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# Status and prospects of faba bean production and improvement in Portugal

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**SUMMARY** - Faba bean, a very traditional crop in Portugal, is grown in nearly all cultivated areas. However, its agricultural and economic importance is more relevant in the southern part of the country. In the sixties the cultivated area was almost 80,000 ha but since then a significant decline has been observed. For centuries faba bean usefulness was preferentially for food and secondarily for feeding animals. Green or dry seeds provided a substantial part of the protein in human and animal diets. The recent movement of rural population to the big cities together with the difficulty of mechanization of the crop and susceptibility to some abiotic and biotic stresses motivated a logical and progressive abandon of faba bean cultivation. Broomrape (*Orobanche crenata*), chocolate spot (*Botrytis fabae*), BYMV, aphids and many other biotic stresses are major constraints but some physiological problems, like susceptibility to cold at flowering time, are also very important. At present, economic reasons emphasize the need to increase the production of vegetable protein. Therefore, applied research assumes a basic importance and must be focused on correlated fields such as germplasm improvement and production technology. In this sense, breeding work on faba bean is being developed at Elvas and Oeiras. Both programs are run in cooperation with ICARDA. In this way it has been possible to manipulate large collections of genetic material belonging to *equina* and *minor* types. Introduced lines included in the preliminary adaptative experiments have not shown outstanding performance, very often landraces yielded much better, even though there are promising breeding materials. Some artificial hybridizations according to conventional breeding methods were made in order to recover suitable recombinants looking especially to increase both the yield and the harvest index.

**RESUME** - "Situation actuelle et perspectives de la production et amélioration de la fève au Portugal". Les fèves sont une culture traditionnelle au Portugal. Elles sont cultivées dans presque toutes les zones, mais leur importance agricole et économique est plus marquée dans la partie sud du pays. Dans les années soixante, la surface cultivée était presque de 80.000 ha, une diminution significative étant observée depuis. Pendant des siècles, les fèves étaient surtout destinées à la consommation humaine, et en second lieu à l'alimentation du bétail. Les graines, vertes ou sèches, fournissaient une partie importante de la protéine dans la nutrition humaine et des animaux. L'exode récent des populations rurales vers les grandes villes, lié au manque d'adéquation de cette culture à la mécanisation et sa susceptibilité à certains stress biotiques et abiotiques ont causé l'abandon logique et progressif de cette culture. L'*Orobanche crenata*, le *Botrytis fabae*, le BYMV, les pucerons et d'autres stress biotiques sont les principales limitations, mais certains problèmes physiologiques comme la sensibilité au froid pendant la floraison sont aussi des facteurs importants. Actuellement, les facteurs économiques accentuent la nécessité d'augmenter la production de protéines végétales. Par conséquent, la recherche appliquée est d'une importance fondamentale et doit se concentrer sur des domaines corrélés tels que l'amélioration du germoplasme et de la technologie. Dans ce sens, des travaux de sélection sur la fève sont réalisés à Elvas et Oeiras. Les deux programmes se développent en collaboration avec l'ICARDA. De cette façon, il a été possible de manipuler des grandes collections de matériel génétique des types *equina* et *minor*. Les lignées introduites incluses dans les expériences préliminaires d'adaptation n'ont pas montré de résultats spectaculaires, les races locales ayant des rendements quelquefois plus élevés; mais il semble exister néanmoins du matériel prometteur parmi ces lignées introduites. Quelques hybrides artificiels produits selon les méthodes de sélection conventionnelles ont été élaborés afin de récupérer les recombinants appropriés pour augmenter notamment le rendement et l'indice de récolte.

## Introduction

Although faba bean was always an important component of the farming systems in the central and southern part of Portugal (Rodrigues, 1989) especially in rich clay soils, and is grown systematically before wheat, a remarkable decrease of the cultivated area can be seen

since the beginning of the sixties. Fig. 1, 2, 3 and 4 show the pattern of cultivated area, total production and yield.

