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Original Article**Smart Agronomic Interventions for Chickpea (*Cicer arietinum* L.) Production****V. K. Yadav¹, Angad Prasad², P. K. Patel³, K. K. Pandey⁴, A. K. Patel⁵ and Anshu Kumari⁶**¹Research Scholar, Faculty of Agriculture, U. P. College, Varanasi-221002²Subject Matter Specialist (Agronomy), KVK, Mau, -221705³Research Scholar, Faculty of Agriculture, D.D.U.G.U., Gorakhpur-273009⁴Assistant Professor, Faculty of Agriculture, S.M.M.T. P.G. College, Ballia-277001⁵Research Scholar, Faculty of Agriculture, S.M.M.T. P.G. College, Ballia-277001⁶Research Scholar, Faculty of Agriculture, J.N.C.U., Ballia-277301*Corresponding author: drvikasagro@gmail.com

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INTRODUCTION

The word 'Cicer' is obtained from a Greek word 'kiros', referring to a well-known Roman family 'Cicero', and 'arietinum' is obtained from a Latin word 'aries', meaning 'ram' (male sheep) because kabuli chick pea is similar to a ram's head shape. The sour taste of leaves and pods is primarily due to malate (malic acid), which makes up 90-96.4%, and oxalate (oxalic acid), which accounts for 4-10%. Chickpeas are beneficial for blood purification, and germinated seeds are often recommended for curing scurvy. Seeds that have been sprouted for 3-5 days contain notably higher levels of vitamin C.



According to taxonomy, chickpeas are members of the Fabaceae family's monogeneric tribe Cicereae. The genus Cicer has 34 perennial species and 9 annual species. The yearly short herb known as Cicer arietinum, or the cultivated chickpea, can grow in a variety of ways, from prostrate to erect. All plant parts are covered in glandular and non-glandular hairs, except the flower's petals. These hairs protect the plant against sucking bugs by secreting a unique acid mixture. There are primary, secondary, and tertiary branches on the stem and a self-pollinated crop, a C₃ plant, a long-day plant, and an indeterminate growth habit of the chickpea crop.

Area and distribution

During 2025–2026, mustard cultivation in India covered 10 to 11 million hectares, underscoring its continued importance among oilseed crops. The total production reached around 11.3 million tonnes, indicating a substantial contribution to the country's edible oil supply. The average productivity stood at 1461 kg per hectare, reflecting improvements driven by better varieties and agronomic practices. Overall, mustard remains a key crop supporting both farmer income and national oilseed security.

Chickpea is the most important pulse crop grown in the Rabi season in India, cultivated mainly in northern India. India is a highly productive country, accounting for nearly 70–75% of global production, according to recent FAO data for 2025-26. In terms of pulse agriculture in India, chickpeas account for about half of both production and cultivated area. In addition to being the world's top importer of chickpeas, the nation is also its largest producer. The four states that cultivate it most are Madhya Pradesh (the largest producer, accounting for about one-third of total production), Rajasthan, Maharashtra, and Uttar Pradesh.

In previous years, Madhya Pradesh has been India's top producer of chickpeas. But according to the Economic Survey 2025–26 (Statistical Appendix, Table 1.0), Maharashtra surpassed Madhya Pradesh to become the biggest producer in 2024–25 with 2.96 million tons. As a result, leadership in chickpea production is dynamic and changes annually due to economic and agroclimatic reasons.

Therefore, Maharashtra is the highest leading state in 2024-25 (as per Economic Survey 2025-26)

State	Production Mt.	% Share
Maharashtra	2.96	26.67
Madhya Pradesh	2.11	19.01
Rajasthan	2.01	18.11

Table 1.0 (Source: Economic Survey 2025–26)

Soil Requirements

Chickpea is grown on different types of soils ranging from deep, well-drained sandy to sandy loams (northern India) to deep black cotton soils. These soils can retain up to 200 mm of moisture in the soil profile to a depth of 1 meter. The pH range of 5.7 to 7.2 provides maximum nutrient availability in the soil. Good soil aeration is necessary for chickpeas. Proper seedbed preparation for heavy soils is essential and requires careful attention. A rough seedbed is beneficial in these types of soils because it is less likely to experience surface compaction from winter rains, which could impede seedling emergence. Chickpeas are sensitive to soil sodicity and salinity.

