

Botanical Name	:	<i>Phaseolus vulgaris</i>
Family	:	Leguminosae
Chr. Number	:	2n=22
Origin	:	South and central America

- There are at least 18 types of cultivated beans covering about eight different genera.
- All beans belong to family Leguminosae
- French bean, cowpea, cluster bean and dolichos bean are of economic importance
- They have an ability to fix atmospheric N through root nodules.
- Used as green vegetables or green shelled or dry as pulses, according to the stage at which they are harvested.
- All beans are a valuable source of protein, Ca, Fe and vitamins
- All beans except broad bean are susceptible to frost and are grown as a summer crop.

Bean type	Botanical name	Chr. no.
French bean	<i>Phaseolus vulgaris</i>	2n = 22
Cowpea	<i>Vigna unguiculata</i>	2n = 22
Asparagus bean or Yard long bean	<i>Vigna unguiculata</i> var. <i>sesquipedalis</i>	2n = 22
Cluster bean	<i>Cyamopsis tetragonoloba</i>	2n = 14
Hyacinth bean	<i>Dolichos lablab</i>	2n = 22
Scarlet runner bean	<i>P. coccineus</i>	2n = 22
Tepary bean	<i>P. acutifolius</i>	2n = 22
Moong bean	<i>V. radiata</i>	2n = 22
Moth bean	<i>V. aconitifolia</i>	2n = 22
Lima bean	<i>P. lunatus</i>	2n = 22
Winged bean	<i>Psophocarpus tetragonolobus</i>	2n = 18
Sword bean	<i>Canavalia gladiata</i> (tall) <i>C. ensiformis</i> (dwarf/jack bean)	2n = 22
Broad bean	<i>Vicia faba</i>	2n = 12



Winged bean



Asparagus bean



Hyacinth bean



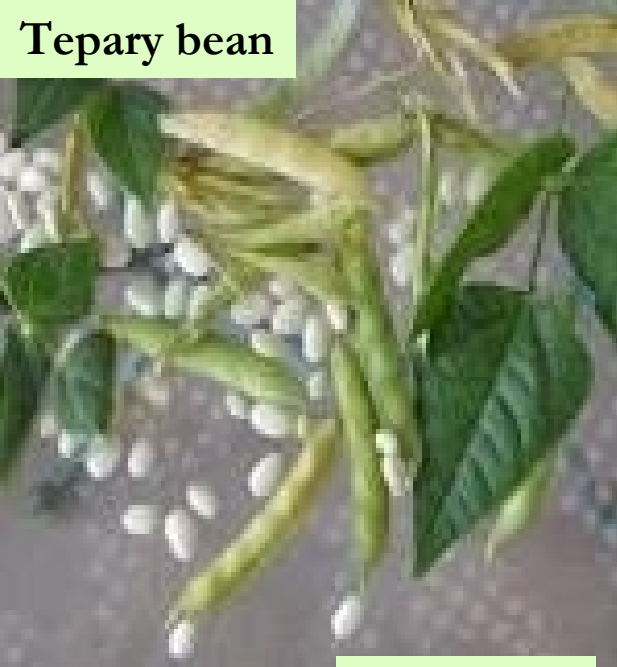
Cowpea



Cluster bean



Scarlet runner bean



Green shelled beans are somewhat fleshier - walled pods with less fibre in the younger stage while pulse type are more fibrous and bear parchment layer which protect shattering of seeds on drying of pods

Varieties of French bean are classified into two categories

On the basis of fibre

1.	Stringy type	Pods contain fiber. The indigenous beans are stringy.
2.	Stringless type	Pods are free from fiber.

On the basis of growth habit

1.	Pole type	<ul style="list-style-type: none">• Varieties are tall, indeterminate in growth, larger internodes but the number of nodes is dependent upon the length of growing season.• Requires support• Main shoot goes on putting growth.• Branching is unlimited.
2.	Bush type	<ul style="list-style-type: none">• Plants are dwarf /short & bushy in their growth habit.• Plants are short, have erect stem with the main axis consisting of 4-8 shortened internodes.• Popular because of compactness, easy harvest & short duration.• Each vegetable stem terminates or ends in the form of terminal inflorescence.
3.	Semi-pole or summer type	<ul style="list-style-type: none">• Plants have 4-8 internodes which are longer than those in bush type.• Inflorescence is terminal but appear somewhat late & give vinal growth.• Require staking for better growth.

