

How to Cultivate Chickpea (Gram) Successfully: A Farmer's Guide

Dr. Anand Kumar Jain¹, *Dr. Suman Kalyani², Dr. Ranvir Kumar³ and Dr. Beerendra Singh⁴

¹Associate Professor-cum- Senior Scientist (Agronomy), Pulses Research Centre, Mokama, Patna, Bihar-803302, India

²Assistant Professor-cum-Junior Scientist (Plant Breeding & Genetics), Bhola Paswan Shastri Agricultural College, Purnea, Bihar-854302, India

³Associate Professor-cum-Senior Scientist (Agricultural Economics), Bhola Paswan Shastri Agricultural College, Purnea, Bihar-854302, India

⁴Assistant Professor-cum-Junior Scientist (Soil Science and Agricultural Chemistry), Irrigation Research Station, Bikramganj (Rohtas), Bihar-802212, India

*Corresponding Author's email: kalyanipbg@gmail.com

Chickpea (*Cicer arietinum*), also known as **gram** or **chana**, is one of the most widely grown and consumed pulse crops in India and across the globe. It serves as an essential source of **plant-based** protein, especially in vegetarian diets, and plays a significant role in ensuring nutritional security for millions of people. Being a rabi (winter) season crop, chickpea thrives in semi-arid regions and is often grown under rainfed conditions. However, with the adoption of improved agronomic practices, its cultivation has expanded to irrigated areas, boosting both production and profitability. Chickpea is not only valuable from a nutritional standpoint but also important agronomically. As a leguminous plant, it enhances soil fertility by fixing atmospheric nitrogen through symbiotic association with *Rhizobium* bacteria. This makes it a sustainable component of crop rotations, especially after cereals like wheat or rice. In recent years, the government has promoted pulse production through various schemes and minimum support prices (MSPs), making chickpea a profitable and low-risk crop for small and marginal farmers. This guide aims to provide a comprehensive overview of successful chickpea cultivation, from land preparation to harvest and marketing.

Botanical Description

Chickpea (*Cicer arietinum* L.) is a member of the **Fabaceae (Leguminosae)** family and is grown primarily for its edible seeds. It is an **annual, cool-season legume**, known for its adaptability to dryland farming and ability to enrich the soil with nitrogen.

Botanical Classification

- **Kingdom:** Plantae
- **Family:** Fabaceae
- **Genus:** *Cicer*
- **Species:** *Cicer arietinum*
- **Chromosome number:** $2n = 16$
- **Type of pollination:** Mostly self-pollinated



Types of Chickpea

There are two major types of cultivated chickpeas:

Type	Seed Characteristics	Suitability
Desi	Small, angular, dark-brown seeds with thick coat	Widely grown in India, drought-tolerant
Kabuli	Large, round, cream-colored seeds with thin seed coat	Preferred for export; needs better soil and irrigation

Morphological Characteristics

- **Root:** Deep taproot system with numerous lateral branches and nodules formed by *Rhizobium* for nitrogen fixation.
- **Stem:** Erect, branched, and covered with glandular hairs.
- **Leaves:** Pinnately compound with 11–15 small leaflets.
- **Flowers:** Papilionaceous (typical of legumes), usually pink, white, or blue, borne singly on short axillary stalks.
- **Pods:** Small, inflated, slightly curved, containing 1–2 seeds.
- **Seeds:** Rounded or angular, smooth or wrinkled, color varies from cream to black depending on the type.

Agro-Climatic Requirements

Successful chickpea cultivation depends heavily on the right climatic conditions and soil type. Chickpea is a cool-season legume crop, highly suitable for rainfed and dryland areas, particularly during the rabi (winter) season in India.

Climate Requirements

- **Temperature:**
 - Optimal temperature for germination: **20–25°C**
 - Best temperature for flowering and pod development: **15–20°C**
 - High temperatures during flowering reduce yield due to **flower drop**.
 - Sensitive to **frost**, especially at flowering and pod formation stages.
- **Rainfall:**
 - Chickpea needs **moderate and well-distributed rainfall** of **400–600 mm**.
 - It is highly **drought-tolerant**, but excessive rainfall or waterlogging severely affects the crop.
- **Sunlight:**
 - Requires **full sunlight** for proper growth and flowering.
 - Shaded conditions reduce photosynthesis and pod setting.