Climate Requirements

Chickpeas grow in a dry, cool environment, but severe cold and frost are injurious. While temperatures between 15-25°C are ideal for vegetative growth, seed germination occurs at 20-25°C. Mild temperatures are crucial for blooming and pod development; exposure to high temperatures above 30-35°C during this period can result in poor pod setting and flower drop. On

the other hand, even if the crop has a small tolerance to low temperatures, severe frost during early growth may harm seedlings. It is preferable to areas having moderate rainfall of 60-90 cm per annum.

Field Preparation

Field preparation for sowing chickpeas depends on the soil type and cropping system. For heavy soils, a rough seedbed should be prepared to prevent the cloddy surface from packing due to winter rains. This approach also helps improve soil aeration and promotes easier seedling emergence.

Variety

The selection of suitable Chickpea varieties should be based on agro-climatic conditions, duration, and resistance to major pests and diseases. High-yielding and region-specific varieties ensure better adaptability and stable production. Table 1.1 below presents important recommended varieties, along with their key characteristics, including maturity duration, yield potential, and disease resistance.

Varieties	Releasing Year	Releasing Center	Yield (q/ha)	Maturity (Days)	State	Special Characters
Raj Vijay Gram 210(RVG-210)	2021	RVSKVV, AICRP, Sehohore (MP)	18-22	106-110	Madhya Pradesh	Tolerance to fusarium wilt and Pod Borer insect (<i>Helicoverpa</i>)
Raj Vijay Kabuli 121(RVG-121)	2021	RVSKVV, AICRP, Sehohore (MP)	19 -21	99-122	Madhya Pradesh	Resistant to fusarium wilt and dry root rot. Tolerant to the Pod Borer insect (<i>Helicoverpa</i>) and also tolerant to the beetle under storage condition
Sabaur chana-1(BRC-1)	2020	BAU, Sabour (Bihar)	24-26	130-134	Bihar	Moderately tolerant to wilt, dry root rot, and stunt disease, and resistant to pod borer insect are also.
Pusa Chickpea (BGM-10217)	2023	ICAR-New Delhi	18-20	124-135	Uttar Pradesh	Highest resistance to Fuserium wilt.
Pant Gram 10 (PG-265)	2024	G.B.P.U.A.T Pantnagar	18	130	Uttar Pradesh, Uttarakhand, Bihar, Jharkhand, West Bengal, Assam	Resistant to Fusarium wilt, collar rot, and stunt virus. Resistant against pod borer.

Nandyal Gram-1267 (NBeG-1267)	2024	A.N.G.R.A.U, Andhra Pradesh	23-25	90-95	Andhra Pradesh, Telangana, Karnataka, and Tamil Nadu	Resistant to Fusarium wilt
Phule Vikrant (Phule G-0405)	2018	Mahatma Phule Krishi Vidyapeeth Rhuri, Maharashtra	22	104-110	Suitable for Central Zone. Maharashtra, Madhya Pradesh, Gujarat, and South Rajasthan)	Moderately resistant to Fusarium wilt.
Pusa Chickpea-4037 (Aswini)	2025	ICAR-IARI	26.73-36.00	130-160	North west plain zone (Punjab, Haryana, Western Uttar Pradesh)	Resistant to Fusarium wilt, moderately resistant to dry root rot, and stunt diseases.
IPC L-4	2025	ICRISAT in collaboration with ICAR-IIPR Kanpur	15-17	128-133	Northwest plain Zone (Punjab, Haryana, part of Rajasthan, Western Uttar Pradesh)	Improved drought-tolerant/rain-fed conditions

Table 1.1 (Recommended Varieties)

Time of sowing

In rain-fed conditions, chickpea is sown to a depth of 8-10 cm. However, in Rajasthan, it is sown to a depth of 15 cm to protect against wilt incidence. In the Rabi season, which ranges from mid-October to mid-November, when the soil temperature is between 20 and 25 °C, chickpeas are best sown. Timely seeding ensures a larger potential yield, better nodulation, and optimal vegetative development.

Seed Rate and Spacing

Seed Rate is recommended based on seed size, Climatic conditions, and variety. Proper spacing ensures optimum plant population, efficient resource use, and higher grain yield.