## Constraints to faba bean cultivation

Several constraints contributed to the decline of faba bean cultivation. Varieties used by the farmers were in

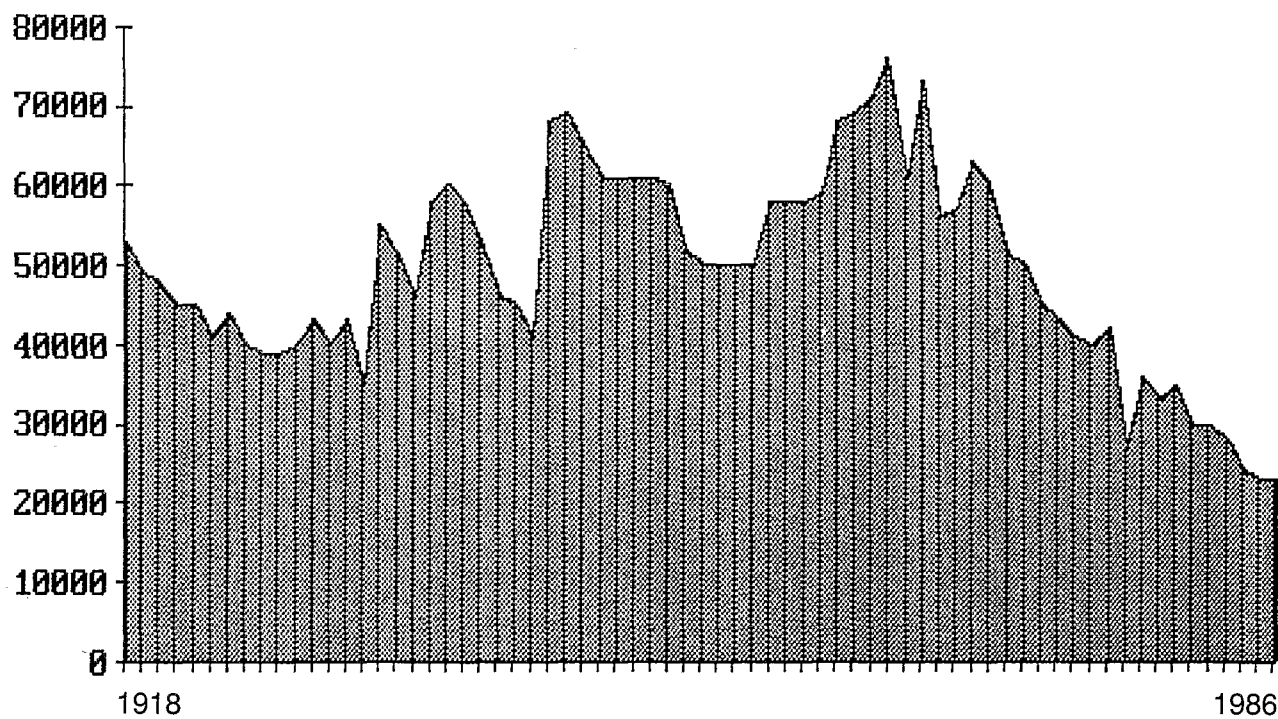


Fig. 1. Areas cultivated with faba bean in Portugal from 1918 to 1986 (in ha). Source: Rodrigues, 1989.

