Chapter 3

Legume Crops

1-Field Bean, Broad Bean

Vicia faba L.

Prepared By

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Introduction:

Faba bean is an annual legume known botanically as *Vicia faba* L. The crop is known by many names, most of which refer to a particular subgroup rather than the whole species. Common names for faba bean include *the large-seeded broad beans or Windsor beans (Vicia faba var. major),* horse beans (*Vicia Faba* var. *equina*), and *the small, round-oval seeded tick bean or pigeon bean (Vicia faba var. minor).*

Faba Bean Uses

- **In Egypt and other Mid-Eastern countries, *faba bean is eaten as a staple food by many strata of the society*, and the increasing population of Middle-Eastern people in the U.S. may be a potential market for faba beans.**

Field bean production:

Total world production from field bean was about 2.5 million ton from cultivated area of about 4.3 million hectare and average productivity of field bean in the world was about 1685 kg/ha. China was the country which cultivated highest area in the world countries i.e. 0.88 million hectare, and Also produced the highest in total productivity in the world i.e. 1.7 million tons and Colombia recorded the highest average of productivity from land unite area and recorded 6444 kg/ha. The total cultivated area in Egypt in 2010 was 77149 hectare produced total grain yield of 233523 ton with an average of 3026 kg/ha

Country	Cultivated area/ha	Total production (tons)	Average of production kg/ha)
World	2561273	4316371	1685
Egypt	77149	233523	3026
Highest country	China 882000	China 1700000	Colombia 6444

Geographical distribution

Field bean cultivated from latitude between 37° Northern and 42° Southern hemisphere and most counties planting field bean in the world are USA, Russia, China, Italy and Spain.

Environments Requirements:

Field bean seed germinate at range of temperature between 15-25C° and optimum of germination temperature at 20C°. **Field bean plant needed moderate temperature for vegetative stage and higher temperature in reproductive development stage.** ***Optimum temperature during growth of field bean and reproductive stage ranged from 20-26C°. Decreasing temperature during Field bean seedling stage reflected early flowering.***

Field bean dry matter, stem and branching will increase as light intensity increased. Reducing light intensity during field bean development reflecting late in field bean flowering, reducing in branching, stems diameters and then lodging. ***Increasing light periods increase NP uptake and vice versa short in light periods than 6 hrs reduce NP uptake and low branches formation and then reduce in seed yield per unite area.***

Seedbed Preparation:

For best results a good seedbed should be prepared, to insure good soil to seed contact. Since faba beans are slow emerge, time spent in preparing a good seedbed will help reduce problems with faba bean and with early weed control.

Faba BeanVarieties:

There are two types of faba bean:

the large seeded *Vicia faba major*, commonly known as broad bean, and the smaller *Vicia faba minor*, sometimes known as tick or horse bean. In fact, the two types are the same species and are only distinguished on the basis of seed size.

Egyptian field bean cultivars

1-Giza 674 variety cultivated in Upper Egypt governments and has 65-70 gm/100 seed.

2-Giza 714 variety cultivated in El-Garbiea and El-Sharqia government and has 65-70 gm/100 seed.

3-Giza 717 variety cultivate in Damietta, Kafer El-Sheik and El-Dakhlia governorate and has 65-70 gm/100 seed.

4-Giza 843variety tolerant to broomrape infection and cultivate in Delta region and has 65-70 gm/100 seed.

