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Vicia faba in France

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SUMMARY - The economic situation of faba bean in France is described. The main objectives of research in genetics and pathology are given, together with the name of active laboratories. Genetic variability within the species seems to be large enough to meet most of the breeding objectives. The main limiting factors for immediate development of the crop in France are the lack of cold hardiness in winter cultivars, poor prices, and inadequate market.

RESUME - "Vicia faba en France". La situation économique de la féverole en France est décrite. Les principaux objectifs de recherche en amélioration génétique et en pathologie sont mentionnés ainsi que les laboratoires français impliqués. Il apparaît une variabilité génétique importante au sein de cette espèce, susceptible de répondre aux grands objectifs de la sélection. Les facteurs limitant actuellement l'étendue de cette culture en France sont d'une part un manque de résistance au froid dans les types hiver et un manque d'attractivité des prix et des marchés.

Introduction

Among various grain legume crops grown in Europe, faba bean ranks presently third in area and production after pea and soybean (Table 1). Unlike UK, Germany and Italy, where faba bean is a major leguminous crop, faba bean in France is rather small crop, with an area almost 1/20 th that of peas, the production being 20 times below.

In 1984, in France, winter faba bean represented a major part of the production (52000 ha, Table 2) with a large distribution in the south-west part of the country. But 3 successive very cold winters have led to a drop in the winter cultivated area (2300 ha in 1988 of which one third is located in the south-west, Fig. 1). Newly released cultivars with higher frost resistance should correct this production trend in the near future. Most of the present faba bean cultivation is located in the north of France (27000 ha) and it concerns spring types. The interest of farmers for spring faba bean in this area is mainly due to the good yield response with early sowing dates in heavy soils. This use in marginal difficult zones partly explains the inferiority of faba bean yields with a national mean close to 3.5 t/ha, when compared to pea which has a national mean yield close to 4.5 t/ha.

Sixty-seven percent of French leguminous seeds are used within France (98% in animal feed, 2% as human food). This utilization does not cover all needs for animal feed: France imported in 1985, 4×10^6 t of soybean meal. Europe is not self-sufficient either since in 1987 it imported 1.1×10^6 t of legume seeds and 19.4×10^6 t of soybean meal. Stability of needs in protein rich products is expected in the near future in Europe. That means that there will be more scope for faba bean production and use.

Major needs of faba bean production in France

- Improved yield and yield stability: beside classical breeding and agronomic aspects, it includes specific needs:
 - Autofertility for winter types
 - *Botrytis* and *Ascochyta* resistance in winter types
 - Frost hardiness in winter types
 - Earliness in winter types adapted to Southern France.
- Improved quality of the product, and adapted technological treatments to get:

Table 1. EEC production of grain legume seeds (000 t).

Crop	Country	Year			
		1985	1986	1987	1988 ^a
Pea	Germany	63	127	150	102
	Belg. Lux.	2	—	20	18
	Denmark	483	514	560	490
	Spain	4	6	4	7
	France	951	1107	1576	2379
	Italy	17	—	—	5
	Netherlands	71	121	122	117
	United Kingdom	360	339	300	400
	Total	1951	2214	2732	3518
Faba bean	Germany	60	100	100	226
	Denmark	—	1	—	11
	Spain	—	52	60	60
	France	131	123	101	115
	Italy	—	30	70	159
	Netherlands	9	30	48	63
	United Kingdom	140	248	230	456
	Total	340	584	609	1090
Lupine	France	3.6	3.2	6.7	7.4
	Spain	—	1	—	6
	Total	3.6	4.2	6.7	13.4
Pulses	Total EEC	2295	2802	3348	4621
Soybean	Spain	6	6	4	10
	France	51	85	190	233
	Italy	286	814	1240	1300
	Greece	—	—	4	22
	Total	343	909	1438	1565

^aEstimated
Source: FAO (1989)

Table 2. French production of faba bean seeds.

Year of harvest	Area (000 ha)		Yield (t/ha) Mean of winter and spring faba bean	Total production (000 t)
	Winter faba bean	Spring faba bean		
1978	1.7	4.5	2.9	18.7
1979	2.0	8.2	2.8	29.0
1980	3.5	10.1	3.0	43.0
1981	7.5	10.8	2.9	55.0
1982	21.2	12.4	2.6	90.0
1983	36.6	16.4	2.5	135.0
1984	52.3	17.9	2.7	197.0
1985	19.4	21.2	3.2	131.0
1986	13.6	25.8	3.1	123.7
1987	4.6	28.2	3.1	101.0
1988	2.3	26.7	4.0 ^a	115.0 ^a

^aEstimated
Source: UNIP/SIDO

- Good energy value
 - Absence of tannins for feeding monogastric animals
 - Absence of glucosides for poultry feeds
- Development of a market (improved collection system, higher prices of the product).

Laboratories presently working on Vicia faba research in France

- 1) Plant Breeding: J. Le Guen, INRA, Station d'Amélioration des Plantes, Domaine de la Motte au Vicomte, BP 29, 35650 Le Rheu.
- 2) Plant Breeding: G. Duc, INRA, Station de Génétique et d'Amélioration des Plantes, BV 1540, 21034 Dijon Cédex.
- 3) Plant Breeding: M. Charpentier, Ets Tourneur, ZI Nord de Montauban, 82000 Montauban.