Varieties recommended in India

Dwarf varieties	Pole type varieties
Contender	Kentucky Wonder
Falguni	SVM-1
Palam Mridula	Luxmi
Solan Naina	Pusa Himlata
Arka Suvidha	VL-Lata bean-12
Arka Komal	VL-Lata bean-17
Premier	Pusa Swarnlata
Pusa Parvati	HAFB-3
Pant Anupama	HAFB-4
Pant Bean-2	RCMFB-1
Arka Anoop	
Phule Surekha	
IVRFB-1	
VL Bauni 1	
IVFB-2	

Institute	Variety	Characters
IARI, Delhi	Pusa Parvati	Bush type variety evolved by mutation, resistant to mosaic and powdery mildew.
	Pusa Himlata	Pole type
	Pusa Swarnlata	Pole type
IIVR, Varanasi	Kashi Param	
	Kashi Sampann	Bush type tolerant to GYMV and high temperature
IIHR, Bangalore	Arka Sharath	
	Arka Suman	
	Arka Komal	
	Arka Suvidha	
	Arka Anoop	
YSP UHF, Nauri	SVM 1	Pole type resistant to angular leaf spot.
	Lakshmi (P-37)	Pole type, stringless
CSK HPKV, Palampur	Palam Mridula	
GBP AU, Pantnagar	Pant Anupama	Bush type
	Pant Bean 2	

Cultivars recommended for growing in Himachal Pradesh

Bush type: Contender, Palam Mridula, Solan Naina, Arka Komal, VL Bauni-1, Pusa Parvati, and Arka Suvidha

Pole type: Kentucky wonder, SVM-1 and Luxmi



CONTENDER

- Ready to harvest in 45 days of sowing
- Stringless, tender, curved pods
- Average yield-75-100q/ha



Palam Mridula

Stingless- tender variety with straight pods
About one week late than Contender.
Ready to harvest with in 50 days of sowing
High yielding average yield is around 120q/ha



SOLAN NAINA

It is a short duration, bush type cultivar of french bean (vegetable type), flower colour white to cream, bears 40-45 pods/plant, meaty, dark green in colour and straight. The pods mature in about 45 days and the seed colour is white. Suitable for spring-summer and autumn- winter production in low and mid hills of the state. The average yield is 125-140 q/ha.

Pole type beans



Kentucky Wonder



SVM-1



Luxmi

SOIL

**A well drained, fertile and sandy loam soils
The most suitable pH range is 5.5 and 6.0**

CLIMATE

**A warm season crop, sensitive to frost and very high temperature.
No seed germination below 16°C. Seed germination takes place
between 16-29°C but congenial temperature is 16-21°C.
Blossoms/ pods drop under very hot or rainy weather
The best pod setting occurs at 15-25°C**

Planting methods

Flat bed method: Followed in spring-summer and autumn-winter crop.

Hill method:

- i. Followed in high rainfall areas as this method facilitates drainage
- ii. 5-6 seeds per hill are sown but later on only 3 plants per hill are retained.
- iii. Row to row distance is maintained between the hills.

Sowing time	Seed rate	spacing	FYM	N:P:K
Rainy season - July September	Bush type- 85-90 kg	60-70 X 15 cm	25 t/ha	75:30:60 kg/ha
Early spring – January February	Pole type- 25-30 kg/ha	1.5-2 X 15 cm		

The fertilizer should be placed in bands about 7-8cm to the side of the seed and placed deeper than the seed.

Weed control – hand hoeing is necessary to control weeds . Pre emergence weedicides like pendimethalin can also be used for effective weed control.

Irrigation – beans are shallow rooted crop and sensitive to an over supply of water. Application of water is just prior to blooming followed by another irrigation at time of pod formation. Additional irrigation are given as per requirement.

Harvesting – green pods are harvested before they are fully grown and while the seeds are small ,pods are ready to harvest after two to three weeks of first bloom. Average yield is 3000 – 4000 kg / ha .

Recommended practices for Himachal Pradesh

Sowing time	Seed rate	Spacing	FYM	N:P:K	Yield
Low hills- February march and August	Dwarf – 75 kg/ha	45 X 15 cm	10 t / ha	45:100:30 kg /ha	10-12 q/ha
Mid hills May – July	Pole – 30 kg /ha	90 X 15 cm			12-18 q/ha
High hills- April –June					
<p>175 kg CAN , 625 kg SSP and 50 kg MOP can be used for fertilization. Apply FYM , SSP, MOP and half of CAN before sowing . The rest of the can can be applied as top dressing at the time of earthing up.</p>					

Problems associated with French bean cultivation

Spring- summer season

- i. The poor crop stand on account of low seed germination due to prevailing low temperature
- ii. Incidence of dry root rots especially in the month of March due to dry weather and high temperature
- iii. *Rhizoctonia* become more serious resulting in rotting of plant and root system.
- iv. Optimum temperature for pod set and development remains for limited time

Autumn – winter crop

- i. Poor crop stand due to root rot as a result of high temperature and humidity at early growth stage.
- ii. More incidence of viral diseases on account of more insect activity.
- iii. Limited fruiting period on account of low temperatures from October onwards.