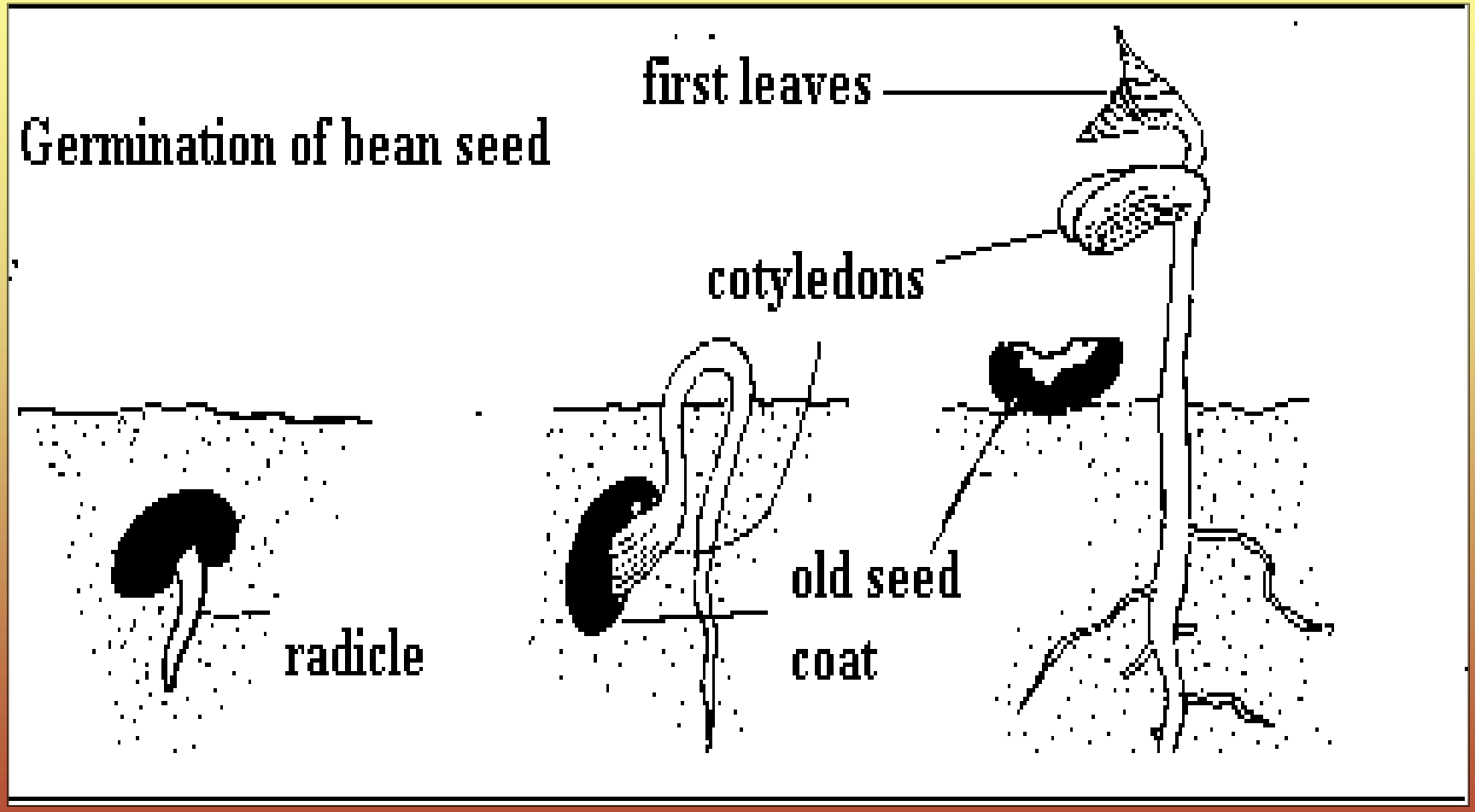
5-Giza 429 variety tolerant to broomrape infection in Upper Egypt governments and has 65-70 gm/100 seed.

6-El-Nobariea 1 variety cultivated in newly reclaimed sand calculus soil especially at Nobariea region and has 100-110 gm/100 seed.

7- Giza Blanka 1 variety cultivated in newly reclaimed sand calculus soil especially at Nobariea region and has 100-110 gm/100 seed.

Germination:

When conditions become suitable for germination, the seed takes in water through its micropyle. The tissues absorb water and swell and the testa becomes soft. The radicle grows first, pushing though the testa and entering the soil. Next, either the hypocotyl or the epicotyl, depending on the species, starts to elongate and carry the plumule upwards through the soil. Elongation of the epicotyl brings the embryo out from between the cotyledons and through the soil, leaving the cotyledons below ground. Elongation of the hypocotyl brings the cotyledons and the plumule above ground (Epigeal)


Germination of bean seed
first leaves
cotyledons
old seed
coat
radicle

Sowing Date:

The suitable sown date of Field bean in Egypt is planting at mid-October to mid-November in Delta region and cultivation at first October to first November at Upper Egypt. ***Late sown of Field bean at optimum date will reduce seed yield may be due to seasonal wind in January which dropped flowers.***

We should cultivated field bean at suitable date due to the following reasons:

1-***In early Field bean planting than optimum date, germination percentage may be reduce due to higher soil temperature can delay seedling emerge and reduce plant population density per unit area.*** **Early planting causes increase in weeds number in the field which competitor with field bean. For these reasons seed yield decreased per unit area.**

2-***In lately Field bean planting than optimum date the vegetative growth period will be reduced, consequently the period of photosynthesis reduce causing reduction in seed yield.*** **There are risks associated with late planting which increase weed competition loss of germination and vigor delayed and reduces yields.**

3-***Planting field bean at optimum planting date increases the period of vegetative growth consequently increase the period of photosynthesis and reduced competition between field bean plants then increase grain yield.*** **Sown at optimum planting date increase number of plants per unit area reflected Field bean plants will be more approached to uniformity which helps sun radiation penetration within field bean plants then increase net photosynthesis, consequently increase seed number and size then increased seed yield.**

Seeding Rate:

Field bean sown at seeding rate of 40-60 kg/fed according to varieties and method of cultivations i.e. plant population density of 30-40 plant/m^2. We should sow field bean at suitable rate due to the following reasons:

1- Sowing Field bean with low seeding reflected decreases in germination rates may be due to higher soil temperature and can delay seedling emerge and reduce plant population. Low seeding rate in field bean planting causes increase in weeds number in the field which competitor with Field bean plants. For these reasons seed yield decreased per unit area.

2-Sowing Field bean with higher plant population density than optimum density, there are risks associated which increase competition between plants which reduce net photosynthesis. The lower leaves was parasite on upper leaves which reflected decreases in seed number and size then decreased seed yield per unit area.

3-*Planting field bean with optimum plant population density reduced competition between plants then increase photosynthesis rate which consequently increase seed yield.* Sowing field bean at optimum stand increase number of plant per unit area reflected field bean plants will be more approached to uniformity which helps sun radiation penetration within Field bean plants then increase net photosynthesis, consequently increase seed

Sowing Methods:

The optimum planting method of Field bean under Egyptian condition by sown on rows 55-60 cm in width by methods of (Affair or Heraty) in hills 20-25 cm according to type of field bean (25-30 plants/m^2) increase seed yield per unit area. Field bean seeds must be planted at suitable row widths. Rows that are (60 cm) common for field bean cultivation by tractors.

If field bean rows too width, crop is unable to rapidly shade the interrow area to capture sunlight and weed quickly become established then competition between plants and weeds results in poorer yield difficulties in disease and insect control and likelihood of lodging.

Fertilization:

1-Field bean seed must incubate with *R. phaseolii* before planting directly.

2-Field bean must be fertilized with nitrogen fertilizer with 10-20 kg N/fed as starter dose before the second irrigation.

3-Field bean must be fertilized with superphosphate calcium (15.5 P_2O_5) before sowing at the rate of 150-200 kg/fed according soil fertility.

4-Fertilization of Field bean using potassium sulphate at rate of 50 kg/acre in the newly cultivated soils.

5-Foilar fertilization of Field bean with microelements, especially in the newly reclaimed soils, with 3 gm from each (Ferro suphate + Zinc sulphate + manganese sulphate) twice after 40 days from planting and after foliar application by two weeks.

Irrigation:

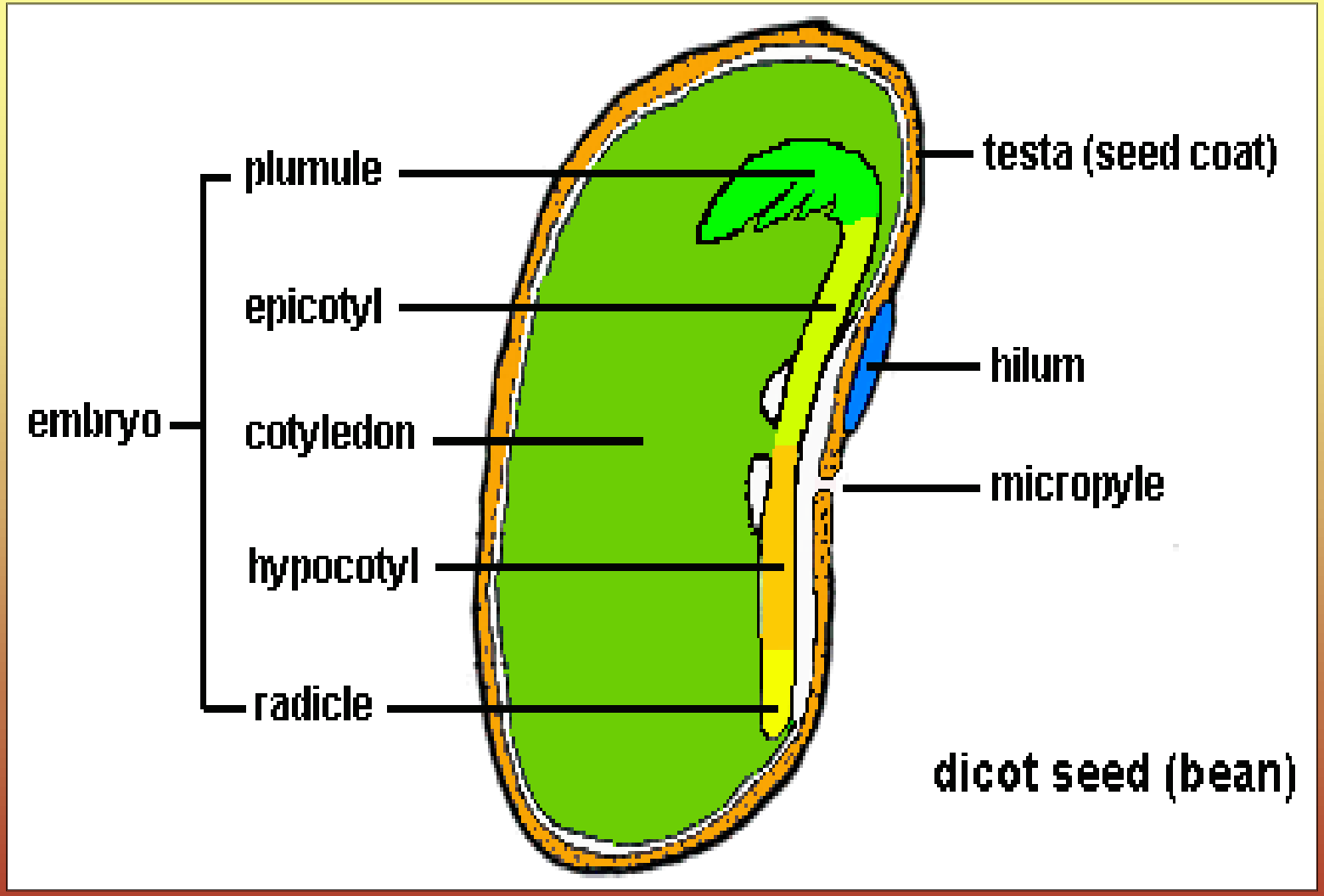
The first irrigation of field bean must be after sown irrigation by 25-35 days that named (El-Tashtea) in Egypt. The second one at will done at flowering stage and must avoid wind during irrigation to prevent flowers dropping. The third irrigation must be done during seed filling, this in the old soil in valley. In case of planting in newly reclaimed soils which especially sandy soil increase number of irrigations and reduce number interval days according to soil type or using sprinkler irrigation.

Weed control:

Weed control of annual winter weeds in Field bean by hand hoeing in Egypt. *Orbanche crenata* is the dangerous weed that chemically controlled using herbicide of Round up 48% at rate of 75 cm^3/200 L water.

Seed yield:

Seed yield of Field bean about 1400-1800 kg/feddan (10-12 ardab/fed) and the weight of ardab is 155 kg.


plumule
epicotyl
embryo
cotyledon
hypocotyl
radicle
testa (seed coat)
hilum
micropyle
dicot seed (bean)

Questions:

1-Why we sown Field bean at suitable sowing date?

2-Why we are sowing field bean with the recommended seeding rates?

3-Why we are planting field bean seed at suitable row width?

Select the most appropriate answer from the following questions.

1.The world hectarage (million ha) and production (million tons) of field bean, respectively are

a) 3.3 and 1.5. **b) 4.3 and 2.5.** **c) 5.3 and 3.5.** **d) 6.3 and 4.5.**

2.The average productivity of field bean in the world is

a) 1485 kg ha^{-1}. **b) 1585 kg ha^{-1},** **c) 1685 kg ha^{-1}.** **d) 1785 kg ha^{-1}.**

3. The highest production country of field bean over world is in

a) Pakistan. **b) India.** **c) Turkey.** **d) Ethiopia.**

4. The highest productivity (kg ha-1) of chickpea in the world is in

a) India. **b) Pakistan.** **c) Colombia.** **d) USA.**

5. 2.The average productivity of field bean in Egypt is

a) 1026 kg ha^{-1}. b) 2026 kg ha^{-1}, c) 3026 kg ha^{-1}. d) 4026 kg ha^{-1}.