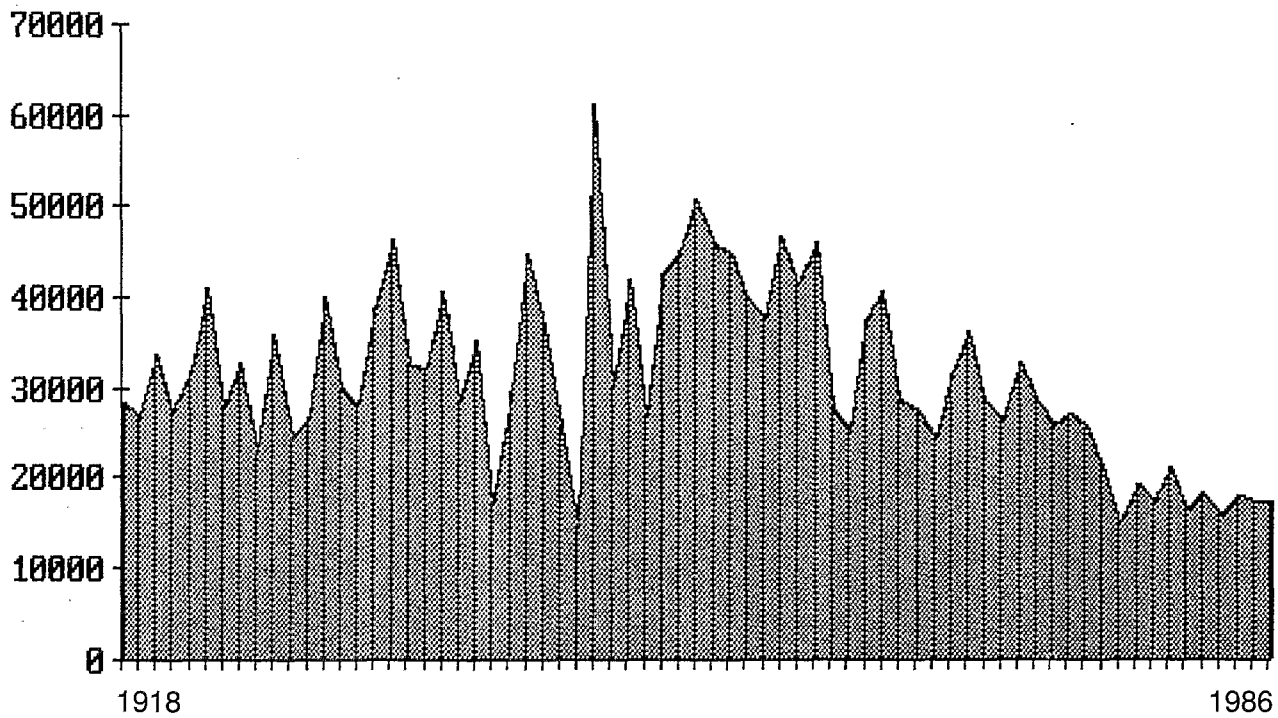


Fig. 2. Faba bean production in Portugal from 1918 to 1986 (in t). Source: Rodrigues, 1989.

