

(Pulses crops)

1. CHICK PEA

Botanical classification

Botanical name- Cicer arietinum L.

Family - Leguminaceae

Rabi season pulse or Cool season food legumes are:

- Chickpea, Filed pea, Lentil, , French bean
 - They contribute 60% world pulse production
- .28 million ha globally

- . They are concentrated on temperate and sub-tropical climate
- . Chickpea, lentil in developing countries
- . Peas in developed countries
- .

CHICKPEA / BENGALGRAM - *Cicer arietinum*

1. *Cicer* derived from 'Cicero' well known Roman family and '*arietinum*' from '*aries*' meaning ram's head shape
2. Gram, Bengal gram, *chana*
3. Mostly used pulse in many products
4. Boiled, roasted, steamed, sprouted, flour made into many delicious food



World Scenario

Country	Million ha	Million t	t/ha
Africa (Ethiopia, Malawi, Morocco, Tanzania, Tunisia)	0.41	0.32	0.79
Mexico	0.11	0.16	1.44
Asia (India, Pak, Turkey, Iran, Myanmar)	9.82	7.37	0.75
India	6.93	5.60	0.81
Europe	0.05	0.04	0.93
Australia	0.09	0.11	1.09
World	10.67	8.24	0.77

Indian Scenario

State	c	Production ('000 t)	Productivity (kg/ha)
MP	2560.7	2371.2	926
Rajasthan	1081.1	478.9	443
UP	739.6	660.6	893
Maharastra	1020	705	691
Haryana	130	72	554
Karnataka	418	229	548
AP	394	627	1591

All India	6896.2	5575.4	808
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1. **Origin**

Gram is cultivated in India from a longer period. It is originated from South West Asia or eastern Mediterranean. It is cultivated in Iran, Turkey, Central and Southern Africa, Rumania and Egypt.

1. **Varieties**

- Two types Desi & Kabuli
- Desi is small seeded
 - Angular shaped edge
 - Shape like chickens head
 - 90% of the world's cultivated
- Kabuli, large and round seeded with white pale cream seed coat
- Duration 90-180 days
- CO 2, CO 3, CO 4 are 90days
- All India – many varieties , Vijay, Pusa 391, DCP 91-3 (HYV, High input response, 150d, 170mg seeds size)

◦ **Other varieties-** Radhey, K468, Pant G114, Avrodhi, Gaurav, Pusa209, 256, 408, 413, C 235, Amar, L 550. Etc.

1. **Climate**

1. Comes well under dry tracts with an annual rainfall of 600 – 1000mm.

2. **Soil**

1. Sandy loam to clay loam soil.

3. **Field preparation**

1. One deep ploughing followed by two harrowing

2. Crop needs clodded and rough seed bed for aeration in root zone.

4. **Sowing**

1. Second fortnight of October to first week of November

5. Seed rate

1. 75 -100 kg/ha, depth of sowing – 8 to 10cm
2. Spacing – 30 cm between rows for Desi types and 40 to 45 cm for Kabuli types

1. Nutrient management

Crop	Ecosystem	Planting time	N	P ₂ O ₅	K ₂ O	S
Chickpea	Rainfed	Normal	20	40	0	20
	Irrigated	Normal	20	60	20	20
		Late	40	40	20	20

1. Weed management

1. 2 hand weeding at 25 to 30 DAS and after 60 DAS
2. Basalin @ 1 kg a.i/ ha as pre emergence + 1 hand weeding at 60 DAS

2. Water management

1. Light irrigation at flowering and grain development stage.

3. Nipping

Plucking the apical buds of the crop at about 30 to 40 DAS is done to stop the apical growth. It promotes the lateral branching, plants to become more vigorous and produce more vigorous and produce more flowers and pods and yield per plant is increased.

1. Harvesting

The matured plants are cut and dried under direct sun. The dried plants are threshed using sticks to separate the grains.

1. Grain yield

Desi types – 1.5 to 2 t/ha
Kabuli types – 2.5 to 3.5 t/ha

PLANT PROTECTION

Disease and their control

1. Wilt:- This disease is caused by a fungus called *Fusarium oxysporum*. Its effect turns the leaves of the plant yellow and the plant stops growing.