Soil Requirements

- **Soil Type:**
 - Prefers **well-drained loamy to sandy loam soils** rich in organic matter.
 - Can also grow in black cotton soils and alluvial soils with good structure.
- **Soil pH:**
 - Optimal pH range: **6.0 to 7.5**
 - Avoid highly acidic or saline soils.
- **Drainage:**
 - Chickpea roots are highly sensitive to water stagnation.
 - Good drainage is essential, especially in low-lying fields.

Field Preparation

Proper field preparation is critical for successful chickpea cultivation, especially in rainfed areas. The aim is to create a **well-aerated, fine tilth** soil structure that facilitates good seed-soil contact, water conservation, and weed control.

Steps in Field Preparation

1. Deep Ploughing

- Begin with **one deep ploughing** (using a moldboard plough) during the summer or after the previous crop harvest.
- This helps break hardpan, expose pests and weed seeds to sunlight, and improve soil aeration.

2. Harrowing and Leveling

- Followed by **2–3 cross harrowings** to crush soil clods and ensure a fine tilth.
- Use a plank or leveller to level the field—this helps in **uniform moisture distribution** and **prevents waterlogging** in low areas.

3. Organic Manure Application

- Apply **5 to 10 tons/ha of well-rotted Farm Yard Manure (FYM)** or compost during the final ploughing.
- Organic matter improves soil structure, moisture retention, and microbial activity.

Special Tips for Rainfed Areas

- In drylands, prepare the field **across the slope** to reduce runoff and conserve moisture.
- **Broad Bed and Furrow (BBF)** system or ridge and furrow methods are recommended in medium to heavy soils for moisture conservation and better root development.

Weed Management during Land Preparation

- Removing **previous crop residues** and **first flush of weeds** during field preparation reduces early weed competition.
- Apply **pre-emergence herbicides** (like Pendimethalin) after sowing but before crop emergence for effective control.

Seed Rate and Sowing

Proper seed selection, treatment, and sowing techniques are essential for establishing a healthy chickpea crop. Uniform germination, optimum plant population, and correct spacing all contribute to higher yields and better crop management.

1. Seed Selection

- Use **certified, disease-free, high-yielding seeds** recommended for the local region.
- Choose **desi** or **kabuli** varieties based on soil, climate, and market preference.

2. Seed Rate

Type of Chickpea	Seed Rate (kg/ha)
Desi Type	60–75 kg/ha
Kabuli Type	100–120 kg/ha

Higher seed rate is used for Kabuli types due to their larger seed size.

3. Seed Treatment

Before sowing, seed treatment is essential to protect from soil- and seed-borne diseases and to promote nitrogen fixation.

- **Fungicide Treatment:**
 - ✓ Treat seeds with **Carbendazim or Thiram @ 2 g/kg** of seed to prevent fungal diseases like collar rot or seed rot.
- **Biofertilizer Treatment:**
 - ✓ **Rhizobium culture:** Enhances nodulation and nitrogen fixation.
 - ✓ **Phosphate-Solubilizing Bacteria (PSB):** Improves phosphorus availability.

Important: Allow treated seeds to dry in shade before sowing.

4. Sowing Time

- **North India: October to mid-November**
- **Central India: Mid-October to early November**
- **Late sowing** results in poor flowering, reduced nodulation, and pest attack.

5. Sowing Method and Spacing

- **Sowing Method:**
 - ✓ Use **seed drill** or **desi plough** for uniform depth and spacing.
 - ✓ Depth of sowing: **5–8 cm**

- **Spacing:**
- ✓ **Row to Row:** 30–45 cm
- ✓ **Plant to Plant:** 10–15 cm

Proper spacing ensures **adequate sunlight penetration**, **better air circulation**, and **reduced disease incidence**.

Soil Moisture Consideration

- Sowing should be done when **sufficient residual soil moisture** is available after monsoon.
- Avoid sowing in dry or overly wet soil.

Irrigation Management

Chickpea is generally grown as a **rainfed crop**, but it responds significantly to **limited, well-timed irrigation**, especially in areas with erratic rainfall or under irrigated conditions. Proper irrigation scheduling ensures better pod setting, seed development, and overall yield enhancement.

1. Water Requirements

- Total water requirement for chickpea: **250–300 mm** (including rainfall + irrigation).
- Excess irrigation can cause **waterlogging**, leading to **root rot** and **fungal diseases**—chickpea is highly sensitive to this.