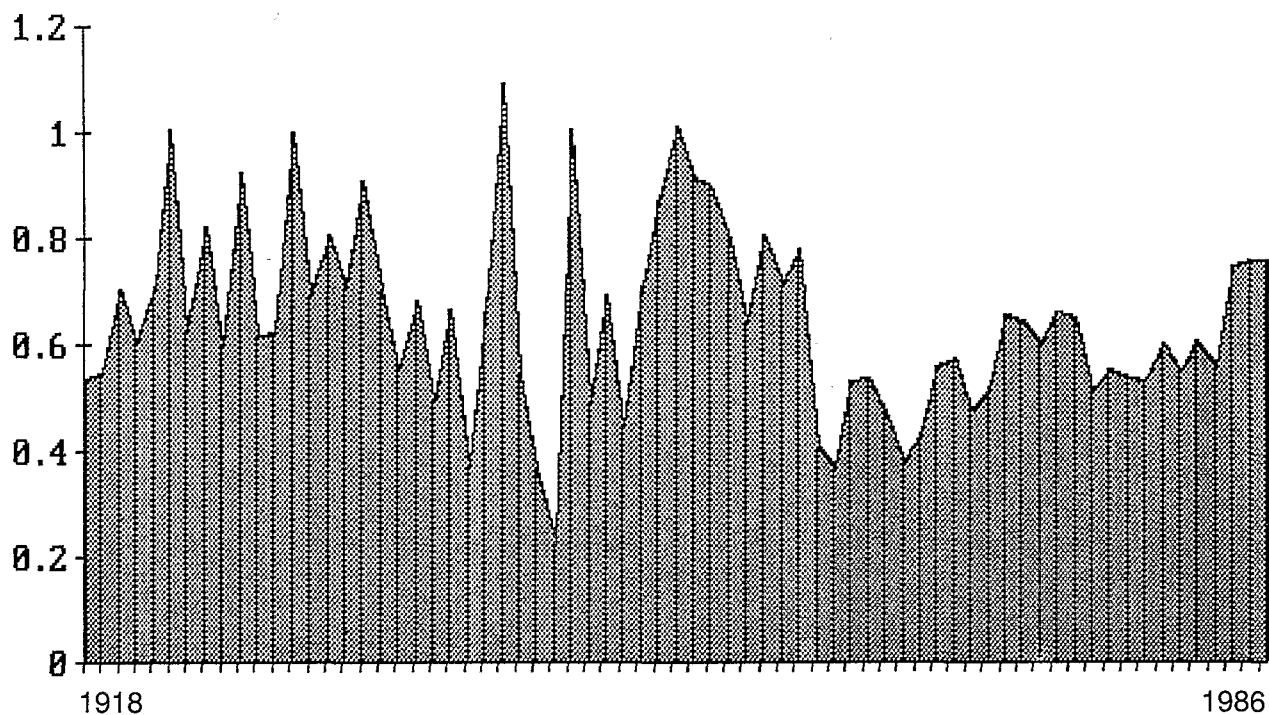


Fig. 3. Faba bean yields in Portugal from 1918 to 1986 (in t/ha). Source: Rodrigues, 1989.

fact landraces which had never been the object of any scientific breeding and show both low to medium yield and lack of stability. In addition these genotypes are very susceptible to major diseases like chocolate spot (*Botrytis fabae*), rusts (*Uromyces viciae fabae*), powdery mildew (*Erysiphe poligoni* and *Leveillula taurica*), downy mildew (*Peronospora viciae*), wilt rot complexes, BYMV, and insects such as *Aphis fabae* Scopoli and *Aphis craccivora* Koch. Broomrape (*Orobanche crenata*), a very aggressive parasitic angiosperm, was the major factor for several disasters mainly in rich clay soils (Guerrero, 1983). This is why almost all the farmers abandoned the cultivation of this crop in these areas.

The major use of faba bean was to feed oxen, horses and mules required for work in the farms, in a subsistence agricultural system. Both green and dry faba bean seeds were also used as food legumes in the standard diet of the rural population. It is worth to emphasize the large amount of manual labour required by this crop for its cultivation.

The development of farm mechanization and the simultaneous decrease of work animals during the sixties caused a reduction of faba bean consumption. On the other hand, the increase of the agricultural wages caused a consequent increase in the production costs of this crop. At the same time, the movement of rural population into the urban areas motivated a progressive decrease of faba bean consumption as dry food legume (Dordio, 1986).

The development of compound feeds in the sixties utilized imported oil seed meals as protein source. Most of the oil seed meals so far used are from soya beans and sunflower, all of them imported with the exception of a small part of sunflower meal. Sunflower is produced in this country under rainfed conditions with very low yield (0.7 t/ha approximately).

In order to solve this problem of lack of protein, the interest on food legumes has recently grown. Besides, food legumes also contribute to increase the nitrogen level in the soil and to improve the soil structure. Thus, they can perform an essential role in a sustainable farming system (Alves, 1961).

## Research on faba bean

Until about 10 years ago, the research concerning faba bean was practically limited to adaptation studies of cultivars and landraces as well as to agronomic studies on rotations including cereals, aiming at exploring their role in both soil fertility and structure (Alves, 1961). The results achieved scarcely influenced the interest on this crop, the constraints mentioned above still being of outstanding importance.

In the last years, however, some agricultural policy issues have lead to start some applied research aiming at the selection of adapted cultivars under different agro-