Control:- Grow anti disease. Do not plant chickpea in wilt planted field for 3 years. Before planting the seeds, treat with thiram(1:1)@2.5gram/kg of seed.

2. Blight:- This disease is also caused by fungi. This disease spreads from seed. Brown spots appear on the stem, leaves and pods of the plant.

Control:- Grow anti-bacterial varieties. Destroy crop residue from the field after harvesting. Adopt appropriate crop cycle. Treat the land with 10kg of captan before sowing.

3. Rust:- It is a fungal disease called *Uromyces* sp..Due to this disease, brown and dark brown spots are seen on the lower surface of the leaves.

Control:- Disease can be avoided by growing anti-disease varieties.

INSECTS AND THEIR CONTROL

1. Cut worm:- It is an underground insect. Its caterpillar is green in colour. It eats the leaf and stem of the plant.

Control:- Drenching of ridges with the solution of Chlorpyrifos 20 EC at the rate of 2.5 l/litre of water when 2 % damage occurs.

- Use of Phorate 10 per cent granules at the rate of 10 kg per hectare or Carbufuran 3 per cent granules at the rate of 30 kg per hectare at the time of sowing has also been found very effective.

2. Gram pod borer:- Its caterpillar pierces the gram bean and eats the grain.

Control:- Adult insects should be collected and destroyed.

2. PEA

Botanical classification

Botanical name- Pisum species

Family - Leguminaceae

- Third important cool season crop next to chickpea and French bean
- Cultivated in about 6.51 million ha world wide with 10.95 million t annually
- Distributed in Asia, Africa, Europe, N.America, & Auastralia
- Usually cultivated for dry pods and variety of snacks



World area production and productivity of Fieldpea

Country	Million ha	Million t	T / ha
Europe	3.28	6.77	2.06
France	0.53	2.57	4.84
Russian Federation	1.18	1.00	0.85
Asia	1.58	1.87	1.19
China	0.70	1.15	1.64
India	0.62	0.56	0.91
N C America	0.72	1.40	1.96
Canada	0.63	1.26	2.00

Australia	0.31	0.38	1.24
South America	0.12	0.10	0.82
World	6.52	10.95	1.68

Indian scene of Fieldpea

State	Million ha	Million t	T / ha
UP	0.41	0.54	1.32
MP	0.19	0.08	0.41
Assam	0.03	0.02	0.61
Rajasthan	0.01	0.02	2.19
All India	0.73	0.72	0.95

- **Origin**

- Mediterranean region of Europe & West Asia
- Before 3000 BC

- **Plant**

- There are two varieties
 - Gardenpea : *P. sativum* var. *hortense*
 - Fieldpea : *P. sativum* var. *arvense*
- Annual herbaceous well developed tap root system plant

- **Plant - gardenpea**

- Flowers auxiliary, long peduncle, raceme with 1-2 flowers
- Pods are variable length and breadth, curved/ straight

- **Plant - Fieldpea**

- Flowers are purple or lavender colored
- Short peduncle
- Seeds smaller than garden pea, angular

- **Varieties**

- Rachna, Pant Marter 5, HUP 2, DMR 11

- **Other varieties-** Shikha, Rachana, J.p-885, Pusa prabhat, Sapna, Aman, Aadarsh, Vikas, Type-19, 56, Swati, Malviya peas2, 15. Etc.

- Crop duration 110-140days
- Seed weighs 160 – 240mg

- **Soil**

- All types of soil
- Poor to fertile
- Well drained soil is more suitable since sensitive to salinity and alkalinity

- **Field preparation**

- On heavy soils rough seed bed is suitable
- Medium tillage is sufficient

- **Seed treatment**

- For seed borne pests and diseases
- Rhizobium for nodulation

- **Season**

- NW Plains – end of October
- NE Plains – Second fortnight of November
- Soil moisture availability decides the time
- Delay in sowing end with terminal drought

- **Seed rate**
 - Depends up on the size of the seeds & spacing
 - 50-60 kg for small seeded and 80-90 kg for bold seeded
- **Method of sowing**
 - Broadcasting and planking
 - Drilling manually
 - Seed drill sowing
- **Depth of sowing**
 - Since all cool season pulses are hypogeal can be planted deep depending on the moisture
- **Nutrient Management**