Transverse Cotyledon Cracking

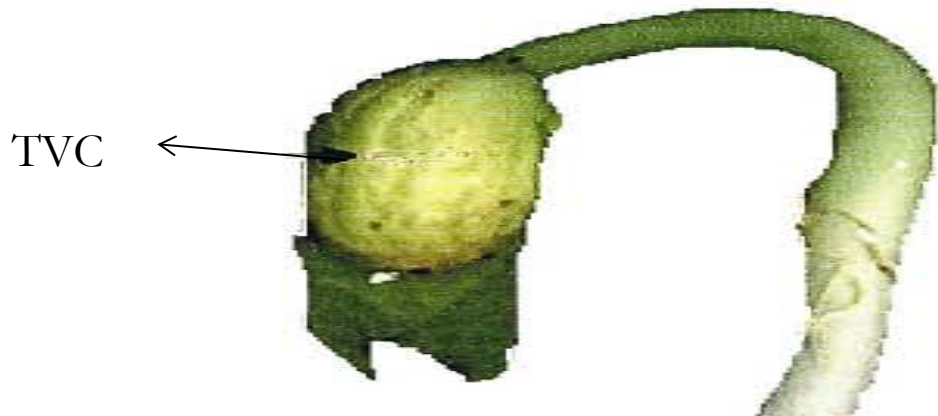
Major disorder in French bean.

White seeded varieties are more prone

It is enhanced by planting dry seeds in wet soil.

Hard seed coat is essential for resistance to this disorder

Seed containing 12% moisture has better germination.



Hypocotyl necrosis

- i. Death of hypocotyl tissues occur.
- ii. It is associated with low Ca and Mg content in the seed.



Ca deficiency



Mg deficiency

COLD TOLERANCE

- **Beans are generally susceptible to low temperature injury at all stages of growth.**
- **Temperature of 10°C or below during imbibition and germination result in permanent injury and vigour reduction, while prolonged temperature at or below 15-16°C can result in stunted plants with no crop.**
- **The characters contributing towards cold tolerance are large embryonic axis, rapid hypocotyl elongation, rapid mobilization of cotyledonary reserves, leaf area and production of surplus photosynthate.**

HEAT TOLERANCE

- **Heat stress particularly affects the development of reproductive organs.**
- **At high temperature, blossom abscission may be due to inability of pollen grains to germinate.**
- **Pod yield of French bean is severely depressed under a high temperature condition.**
- **It is determined by the number of pods, which is a product of the number of flowers and pod-set-ratio.**
- **Since pod-set-ratio is strongly affected by pollen fertility under high temperature condition, pod yield deterioration in the summer cropping might be due to decrease of pollen fertility.**

DROUGHT TOLERANCE

- The water stress during flowering and grain filling reduces the seed yield and seed weight and accelerates the maturity of bean.
- Reduction in yield during flowering is the result of both fewer pods and seeds per pod.

SALINITY TOLERANCE

- The common bean is a salt sensitive species.
- Salinity impairs seed germination, reduces nodule formation, retards plant development and reduces crop yield.

Diseases

Disease	Management
Anthracnose	<ul style="list-style-type: none">• Seed treatment.• Spray Bavistin or Dithane-M-45.• Use resistant varieties (Tweed wonder)
Leaf spot	<ul style="list-style-type: none">• Spray of Bavistin or Dithane-M-45
Powdery mildew	<ul style="list-style-type: none">• Spray Karathane or Sulphur fungicides.
Ashy stem blight	<ul style="list-style-type: none">• Seed treatment.
Rust	<ul style="list-style-type: none">• Spray Bavistin/ DM-45
Web blight	<ul style="list-style-type: none">• Crop rotation• Spray Bavistin/Dithane-M-45
Bacterial blight	<ul style="list-style-type: none">• Use disease free seed• Soak the seed in a mixture of Streptocyclin (1g) & Hexacap (25g) in 10 lt. of water for 4 hrs before sowing.
Common bean mosaic	<ul style="list-style-type: none">• Vector: Aphids
French bean yellow & golden mosaic	<ul style="list-style-type: none">• Vector: White fly