(A) On the basis of seed shape

Shape of Seed	Kg/ha
Small Size	55-65
Medium Size	65-75
Large Size	80-100

(B) On the basis of Climatic Conditions

Climatic Conditions	Seed Rate
Irrigated	80-100 Kg/ha
Rainfed	110-120 Kg/ha

Seed Treatment

For effective crop establishment, seeds should be treated strictly following the FIR sequence (Fungicide–Insecticide–Rhizobium) to protect against seed- and soil-borne pathogens and early insect pests, and to enhance biological nitrogen fixation.

Fungicidal treatment: Treat seed with Thiram @ 2 g + Carbendazim @ 1 g per kg of seed to manage wilt and root rot.

Insecticidal treatment: Thiamethoxam 70 WP @ 3 g/kg seed for protection against early-season insect pests.

Biofertilizer and micronutrient treatment: Subsequently, inoculate seeds with Rhizobium culture @ 5 g/kg seed and Phosphate Solubilizing Bacteria (PSB) @ 5 g/kg seed to enhance nodulation and nitrogen fixation.

Depth of Sowing and Spacing

The crop can be sown at 30 to 45 cm apart using a local plough or a seed drill. Since wilt is more likely to harm a crop that is sown in a shallow manner, the seed should be planted 8–10 cm deep.

Manures and Fertilizers

Soil testing is the first and most essential step in planning nutrient management for chickpea. A pre-sowing soil test helps determine the availability of major nutrients (N, P, K), secondary nutrients (such as sulfur), and micronutrients (such as zinc and boron), enabling site-specific fertilizer recommendations. As a leguminous crop, chickpeas use symbiotic nitrogen fixation, which starts to work three to four weeks after seeding, to supply around 75% of their nitrogen needs. A starting dose of 20–25 kg N/ha is helpful for boosting early crop growth just before nodulation in soils with low levels of available nitrogen and organic matter. When both nitrogen and phosphorus are lacking, DAP (18-46-0) at 100–150 kg/ha should be applied prior to the final land preparation, as pulses

respond strongly to phosphorus. Although potassium response varies, fertilizers should be drilled in furrows at a depth of 7–10 cm for optimal nutrient utilization efficiency.

Water Management

Although chickpeas are primarily rain-fed, pre-sowing irrigation ensures consistent germination and an effective crop stand in irrigated areas. Two life-saving irrigations—one during pre-flowering and another at pod development—are adequate to stabilize yield when winter rainfall is lacking. Irrigation must be rigorously avoided during flowering, and the first irrigation should never be administered before four weeks following sowing. Since excessive moisture encourages lush vegetative growth at the expense of grain yield, only modest irrigation is advised. Therefore, in chickpea production, over-irrigation is more detrimental than beneficial.



Weed Management

Efficient weed management in chickpea during the critical crop-weed competition phase (30–45 DAS) is crucial to reduce resource depletion, improve nutrient uptake efficiency, and foster optimal crop growth and yield achievement. Preventive measures involve clean cultivation practices, use of certified weed-free seed, weed-free seedbeds, well decomposed organic manures, weed-free bunds and irrigation channels, and clean farm tools and machinery and preventing weed seed production by controlling weeds prior to the reproductive stage (Bahadur *et al.*, 2015). **Table 1.2** presents the recommended herbicides and time of application for effective weed suppression

Hearbicide	Time of Application	Dose (g ai/ha)	Remark
Fluchloralin	PPI	1 kg a.i./ha	
Flumioxin	Pre-emergence (0-3 DAS)	50 g a.i./ha	To control broadleaf weeds and some grasses in chickpea crops.
	(IBS- Incorporated Before Sowing)	75 g a.i./ha	
	Early post-emergence (14-21 DAS)	25 g a.i./ha	
Topramezone	Post-emergence (25 DAS)	20.6 g ai/ha	Broad-spectrum of broadleaf and grassy weeds with 78-83% weed control efficiency
Quizolfop ethyl	Post-emergence	@1 l/ha	Grassy weeds killer

Table 1.4 (Recommended herbicide for Weed Control)

Plant Protection

1. Disease Control

Diseases such as Fusarium wilt, Ascochyta blight, and collar rot can significantly reduce chickpea yield and crop quality. Proper disease management through the use of resistant varieties, seed treatment, crop rotation, and timely plant protection measures is essential to maintain healthy crop growth. Adoption of these practices helps in minimizing disease incidence and improving overall productivity of chickpea (Table 1.5).