Ecosystem	Planting time	N	P2O5	K2O	S
Rainfed	Normal	20	40	0	20
Irrigated	Normal	40	40	20	20
	Late	40	40	20	20

- Crops are sown in residual soil moisture
- They may face terminal drought
- One or two supplemental irrigation is needed
- May be moisture conservation practices
- **Weed management**
 - All methods to be employed
 - Herbicides can also be as per kharif pulses
- **Cropping systems**
 - Cereal – legume is always good

- They also under mixed community with winter cereals like wheat and barley
- **Harvest**
- Over ripening leads to great loss of yield
- Staggered harvesting is one way
- Cut entire plant and carry with moisture & then dry and thrash, clean
- Store the seeds at 8-10% moisture

PLANT PROTECTION

(DISEASE AND THEIR CONTROL)

1. Powdery mildew:- This disease is caused by a fungus called Erysiphe poligoni. This disease occurs in the most humid weather. White powdery composition appears on the leaves.

Control:- To prevent these disease, dissolve 3kg of soluble sulfur in 1000 litres of water and sprinkle it in one hectare.

2. Rust:- This disease is caused by a fungus called Uromyces fabae. This disease sometimes causes more damage to the crop.

Control:- Anti- disease varieties should be grown to prevent this. To prevent this, spray 2.25 kg of Dithane M-45 in 1000 liters of water and sprayed per hectare.

3. LENTIL

Botanical classification

Botanical name- Lens esculenta Moench

Family - Leguminaceae

1. Importance

1. Consumed as dry seed
2. In India as flour, dal (boiled, smashed in to soup), several snacks and sweets
3. Rich source of ca, phosphorous and iron
4. Protein 24-26%
5. Also rich in vitamins

2. Global area production

1. 5% of pulses
 2. 3.3 million ha &
 3. 2.9 million t
3. Predominantly grown in Asia (80%)
 4. Also grown in N & E Africa, N-C America, S. Europe



Area in India

State	Area	Production	t/ha
UP	0.55	0.45	0.81
MP	0.49	0.24	0.48
Bihar	0.17	0.10	0.58
WB	0.05	0.04	0.84
Rajasthan	0.01	0.03	1.01
All India	1.34	0.88	0.66

1. Origin

- Egypt is its origin. It is grown in Spain, Pakistan, Bangladesh and Syria
- Broadly classified as microsperma and macrosperma
 - Microsperma are predominantly cultivated in India
 - Macrosperma are large sized grains cultivated in Mediterranean region
- To mention some varieties in India
 - Pant L 406, 639, Pant L 4
 - DPL 15 and DPL 62

2. Climate

As the crop requires very cool climate it is cultivated in winter season. It can tolerate severe winter and frost condition also.

- **Soil**

- The suitable soil types are alluvial are black cotton soils.

- **Varieties**

- Pusa-1, Pusa-4, Pusa-6, Pusa-206, Pant-209, T-36, B-77, Pant L-639.
- **Other Varieties-** IPL-81, Narendra massor-1, Pant massor-5, 4, L-4076, Pusa vaibhav, K-75, Shekhar-3, Shekhar-2, VL-4, IPL-406, Type- 36, Type-8, DPL-15 etc.

- **Cultivation practises**

- Lentil is grown as second crop after rice. The seeds are also sown broadcast in standing rice crop without any field preparation.

- **Seeds and sowing**

- The seeds are sown in lines at 20 -30 cm apart using 30 -50kg seed/ha.

- **Fertilizer management**

- The crop may be grown on residual fertility. Application of 15 kg N and 40 kg P₂O₅ per hectare gives better yield.

- **Water management**
- If there is no winter rain one or two light irrigation at flowering and grain filling stages are given.

- **Yield**
- The crop produces 8 – 9 quintals/ha under rainfed and 18-20 quintals/ha under irrigated condition with good fertilizer management.

PLANT PROTECTION

Disease and their control

1. Wilt:- This disease is caused by a fungus called *Fusarium oxysporum*. Its effect turns the leaves of the plant yellow and the plant stops growing.

Control:- Grow anti disease. Before planting the seeds, treat thiram(1:1)@2.5gram/kg of seed.