- 8) Chemistry of polyphenols: M. Jay, Université Claude Bernard, Lyon I, Laboratoire de Biologie Micromoléculaire et Phytochimie, 43 Bd du 11 Novembre 1918, 69622 Villeurbanne Cédex.
- 9) Soil microbiology: N. Amarger, INRA, Station de Microbiologie des Sols, BV 1540, 21034 Dijon Cédex.
- 10) Zoology of pollinators: M. Mesquida, INRA, Station de Zoologie, BP 29, 35650 Le Rheu.
- 11) Pollen conservation and cytology: M.T. Cerceau, Muséum d'Histoire Naturelle, Laboratoire de Palynologie, 61 rue Buffon, 75005 Paris.
- 12) Animal science: L. Lacassagne, INRA, Station de Recherches Avicoles, Tours-Nouzilly, 37380 Monnaie. D. Bourdon, INRA, Station de Recherches Porcines, Domaine de la Prise, Saint-Gilles, 35590 l'Hermitage.
- 13) Technology of glucosides and proteins: B. Quemener and D. Gueguen, INRA, Chemin de la Geraudière, 44072 Nantes Cédex.

Interprofession and organizations of development

- GIE Féverole, 12 Avenue Georges V, 75008 Paris.
- UNIP, P. Campredon, 12 Avenue Georges V, 75008 Paris.
- ITCF, P. Plancquaert, 8 Avenue Président Wilson, 75116 Paris.

Main research programs on faba bean presently conducted in France are in the fields of plant breeding, pathology, agronomy, physiology and with the objectives stated in the sections that follow.

Yield improvement

Study of yield establishment (laboratories 1,2,3,4,5,7,9)

- Expression of yield is analysed through different components (flower abortion, seed development, 100 seed weight, number of seeds per pod, number of pods per node, number of stems).
- Different factors are evaluated for their effect on yield and its parameters:
 - Environmental factors (year, location, density, light interception, water availability, nitrogen source)
 - Genetic factors (search of a plant ideotype): different specific characters being studied (terminal

inflorescence, independent vascular supply, number of ovules/pod, supernodulating and nitrate-tolerant genotypes).

Higher autofertility (laboratories 1,3,10)

This character is required in winter types of faba bean which are flowering early in the season when pollinators activity is low. Genetic variability is available for this character.

Earliness (laboratories 1,2,3,4)

Earliness is necessary for winter types destined for Southern France and spring types for Northern France. Genetic variability for this trait indicates possibilities of rapid progress.

Hybrid production (laboratories 2,1,10,11)

Hybrid vigor has been demonstrated in various studies and its level is large enough for an economic interest for hybrid seed production. The limit is instability of available sources of cytoplasmic male sterility. The prediction of better stability by the measurement of cytoplasmic RNA content in plant tissues carrying particles opens a new way of breeding for stable male sterile lines.

Resistance to *Botrytis fabae* and *Ascochyta fabae* (laboratories 1,6)

These two pathogens are the most important ones in winter types. An artificial screening in growth chambers has been developed in *Vicia faba*. It can be applied on numerous single plantlets. Sources for *Botrytis* resistance (obtained from ICARDA and Egyptian National program) and for *Ascochyta* resistance are now introduced in current breeding programs involving these screening techniques.

Frost resistance

The level of frost hardiness on hardened plants is not high enough for France in present winter cultivars (around -15°C for late cultivars, -10°C for early cultivars).

Genotypes from France ('Côte d'Or'), Germany and United Kingdom seem to show high levels of frost hardiness. They will be used in starting a breeding program conducted within the 'GIE Féverole', the first objective

will be the development of an artificial screening technique.

Quality improvement (laboratories 2,1,8,12,13)

Exploration of genetic variability has shown that genotypes free of typical antinutritional factors can be selected (free of tannins in the seed coat, free of glucosides in green and dry seeds), these characters being simply inherited. These results open the way for a breeding work aimed at improving nutritional quality of *Vicia faba*.

International cooperation

Some of these programs are connected with other national programs:

- With EEC *Vicia faba* breeders and agronomists (through an EEC DGVI project on yield stability and quality evaluation of different plant types). Two types of trials are considered: those adapted to Northern Europe and those adapted to Southern Europe.

- With Dr. G.G. Rowland (Saskatoon, Canada) on flower fertility.
- With Dr. Davies in Dundee on plant nitrogen nutrition.
- With Dr. Briquet and Dr. Boutry (Belgium) on molecular characteristics of cytoplasmic male sterility.
- With Egypt on pathology.
- With ICARDA on general breeding.
- There is a cooperative project with Morocco.

Conclusion

The immediate future prospects of faba bean cultivation in France will depend on two main factors:

- The improvement of cold hardiness in winter cultivars.
- The prices and market for production.

Adequate genetic variability is available to improve cold hardiness, yield and quality of faba bean.