Disease	Causal Organism	Disease Symptom	Chemical Control	Non-Chemical Control
Wilt	<i>Fusarium oxysporum</i>	Soil born disease, root turns black and ultimately decomposes.	Seed treatment (much preferable) Carbendazim 50% WP @2 g/kg seed. Thiram+Carbendazim @ 3 g/kg Soil Application Trichoderma-mixed fungicide	Resistant varieties Crop rotation Healthy seed selection Trichoderma viride @ 4-5 g/kg Field sanitation
Sclerotia blight (White mold)	<i>Sclerotiana sclerotiorum</i>	Sudden wilting of branches, black mustard like sclerotia inside or on stem.	Thiophanate methyl @ 0.1 %, repeat after 11-12 days if needed.	Resistant varieties Crop rotation Healthy seed selection Trichoderma viride@ 4-5 g/kg Field sanitation
Ascochyta blight	<i>Ascochyta rabi</i>	Small round, brown spots with dark margins on leaves.	Foliar spray Mancozeb or chlorothalonil @ 0.2% at the first symptom. After that repeat 11-14 days under favorable condition	Resistant varieties Crop rotation Healthy seed selection Trichoderma viride/ T. harzianum @ 4-5 g/kg Field sanitation

(Table 1.5)

2. Insect Control

In chickpea production, effective insect control is essential to minimize yield losses and ensure healthy crop growth. Major insect pests such as pod borer can significantly reduce grain yield if not managed properly. Therefore, the adoption of integrated pest management practices, including

timely monitoring and appropriate control measures, is necessary for sustainable chickpea production (Table 1.6).

Insects	Symptoms	Chemical control	Non-chemical Control
<p>Gram pod borer <i>Helicoverpa armigera</i></p>	<p>A serious pest of chickpea that causes up to a 75% reduction in yield, the caterpillar makes holes in the pods and feeds on the developing grains.</p>	<p>Spray 126 ml Coragen 18.5 SC (Chlorantraniliprole) or 200 g Proclaim 5 SG (emamectin benzoate).</p>	<ul style="list-style-type: none"> ➤ Deep summer ploughing, crop rotation with non-host crops. ➤ Pheromone trap, light traps ➤ Use of Predators, (NSKE) 5% Neem Seed Kernel Extract spray
<p>Gram semilooper <i>Autographa nigrisigna</i></p>	<p>Mostly affected in north India, feed on buds, flowers, and pods. Insects are formed as a loop at the center of the body when they move, so they are known as semilooper, and their larvae feed on leaves and check the photosynthetic area, which ultimately decreases crop yield.</p>	<p>Same as gram pod borer.</p>	<ul style="list-style-type: none"> ➤ Trichogramma chilonis can parasitize the eggs of semilooper and control its population. ➤ Spray Neem Seed Kernel Extract (NSKE) at 5%. ➤ Spray of Bacillus thuringiensis formulation check or contro of early instar larvae. ➤ Beauveria bassiana also can infect and kill semiloopers larvae.
<p>Cut worm <i>Agrotis ipsilon</i></p>	<p>Most serious pest in North India, Cutworms are serious soil-dwelling pests that damage the crop.</p>	<p>Application of heptachlor approx. 5 % in soil @ 20- 25 kg/ha and Chlorpyrifos 20 EC @ 2-2.5 L/ha, also control with the time of irrigation.</p>	<p>Deep ploughing at summer time to expose and kill larvae and pupa and also use of light traps to attract and kill adult moths. Use of a biological agent, such as</p>

			Bacillus thuringiensis, which infects larvae.
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(Table 1.6)

Harvesting

Chickpeas are harvested when they reach physiological maturity, indicated by the plants turning yellow-brown and the pods becoming brittle and dry. Grain moisture is reduced, and effective threshing is enabled by properly cutting the crop close to the ground and allowing it to sun-dry. To ensure that the seeds are completely separated from the pods, the grain is subsequently separated using mechanical threshers or by hand pounding. In addition to minimizing post-harvest losses and seed damage, proper harvesting and threshing techniques also preserve excellent grain quality for market and storage.



Yield

Under appropriate agronomic management, yield-contributing characteristics such as the number of pods per plant, seeds per pod, and seed weight play a significant role in determining chickpea productivity. These factors collectively contribute to achieving grain yields of approximately 20–26 quintals per hectare under favorable conditions. Moreover, agricultural productivity and grain yield can be substantially enhanced through timely sowing, effective insect-pest management, and balanced nutrient management, which help optimize plant growth and improve overall crop performance (Singh et al., 2020)

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