2. Blight:- This disease is also caused by fungi. This disease spreads from seed. Brown spots appear on the stem, leaves and pods of the plant.

Control:- Grow anti-bacterial varieties. Destroy crop residue from the field after harvesting. Adopt appropriate crop cycle. Treat the land with 10kg of captan before sowing.

3. Rust:- It is a fungal disease called *Uromyces fabae*. Due to this disease, brown and dark brown spots are seen on the lower surface of the leaves.

Control:- Disease can be avoided by growing anti-disease varieties. Take two sprays of 0.2 % dithane M-45 medicine solution at a 15-15 days difference.

INSECTS AND THEIR CONTROL

1. Cut worm:- It is an underground insect. Its caterpillar is green in colour. It eats the leaf and stem of the plant.

Control:- Drenching of ridges with the solution of Chlorpyrifos 20 EC at the rate of 2.5 l/litre of water when 2 % damage occurs.

- Use of Phorate 10 per cent granules at the rate of 10 kg per hectare or Carbofuran 3 per cent granules at the rate of 30 kg per hectare at the time of sowing has also been found very effective.

4. (RAJMAH/RAJMASH)

Botanical name- Phaseoles vulgare

Family- Leguminaceae

Kidney beans is also known as the chilli bean because of its dark red color and the visually resemblance the shape of a kidney. Kidney beans are a good source of protein also it is excellent source of molybdenum. It contain good source of cholesterol-lowering fibre. Rajma is a popular dish from the North Indian cuisine made from red kidney beans. Maharashtra, Jammu and Kashmir, Himachal Pradesh, Uttarakhand, West Bengal, Uttar Pradesh, Tamil Nadu, Kerala and Karnataka are major kidney bean growing states in India.

CLIMATE

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Temperature

15-25°C

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Rainfall

60-150mm

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Sowing Temperature

22-25°C

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Harvesting Temperature 28-30°C

SOIL

It can be grown on wide range of soils from light sandy to heavy clay soils. Well drained loamy soil is good for kidney beans cultivation. It is very sensitive to saline soils. Gives best result when pH of soil is 5.5 to 6.

POPULAR VARIETIES WITH THEIR YIELD

VL Rajma 125: Suitable for timely sown of Uttarakhand Hills. 4-5 seeds per pods and 100 seed weight about 41.38gm.

RBL 6: Suitable for irrigated areas of Punjab state. 6-8 seeds per pod and seeds are of light green color.

Other varieties:- P.D.R-14, Malviya-137, V.L-63, Utkarsh, Varun, B.L-63, HPR-35, Ankur, PDR-14, Arun, etc.

Other high yielding varieties grown in India are HUR 15, HUR-137, Amber and Arun. Also Arka Komal, Arka Suvidha, Pusa Parvathi, Pusa Himalatha, VL Boni 1, Ooty 1.

LAND PREPARATION

Give two to three ploughing to bring soil at fine tilth. Make field level so that water stagnation should not occurred in main field. Crop is very sensitive to water logging. At last ploughing apply Farmyard Manure or well decomposed cow dung@60-80qtl/acre.

SOWING

Time of sowing

For spring season, best time for Kidney beans cultivation is February-March and for Kharif season, it is sown during May-June month. In Punjab, some farmers sow Kidney beans in last week of January.

Spacing

For early sown varieties use spacing of 45-60 cm between rows and 10-15 cm between plants. For pole type varieties sown at distance of 1 m in hill@3-4plant per hill.

Sowing Depth

Sow the seeds at depth of 6-7 cm.

Method of sowing

For sowing dibbling method used. In plain area seeds are sown in line or on bed where as in hilly areas, seeds are sown on ridge.

SEED

Seed Rate

For early sown varieties use seed rate of 30-35kg/acre. For pole type varieties sown at distance of 1m in hill@3-4plant per hill with seed rate of 10-12kg/acre.

Seed Treatment

Before sowing treat seeds with Thiram@4gm per Kg of seeds. Dried seed in shade and then sown immediately.

FERTILIZER

Fertilizer Requirement (kg/acre)

UREA	SSP	MURIATE OF POTASH
87	150	On soil test results

Nutrient Requirement (kg/acre)

NITROGEN	PHOSPHORUS	POTASH
40	25	#

Apply Nitrogen@40kg/acre and Phosphorus@25kg/acre in form Urea@87kg and SSP@150kg/acre. Do soil testing before sowing for accurate fertilizer application.