2. Critical Stages for Irrigation

If irrigation is available, apply **two to three irrigations** at the most **critical growth stages**:

Stage	Time After Sowing (DAS)	Importance
Branching Stage	25–30 DAS	Promotes vegetative growth
Flowering Stage	45–50 DAS	Supports flower formation and prevents flower drop
Pod Development Stage	60–70 DAS	Ensures proper pod filling and seed development

Avoid irrigation during germination if there is enough residual moisture.

3. Methods of Irrigation

- **Border strip or check basin:** Suitable for level fields.
- **Furrow irrigation:** Prevents water stagnation near root zone.
- **Sprinkler irrigation:** Suitable for sandy or undulating land.
- **Drip irrigation:** Not common, but can be adopted for water-saving precision farming.

4. Precautions During Irrigation

- Avoid **over-irrigation**, especially at flowering stage.
- Never irrigate during **pod maturity**, as this can lead to pod rotting and poor seed quality.
- Ensure **proper drainage** in heavy soils.

5. Rainwater Harvesting and Moisture Conservation

- Use **mulching** (crop residues or straw) to conserve soil moisture.
- In dryland farming, adopt **ridge and furrow** or **broad-bed and furrow** systems to retain soil moisture.

Weed and Pest Management

Weed infestation, insect pests, and diseases are major factors that reduce chickpea yield, especially during the early growth and reproductive phases. Integrated weed and pest management practices can help minimize crop losses and ensure healthy growth.

A. Weed Management

Critical Period

- First **30–45 days after sowing (DAS)** are crucial for weed control.

Common Weeds in Chickpea

- *Chenopodium album* (Bathua)
- *Cynodon dactylon* (Doob grass)

- *Anagallis arvensis*
- *Phalaris minor*

Control Measures

• Cultural Methods:

- ✓ One or two **hand weeding or hoeings** at 25–30 DAS

• Chemical Control:

- ✓ **Pre-emergence:** Pendimethalin @ 1.0 kg/ha (within 1–2 days of sowing)
- ✓ **Post-emergence:** Imazethapyr @ 50 g/ha (20–25 DAS), if needed

B. Insect Pest Management

1. Pod Borer (*Helicoverpa armigera*)

- **Damage:** Larvae bore into pods and feed on developing seeds
- **Management:**
 - ✓ Use **Heli traps** or pheromone traps (5/acre)
 - ✓ Spray **Neem Seed Kernel Extract (NSKE)** 5% or **Emamectin Benzoate 5 SG** @ 220 g/ha
 - ✓ Release **Trichogramma chilonis** or **Nuclear Polyhedrosis Virus (NPV)** as biological control

2. Termites

- **Damage:** Attack roots and seedlings in early stages
- **Management:**
 - ✓ Seed treatment with **Chlorpyrifos** @ 5 ml/kg of seed
 - ✓ Apply chlorpyrifos in soil if infestation is high

3. Cutworms

- **Damage:** Cut young seedlings at ground level
- **Management:**
 - Deep summer ploughing
 - Avoid late sowing
 - Spray appropriate insecticide in infested patches

C. Disease Management

1. Fusarium Wilt (*Fusarium oxysporum f.sp. ciceri*)

- **Symptoms:** Yellowing, drooping, and wilting of leaves
- **Control:**
 - Use resistant varieties (JG 11, KWR 108)
 - Crop rotation
 - Treat seeds with *Trichoderma viride*

2. Ascochyta Blight (*Ascochyta rabiei*)

- **Symptoms:** Brown lesions on stems, leaves, and pods
- **Control:**
 - Use disease-free seed
 - Spray Carbendazim + Mancozeb at early symptom stage

3. Botrytis Gray Mold (*Botrytis cinerea*)

- **Symptoms:** Gray fungal growth on flowers and pods under humid conditions
- **Control:**
 - Avoid close spacing
 - Use protective fungicide sprays

Integrated Pest Management (IPM) Practices

- Use **certified, treated seeds**
- Follow **crop rotation** and **proper field hygiene**
- Install **pheromone traps** and promote **natural predators**
- Use chemicals only when pest threshold is exceeded

Varieties Recommended for Cultivation

Choosing the right variety is one of the most important steps in chickpea cultivation. High-yielding, disease-resistant varieties suited to the local climate and soil can significantly improve productivity and reduce risk from pests and diseases.

