Field Bean [Broadbean, Fababean] *(Vicia faba L.)*

French: Feverole; Spanish: Haba comun; Italian: Fava; German: Ackerbohne

Crop data

Annual. Harvested part: grain (straw).
Sown autumn or early spring.
Flowers 7-8 months (winter variety) or 2-4 months (spring variety) after sowing.
Harvested 9-10 months (winter variety) or 5-7 months (spring variety) after sowing.
Target plant density 20-25 plants/m2 (winter variety) or 40-50 (traditional: 15) plants/m2 (spring variety).
Preferably grown on medium to heavy well drained, deep soil, pH 6-8.
Very sensitive to lack of water from flowering time.

Optimum soil requirements

Organic matter > 1.5 %; calcium carbonate < 4 % EC; conductivity < 4 mmohs/cm;
P (Olsen extractant) > about 20 ppm; K (ammonium acetate) > 66 ppm or (sodium acetate) > 75 ppm; available Fe and Mn > 5 ppm, available Zn > 1.5 ppm.
Susceptible to K deficiency (clayey soils), to P, Zn, Mn and/or Fe deficiency (intensive cropping in arid/semi-arid regions).

Nutrient demand/uptake

The crop requires about 300 kg/ha N (60 kg N/t beans), coming mainly from N fixed from the atmosphere.

Maximum uptake of P and K (around 70-80 kg/ha P2O5 and 250-300 kg/ha K2O) occurs about 100 days after sowing (spring variety), but a substantial proportion of the K taken up is returned to the soil later.

Nutrient removal in harvested beans and haulms - Macronutrients							
Yield/ha	Source	kg/ha					
		N	P2O5	K2O	MgO	CaO	S
6.5 t beans 21.0 t total	El-Fouly et al, 1989	240 405	49 102	94 258	- -	- -	- -
6.0 t beans	Taureau, 1984	-	69	81	10	-	9
5.0 t beans 3.7 t haulms	Poulain, 1989 Poulain, 1989	- -	65 5	91 64	11 6	7 40	- -
4.0 t beans 10.0 t total	Finck, 1982	240	73	192	55	120	28
3.1 t beans 9.5 t total	NRC-GTZ, 1991	228	59	156	74	-	-

Nutrient removal in harvested beans and haulms - Micronutrients					
Yield/ha	Source	g/ha			
		Fe	Mn	Zn	Cu
6.0 t beans	Taureau, 1984	-	68	145	60
5.0 t beans 3.7 t haulms	Poulain, 1989 Poulain, 1989	- -	75 81	255 66	75 10
3.1 t beans 9.5 t total	NRC-GTZ, 1991	12 000	800	500	100

Plant analysis data

Nutritional disorders may be diagnosed by soil testing, visual deficiency symptoms (which, unfortunately, can often be confused with pathological or physiological disorders) or plant tissue analysis. Critical concentrations in the plant dry matter are summarized below. The youngest fully expanded trifoliate leaf blades without petiole at the 3rd node from stem apex, at 10 % flowering provide the best indicator tissue.

Plant analysis data (2nd/3rd leaf from apex at initial flowering) - Macronutrients					
Supply	**Source**	**% of dry matter**			
		N	**P**	**K**	**Mg**
Optimum	Neubert, 1976	3.0-4.5	0.22-0.3	1.0-1.75	-
	Reuter, 1988	4.8-5.3	0.3 -0.4	2.2-3.2	-
	NRC-GTZ, 1991	4.5-5.5	0.25-0.4	2.1-3.5	-
	Chapman, 1973	-	-	-	0.33-0.6
Deficient	NRC-GTZ, 1991	2.8	0.19	1.5	0.2

Plant analysis data (2nd/3rd leaf from apex at initial flowering) - Micronutrients					
Supply	**Source**	**ppm dry matter**			
		Fe	**Mn**	**Zn**	**Cu**
Optimum	NRC-GTZ, 1991	100-?*	58-200	40-75	13-20
	Chapman, 1973	-	68	-	-
Deficient	NRC-GTZ, 1991	?*	40	2	7
* Total Fe in leaves is not reliable for diagnosis.					

Deficiency symptoms

N: uniform yellowness and poor growth. May occur where root nodules have been destroyed by pea weevil larvae (Sitona lineatus) or where waterlogging and compacted soil conditions have damaged the root system.

P: dark green leaves; older leaves drop; thin stems; sparse flowering.

K: bluish green leaves, edges becoming black to brown, followed by marginal scorch; leaves form obtuse angle with stalk; short internodes.

Mg: leaves with central interveinal chlorosis and green margins, older leaves affected first.

Ca: blackening and death of plant.

B: terminal bud blackens and dies downward from tip; dark green, leathery leaves which shed early; few secondary branchings of roots.

Mn: leaves practically normal, or slight interveinal chlorosis and brown flecking; growing point dies; brown spots in centres of cotyledons (as with marsh spot of peas), affecting quality of seed crops.

Zn: shedding of leaves and flower buds; failure of seed pods to develop.

Mo: pale lower leaves; interveinal areas turn grey and wilt or collapse, followed by dark brown or black scorch; stems become defoliated.