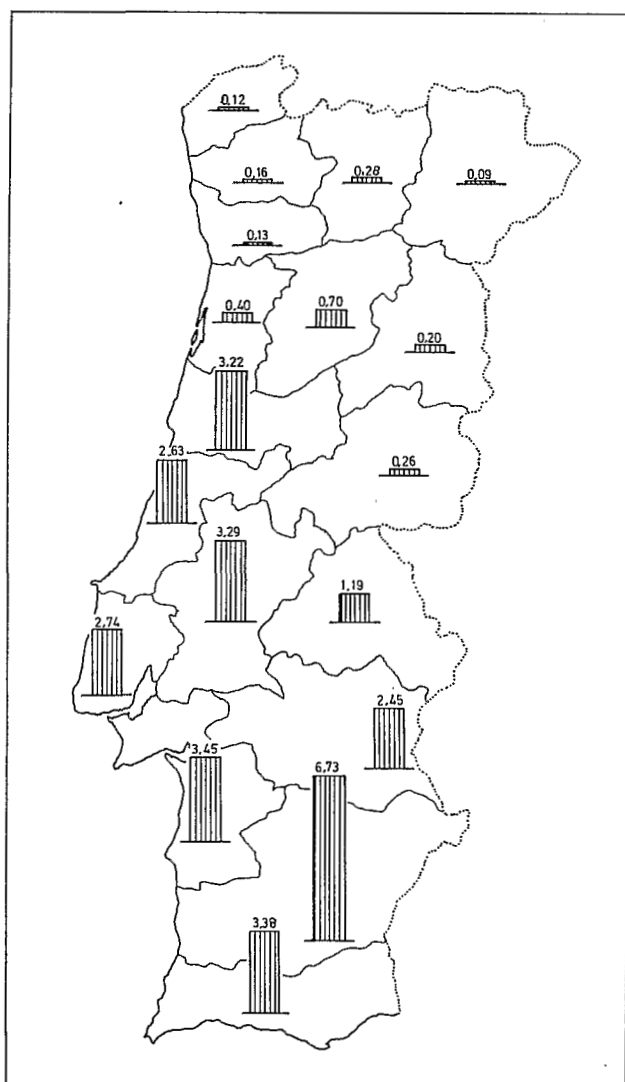


Fig. 4. Faba bean area (000 ha) in Portugal during period 1980-86 (in ha). Source: Rodrigues, 1989.

ecological conditions. These genotypes must show tolerance to abiotic stresses, such as cold and drought, favourable plant structure and lodging resistance in order to permit mechanical harvesting, better yield, yield stability and, finally, a low content of antinutritional factors.

In 1985, the ENMP at Elvas started with a small faba bean breeding program in the more continental regions of Portugal in close cooperation with ICARDA who provided a large amount of improved germplasm, especially of small seed types. In 1986, EAN at Oeiras also started a selection program from which good results are expected mainly in the coastal region, where the Atlantic influence is very strong.

These two programs aim at the selection of stable and high yielding varieties showing high levels of self-

fertility. To fulfill this purpose, some artificial hybridization was performed in order to combine floral fertility with high tolerance to *Botrytis fabae*. Progeny selection is being made until  $F_6 - F_7$  in isolated environment free of pollinator insects; the yielding ability of the lines selected are analysed in comparative yield trials which are obviously carried out in standard field conditions (Sousa, 1988).

The preliminary evaluation of the indeterminate types either of national landraces or received from ICARDA and other sources did not show very interesting results. The introduced faba bean lines included in the comparative yield trials carried out at Elvas, in the periods 1986/87 and 1987/88, and at Oeiras, in the period 1986/87, showed for a few lines some yield improvement (Dordio, unpublished; Sousa, 1987, 1988). Some new determinate types tested for the first time in 1987/88, showed very interesting performance. They out yielded the local check and a large number of plants stood erect at maturity in spite of a rather reduced height. However, these lines seemed much more susceptible to *Uromyces viciae fabae* than the local types. Further observations are needed to obtain a more complete information on these aspects (Costa Pinto, 1989, pers. comm.).

## Prospects

In Portugal, the largest potential area for growing food legumes is in the cereal traditional regions (Center and South of the country) (Rodrigues, 1989). As the tendency of cereal prices in all EEC countries tend to be maintained or even reduced, the growing areas under cereals will also be reduced and will be confined to soils with high levels of fertility. Thus, food and feed legumes will likely occupy an important place in the cropping rotations with cereals. Thus, if the actual systems of subsidy to production are maintained in EEC countries, the cultivated area of those species will probably increase. Then, high yielding cultivars of different grain legumes fitted to advanced agronomical technology will be required. However, it seems difficult to foresee which species will offer better possibilities in the future. Much more basic as well as applied research should be dedicated on such winter legume species as faba bean and chickpea, bitter and sweet lupins and even field pea, since this crop has recently been introduced and is well accepted by the industry.

On the other hand, it seems that soil conditions will play an important role in the regional distribution of these species. So, lupin species will be recommended to sandy, poor to medium fertile soils with pH lower than 6. Faba bean growing area can remain stagnant for several years, because the cultivars available at present do not have the necessary yield potential and stability to overcome the serious constraints that systematically af-

fect this crop. Thus, the desirable increase in importance of this crop is fully dependent on the success of the breeding programs. But as soon as well adapted varieties are developed, faba bean will be grown preferentially in neutral, rich, clay soils of the central and southern part of Portugal alternating with wheat (Alves, 1961). Faba bean will continue to be cultivated in small areas corresponding to specific agro-ecological conditions and producing mainly green seeds for fresh and frozen food.

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