Classification of Chickpea Varieties

Chickpea varieties are broadly classified into:

Type	Characteristics	Suitability
Desi Type	Small, angular, dark brown seeds; rough seed coat; early maturing; hardy	Preferred in most Indian states for rainfed areas
Kabuli Type	Large, round, cream-colored seeds; smooth coat; long duration; sensitive to stress	Grown under irrigation; good for export markets

Popular Desi Varieties

Variety	Yield (q/ha)	Special Features	Suitable Areas
JG 11	20–25	Wilt resistant, early maturing	MP, Maharashtra
JAKI 9218	22–28	Resistant to wilt and stunt	Central India
Pusa 372	18–22	Tolerant to drought, bold seeds	UP, Bihar
Vijay	20–25	Suitable for rainfed	Maharashtra, Karnataka
RSG 888	20–24	Tolerant to Ascochyta blight	Rajasthan
Sabour Chana-1	22-24	Resistant to Wilt and Stunt	Bihar

Popular Kabuli Varieties

Variety	Yield (q/ha)	Special Features	Suitable Areas
KAK 2	15–20	Large seed size, attractive color	MP, UP
Phule G-95311	18–20	High yielding, bold seed	Maharashtra
Pusa 1003	20–22	Early maturity, export quality	Haryana, Punjab
PKV Kabuli 2	16–18	Drought-tolerant, suitable for processing	Maharashtra

Points to Consider When Selecting a Variety

- **Rainfed areas:** Choose early-maturing, drought-tolerant desi types
- **Irrigated areas:** Opt for bold-seeded kabuli types
- **Disease-prone areas:** Choose varieties resistant to wilt, blight, and root rot
- **Market preference:** Consider seed size, color, and cooking quality (especially for kabuli)

Harvesting and Yield

Harvesting at the right stage and following proper post-harvest practices are crucial for minimizing losses and ensuring **good grain quality**, which directly influences market price and profitability.

A. Maturity Indicators

Chickpea is ready for harvest when:

- **Leaves start drying and shedding**
- **Pods turn brown and rattle when shaken**
- Seeds are **hard** and reach full maturity
- Moisture content in grains is reduced to around **15–18%**

Delayed harvesting can lead to:

- Pod shattering
- Loss of seed viability
- Increased pest and disease risk

B. Harvesting Method

- **Manual Harvesting:**
 - ✓ Plants are either **cut close to the ground** or **uprooted** using sickles.
 - ✓ Collected plants are **sun-dried** for 4–5 days.



- **Mechanical Harvesting** (if available):
 - ✓ Combine harvesters can be used in large-scale chickpea fields.

C. Threshing and Cleaning

- Dried plants are **beaten with sticks** or threshed using **axial flow threshers**.
- Grains are cleaned using **winnowing** or grain cleaners.
- Ensure that **foreign matter and broken seeds** are removed before storage or sale.

D. Average Yield

Variety Type	Under Rainfed (q/ha)	Under Irrigated (q/ha)
Desi	10–15	15–20
Kabuli	12–16	16–22

Yield varies depending on variety, soil fertility, irrigation, and pest/disease management.

E. Post-Harvest Storage

- Dry grains to **8–10% moisture** before storage to prevent fungal or insect infestation.
- Store in **airtight containers or gunny bags** in a cool, dry place.
- Use **Neem leaves or herbal powders** as natural grain protectants.

Conclusion

Chickpea (*Cicer arietinum*) cultivation offers a profitable, low-risk, and sustainable farming opportunity for both rainfed and irrigated regions of India. As a leguminous crop, chickpea plays a dual role—enhancing soil fertility through nitrogen fixation and providing a high-protein food source for millions.

With the increasing demand for pulses and the government's support in the form of minimum support prices (MSP), input subsidies, and crop insurance schemes, chickpea cultivation is becoming increasingly attractive to small and marginal farmers.

Adopting improved varieties, balanced fertilization, timely sowing, and integrated pest and weed management can significantly enhance productivity. Moreover, value addition, clean harvesting, and efficient marketing strategies ensure better price realization and income stability.

In summary, chickpea is not just a traditional pulse crop but a strategic choice for climate-resilient, nutrition-sensitive, and economically viable agriculture. By following scientific practices outlined in this guide, farmers can unlock the full potential of chickpea farming and contribute to India's pulse self-sufficiency and rural prosperity.