6. The optimum temperature for field bean germination is

a) 10°C. b)15°C. c) 20°C. d) -30°C.

7. In the hemisphere, field bean is grown between

a) 10°N and 15°N. b) 5°N and 15°N.

c) 37°N and 42°S. d) 30°N and 50°S.

8. Field bean growth and production are best in newly reclaimed lands in

a) Heavyloamy soils. b) calcic terrarosa.

c) deep black cotton soil. d) sandy soils.

9. The optimum plant population of field bean depends upon

a) genotype. b) environmental conditions.

c) nutrients and irrigation. d) all the above.

10. Delayed sowing of Field bean results in

a) reduced growth. b) poor seed quality. c) low yield. d) all the above.

11.Reducing in temperature during seedling stage of field bean lead to

a) reduced growth.b) poor seed quality.c) reduce dry matter. d) early flowering.

12. Increasing in light intensity during field bean grown lead to

a) increase branching. b) increase dry matter.

c) reduce dry matter. d) answer a + b.

13. Reducing in light intensity during field bean grown lead to

a) reduce branching. b) late flowering.

c) increase dry matter. d) answer a + b.

14. Increasing in light periods during field bean grown lead to

a) increase NP uptake. b) low branching.

c) reduce dry matter. d) reduce flowering.

15. Field bean cultivar tolerant to broomrape infection is

a) Giza 843. b) Giza 714. c) Giza 717. d) El-Nobaria 1.

16. Field bean cultivar sown in sandy newly reclaimed soils is

a) El-Nobaria 1. b) Giza 714. c) Giza 717. d) Giza843.

17. Field bean cultivar has 100 seed weight 100-110 gm per 100 seeds is

a) Giza Blanka. b) Giza 714. c) Giza 717. d) Giza843.

18. The optimum rate of nitrogen (N) application in field bean is

a) 5-10 kg fed^{-1}. b) 10-15 kg fed^{-1}. c) 15-25 kg fed^{-1}. d) 40-50 kg fed^{-1}.

19.The optimum sowing date in field bean in Egypt is

a) Mid-October to Mid-November.

b) Mid-September to Mid-October.

c) Mid-November to Mid-December.

d) First December.

20.Field bean fertilized with Zinc, Ferro and manganese micronutrients in newly reclaimed lands at rate of

a) 1gm per liter. b) 2gm per liter. c) 3 gm per liter. d) 4 gm per liter.

Put sign True or False before the following sentences:

1-( ) If field bean rows too width, crop is unable to rapidly shade the interrow area to capture sunlight and weed quickly become established then competition between plants and weeds results in poorer yield difficulties in disease and insect control and likelihood of lodging.

2-( ) Planting field bean with optimum plant population density reduced competition between plants then increase photosynthesis rate which consequently increase seed yield.

3-( ) Planting field bean at optimum planting date increases the period of vegetative growth consequently increase the period of photosynthesis and reduced competition between field bean plants then increase grain yield.

4-( ) In lately Field bean planting than optimum date the vegetative growth period will be reduced, consequently the period of photosynthesis reduce causing reduction in seed yield.

5-( ) in early Field bean planting than optimum date, germination percentage may be reduce due to higher soil temperature can delay seedling emerge and reduce plant population density per unit area.

6-( ) Late sown of Field bean at optimum date will reduce seed yield may be due to seasonal wind in January which dropped flowers.

7-( ) Optimum temperature during growth of field bean and reproductive stage ranged from 20-26C°. Decreasing temperature during Field bean seedling stage reflected early flowering.

8-( ) Field bean seed germinate at range of temperature between 15-25C° and optimum of germination temperature at 20C°.

9-( ) Faba bean is eaten as a staple food by many strata of the society.

10-( ) The small, round-oval seeded tick bean or pigeon bean (Vicia faba var. minor).

11-( )The large-seeded broad beans or Windsor beans (Vicia faba var. major)