 2. Yield gap between potential and actual farm yield of faba bean in Middle Egypt region.

identify constraints contributing to this gap and verify available technologies developed at research stations but rarely tested under farmers conditions was felt necessary prior to recommending application of such technologies to farmers.

On farm trials for testing agronomic packages

On-farm trials to assess the yield gap were designed according to the methodology described by Datta *et al.* (1978) where farmers participated in the trials by implementing their own practices in plots allotted to them. The study was then moved to other plots to implement the recommended level of test factors under the researchers' supervision.

This study was carried out in three areas:

- Minia and Fayoum governorates (Middle Egypt) which have about 30,000 and 9,192 ha of the total area under faba bean. With a fairly high average yield of about 2.1 and 2.9 t/ha, Minia and Fayoum account for about 23.4 and 9.9%, respectively of total faba bean production in the country.
- Kafr El-Sheikh governorate in North Delta, which has about 3,800 ha of the total area under faba bean. With a low average yield of about 1.7 t/ha, Kafr El-Sheikh accounts for only 3% of the total faba bean production of Egypt, but represents the North Delta Agroecological Zone accounting for 20% of total faba bean production.

The on-farm trials dealt with the following production factors: variety, seed rate/plant population, level of N and P fertilization, tillage practice, weed control, fungicide application and control of the parasitic weed (*Orobanche*) by planting 'G 402' variety and spraying glyphosate (Nassib *et al.*, 1983).

Some results

Plant population and N and P fertilizer application

Results showed that the recommended plant population (33 plant/m^2) and rates of nitrogen (35.7 kg N/ha) and phosphorus (71.4 kg P_2O_5/ha) improved yield in the three governorates over the farmers levels; the yield increases were of course are highly variable not only between but also within each governorate.

Weed control

Igran (terbutryn) application (2.5 kg a.i./ha) as a pre-emergence herbicide proved to be effective in all the three governorates.

Diathane M45 application for control of foliar diseases

Diathane M45 sprayed at the rate of 250 g/100 l water four times starting around mid-January at about two-weeks intervals in Kafr El-Sheikh controlled chocolate spot disease and increased seed yield.

Tillage practices

On-farm trials indicated that the farmers' no-tillage practice after harvest of summer crops (i.e. cotton, corn and soybeans in Minia and Fayoum or rice in Kafr El Sheikh) did not adversely affect seed yield or increased weed population. Thus, no-tillage was recommended to farmers to avoid late planting, overcome the problem of unavailability of machinery and save costs.

Table 2. Effect of *Orobanche* control package on faba bean seed and straw yield and parasite infection in the Minia governorate during the 1984 and 1985 seasons.

Variety	Plant population and fertility	Glyphosate spray	Yield (t/ha)		*Orobanche* spikes/m^2	
			Seed	Straw	No. (log)	Dry wt. (log)
G2	Farmers level	No	2.86[a]	4.64	1.24	1.63
G402	Test level	Twice	4.39	6.87	0.62	0.87
G402	Test level	No	3.40	5.96	1.03	1.47
L.S.D. .05			0.48	1.24	0.15	0.20

[a]Average of six sites

Table 3. Average seed and straw yield gains, variable cost and net benefit.

Farmers seed yield t/ha	Gain due to package		Farmers straw yield t/ha	Gain due to package		Variable cost LE		Net benefit LE		Profitability LE	
	t/ha	%		t/ha	%	Test	Farmer	Test	Farmer	Test	Farmer
Minia Governorate[a]											
2.93	0.48	16.4	5.31	0.68	12.8	792	838	1220	934	154	113
Fayoum Governorate[b]											
2.58	0.55	21.3	5.74	0.54	9.4	–	–	–	–	–	–
Behera Governorate[b]											
1.09	1.07	98.2	0.97	0.27	27.8	–	–	–	–	–	–

[a]Average of 135 demonstration plots in Minia Governorate over three seasons (1986 to 1988).
[b]Average of 18 and 4 demonstration plots in Fayoum and Behera Governorates, respectively (1988 season)

Orobanche control

Orobanche is a serious parasite which markedly reduces yield and in heavily infested soils can cause total crop loss. 'Giza 402' has proved to be very promising cultivar in controlling this parasite when tested widely on farmers fields in Minia (Nassib *et al.*, 1985). In addition, Glyphosate spraying twice (at a rate of 64 g a.i./ha) at flower initiation and 15 days there after reduced *Orobanche* population considerably in infested farm field.

Farmer managed trials showed that the resistant variety 'Giza 402' planted at test level of plant population and fertilizers and sprayed later with Glyphosate raised seed yield level from 2.86 to 4.39 t/ha (i.e. 53.5% increase) and straw from 4.64 to 6.87 t/ha (i.e. 48.1% increase) on the average. Reduction of 82.6% in *Orobanche* dry weight/m^2 was also recorded (Table 2).

Research - extension linkage

Under the ICARU/IFAD Nile Valley Project on-farm testing of some test factors which were believed to be responsible for gap between potential and actual farmer yields, included varieties, tillage systems, plant population, fertilizers, trace elements, irrigation and weed, *Orobanche* and aphid control. These were tried in two agro-ecologically distinct areas for faba bean production. Socio- economic surveys of faba bean production and evaluation of the results of on-farm trials were conducted (Nassib and Basheer, 1983).

After verification, packages including varieties, seed and fertilizer rates, weed, *Orobanche* and aphid control were implemented by farmers in demonstration plots monitored by multidisciplinary research teams and extension staff (Table 3). Impact on production, information dissemination and farmers' attitude towards recommendations were estimated.

The subject matter specialists of the Nile Valley Project were involved in training extension staff and visit their program with the district staff under the Menia-IFAD Agricultural Development Project. These staff members in turn worked as SMS in extending the recommended package to village extension agents who through contact farmers disseminated information to the rest of village farmers.

Training of the whole National extension staff through periodical meetings and dissemination of information through journals and bulletins is underway. Training, facilities and continuity are needed to strengthen research-extension linkages and interaction for better serving farmers and improving agricultural production.

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