Fertilizer recommendations

N: Many studies have shown that no fertilizer N is needed where Rhizobium leguminosarum is present in the soil. Fertilizer N reduces N fixation by the Rhizobium, and can promote excessive growth and stimulate weed competition. Although there appears to be no economic benefit from application of fertilizer N, it is used in some countries and applied to the seed bed to aid establishment; a rate of 30-40 kg/ha N is enough but responses tend to be too erratic to make a recommendation. Where Rhizobium leguminosarum is absent, inoculation of the seed with bacterium is an alternative used in some countries.

P and K: Responses are dependent on residual levels in the soil, which depend in part on the previous cropping history. K is one of the most important major nutrients for field beans; although average responses are small, they are much larger where the soil is poor in readily available K. General recommendations are 80-120 kg/ha P2O5 and 100-200 kg/ha K2O, about one fifth of the P2O5 and one half of the K2O being considered as an advance for the next crop.

Secondary nutrients: S deficiency occurs widely throughout the world; for optimum production, soils should contain at least 10 ppm sulphate S and, below that level, 15-20 kg/ha S should be applied (generally, superphosphate with 18-25 % P2O5 brings enough S for crop maintenance). Mg deficiency is rare but can be corrected by application to soil, or to leaves as 5 % magnesium sulphate spray. Ca deficiency is very rare; uptake of 120 kg/ha by the plant is mostly returned to the soil at harvest time (but see above for the effect of acidity).

Micronutrients: only limited research has been conducted but where deficiencies are diagnosed they can mostly be readily corrected. Soils with < 0.5 water-sol. boron should be given 1-2 kg/ha B (McDole & Mahler 1984) but repeated foliar applications should never exceed 0.2 kg/ha B (Mahler et al. 1981). Co deficiency has been detected in some countries (Tisdale et al. 1985) and can be corrected by application of cobalt sulphate at 0.03-0.15 kg/ha Co. Cu deficiency is rare except perhaps on soils rich in organic matter; mineral soils should contain more than 4-6 ppm Cu (Lucas & Knezek 1972), Bull & Mahler 1983); in general, 3-8 kg/ha Cu is recommended for application to deficient soils, or foliar sprays of 15 % copper oxychloride, 1 % un-neutralized copper sulphate or 5 % neutralized copper sulphate. Fe deficiencies are temporary and occasionally encountered on alkaline soils, but are difficult to correct; foliar applications of chelate sulphate Fe at minimum 1 kg/ha Fe are usually given. Mn deficiency is mostly associated with alkaline soils or where lime has been applied, or sometimes with poor drainage; it can usually be corrected by several applications of manganese sulphate at 5 kg/ha in at least 300 l/ha water at the beginning of flowering. Mo deficiency is extremely difficult to distinguish from nutritional problems with N and S; it can be corrected by seed treament at 200-400 g/ha Mo or foliar application at 100-200 g/ha Mo. Zn deficiency is rare in acid soil but appears on alkaline soils (pH > 7), where the organic matter layer has been severely disturbed or levelled for irrigation; applications of 5 kg/ha Zn should be considered where deficiencies are known to occur.

Present fertilizer practices

Egypt

(Traditional varieties, 2.5 t/ha beans):
Basal fertilization, banded in the seedrows and incorporated in upper 10 cm of soil

36 kg/ha N
72 kg/ha P2O5

(Improved varieties, 5 t/ha beans, on medium and heavy soils):
Basal fertilization

36 kg/ha N
72 kg/ha P2O5

Two topdressings, 40 and 70 days after sowing, each of

57 kg/ha K_2O
Micronutrient spray (60 g/ha Zn, 40 g/ha Mn, 20 g/ha Fe)

Seeds should be inoculated with Rhizobium before sowing.

United Kingdom.

The rates of application recommended by the Ministry of Agriculture, Fisheries and Food in relation to residual fertility (soil index) are given below. Experimental work indicates that these are good estimates which can be applied in most countries.

Soil index	Soil analysis values			Application rates		
	(mg/l)			(kg/ha)		
N, P, or K	Nitrate N	P	K	N	P_2O_5	K_2O
0 very low	0-25	0-9	0-60	0	75	120
1 low	26-50	10-15	61-120	0	50	50
2 medium	51-100	16-25	121-240	0	0*	0*
3 high	100	25	240	0	0*	0*
* Maintenance treatment of 40 kg/ha may be applied to replace removal in crop.						

Survey work in the U.K. has shown that about 40 % of the field bean area receives no fertilizer because most U.K. soils on which the crop is grown have good residual fertility. A few research workers have been able to identify positive interactions between P and K at the levels applied, but this is likely to occur only where the base level of one of these nutrients is low.

China

Single superphosphate is used in most areas at about 375 kg/ha with 4.5 t/ha f.y.m. (equiv. 22 kg N, 12 kg P_2O_5, 19 kg K_2O per ha). After seedling emergence, about 2.25 t/ha wood ash is applied (equiv. about 25 kg P_2O_5 and 150 kg K_2O per ha). Finally, at 10 % flowering stage, an average of 7.5 t/ha f.y.m. is given (equiv. 36 kg N, 46 kg P_2O_5, 38 kg K_2O per ha).

Further reading

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