Show Less

WEED CONTROL

Initial growth period is crucial for crop growth. Avoid weed infestation at this stage. Complete weeding operations synchronized along with fertilizer and irrigation operations. Use Fluchloralin@ 800ml/acre or Pendimethalin@1ltr per acre as pre-emergence weedicide.

IRRIGATION

For better germination of seed give pre-sowing irrigation. 6-7 irrigations are required during growing season. Irrigation on 25th day after sowing and three irrigation at 25 days interval are necessary to get optimum yield. Give irrigation prior to blooming, during flowering and at pod development stage, water stress at these stage will lead to yield loss.

PLANT PROTECTION



- **Pest and their control:**

Thrips: Commonly observed pest. Mostly observed in dry weather. They suck sap from the foliage and results in curling of leaves. Also causes flower drop. To check severity of thrips incidence, keep blue sticky traps @6-8 per acre. Also to reduce the incidence spray Verticillium lecani@5gm/Ltr water

2) If incidence of thrips is more, then take spray of Imidacloprid 17.8SL or Fipronil @1ml/Ltr water or Acephate 75% WP@1gm/Ltr.



Aphid: They suck sap from the leaf. They excrete honey like substance and developed sooty mould i.e blackish colour fungus on the Calyx and pods thus deteriorate quality of product.

To control take spray of Acephate 75SP@1gm/Ltr or Methyl demeton 25EC@2ml/Ltr of water. Soil application of granular insecticides viz Carbofuran, Phorate@4-8kg/acre on 15 and 60 days after transplanting were also effective.



Mite: These are widely distributed pest observed throughout the world. Nymphs and adults feed exclusively on the lower surface of the leaves. Infected leaves gives cup shape appearance. Heavy infestation results in defoliation, bud shedding and drying of leaves. If Infestation of yellow mite is observed in field, spray of Chlorfenapyr@15ml/Ltr, Abamectin@15ml/Ltr are found effective. Mites is a serious pest and it may cause yield loss up to 80%. For effective control spray Spiromesifen 22.9SC @200ml/acre/180Ltr of water.



- **Disease and their control:**

Powdery Mildew: Patchy, White powdery growth appear on lower side of leaves. It parasitizes the plant using it as a

food source. It can developed at any stage of crop development. In severe infestation it causes defoliation. Avoid water lodging in field. Keep field clean. To Control spray with Hexaconazole along with sticker@1ml/Ltr of water. In case of sudden rain, chances of powdery mildew. Mild infestation take spray of water soluble Sulphur@20gm/10Ltr of water 2-3 times with interval of 10 days.



Wilt: Moist and poorly drain soil causes damping off disease. It is soil borne disease. Water soaking and shrivelling of stem occurs. Seedlings killed before emergence.

To control Wilt, Drench nearby soil with Copper oxychloride@25gm or Carbendazim@20gm/10Ltr of water. To control Wilting of plants due to root rot do drenching with Trichoderma bio fungus@2.5kg/500Ltr water, near to roots of plants.



Yellow Mosaic: Light and green patches observed on leaves. In early stage plant growth get stops. Yellowing, chlorotic ring spots on leaves and fruits. Select healthy and disease free seeds for cultivation. Uproot and destroyed infected plant away from field. If observed in field to control it take spray of Acephate 75SP@600gm/200Ltr or Methyl demeton 25EC@2ml/Ltr of water.

HARVESTING

Harvest when pods are full grown and ripe and there color turn to yellow. Also leaves turn yellow and majority of leaves drop. Depending upon variety use pods are ready to harvest 7-12 days after flowering. Overall crop is ready to harvest in 120-130 days. Do harvesting at right time as delay cause shattering. Keep harvested plant for three-four days in sun. After proper drying of crop, threshing is done with help of bullocks or with sticks.

POST-HARVEST

Kidney beans required little processing after harvesting but take care during storage to maintain good quality. Before storing, do sorting and remove damaged, infected beans.

Heat and humidity cause deterioration in quality so always stored beans in cool, dark and dry place.