Insect-Pests

Insects	Management
Aphids	Dimethoate (0.03%), Methyl demeton (0.025%) or fenvalerate (0.01%) before flower initiation stage.
Jassids	-do-
Pod borer	Carbaryl (0.2%) or Endosulfan (0.05%) at 15 days interval.
Bean beetle and Bean bugs	Endosulfan or Nuvan
Hairy caterpillar	Endosulfan
Bean Weevil	Storage pest. Put 1-2 tablets of Celphos/tonnes of material.
RED SPIDER MITE	Azadiractin (0.03%) or Malathion (0.05%) or Dicofol (0.04%). Repeat sprays at 10 day intervals

Disease Resistant Cultivars of French bean In India

Disease	Resistant Cultivar
Powdery mildew	Contender, Pusa Parvati
Wilt	Jampa
Rust	Pant Anupama, VL Boni-1, Arka Bold, Pant Bean 2, Kentucky Wonder
Angular leaf spot	Lakshmi, SVM1, Pant Anupama
Common bean mosaic	Pant Anupama (moderately resistant) Pant Bean 2 (moderately resistant)

COW PEA (*Vigna unguiculata*)

Origin	Africa
Climate	<ul style="list-style-type: none">•A warm season crop, suitable for humid tropics and subtropical zones.•Tolerates hot and dry conditions but intolerant to frost.•Thrives best between 21 and 35°C.•Different varieties respond differently to temperature and day length. Rainy season varieties if sown during summer, may give only vegetative growth.
Soil	Grown in all types of well drained soil with pH 5.5 to 6.5
Cultivars	Pusa Phalguni, Pusa Barsati, Pusa Dofasli, Pusa Komal, Pusa Rituraj, Pusa Sukomal Arka Samridhi, Arka Garima, Arka Suman, Bidhan Barbati-1, Bidhan Barbati-2, Kashi Shyamal, Kashi Kanchan, Kashi Sudha, Kashi Nidhi, Kashi Gauri, Kashi Unnati, Pusa Sukomal
Sowing time	Spring-summer crop: February-March, Rainy season: June- July South India: December-January for spring-summer crop.
Seed rate:	12.5-20 kg / hectare.
Spacing	45-60 cm X 10-15 cm (bush type), 75 cm X 20-25 cm (indeterminate types)
Nutrition Requirement	50:80:80 kg NPK /ha, Band fertilizer 7-10 cm deep & 5-7 cm away from the seed is good practice.
Irr. and inter culture	As frenchbean
Harvesting	At three different stages of maturity: green snaps, green mature and dry.
Yield	50-80 q
Diseases	Anthracnose, Die back, Ashy stem blight, Powdery mildew, Bacterial blight, Mosaic
Insects	Aphids, Jassids, Pod Borer, Bean Weevil

CLUSTER BEAN / GUAR

Importance	The mucilagenous seed flour is valued as a guar gum (glactomannan) and used in textile, paper, cosmetic and oil industries. It is a useful absorbent for explosives.
Origin	Africa
Climate	<ul style="list-style-type: none">•Its typical tropical crop which prefer warm climate, though its grown in subtropics during summers.• Guar requires long day conditions for vegetative growth and short day conditions for induction of flowering.•Average Temp in the range 30-40⁰C is congenial for growth and development.
Soil	<ul style="list-style-type: none">•Guar can tolerate saline and moderately alkaline soils with pH 7.5 and 8.•Prefers well-drained sandy loam soils.
Cultivars	Pusa Mausami, Pusa sadabahar, Pusa Navbahar, Sharad Bahar, Goma Manjari
Sowing time	NI: June- August South India: Through out year
Seed rate:	15-40 kg / hectare.
Spacing	45-60cm X 10-15 cm
Nutrition Requiremen	10-20: 50-70:50-70 kg NPK/ha

Lablab bean or Dolichos bean or Hyacinth bean or *Sem Phali*

Cultivars	Pusa Early Prolific, Co-1, Co.2, Co.10, Hebbal Avare 3, Hebbal Avare 4, Deepaliwal, Kashi Haritima, Arka Ajay, Arka Vijay
Sowing time	NI: July- August South India: Through out year
Seed rate:	20-30 kg / hectare.
Spacing	60 × 30cm (bush) and 100 × 75 cm (tall)
Nutrition Requirement	10-20: 50-70:50-70 kg NPK/ha
	Rest practices are same as other beans