



Good Agricultural Practices

CUMIN



Good Agricultural Practices – Cumin



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Cumin (*Cuminum cyminum* L.) (Family: *Apiaceae*) is an annual herb and the earliest known minor spices used by mankind. It is an important spice crop mainly cultivated for flavouring vegetables, pickles, soups. Its pleasant aroma is due to cuminol or cuminaldehyde, a component of volatile oil present in the seeds. The mean volatile oil of indigenous collections varies from 2.5 to 3.5%. The seeds are extensively used in Ayurvedic medicines prescribed for stomach pain and dyspepsia. Cumin is believed to be native of Mediterranean region, mainly cultivated in India, Egypt, Libya, Iran, Pakistan, Mexico and Japan. In India, it is mainly cultivated in the states of Rajasthan and Gujarat.

Climate and soil requirements

Seed purpose crop is successfully cultivated in moderately cool and dry climate during winters (Rabi season) in an area free from severe frost during flowering. It does not prefer humidity during flowering and seed setting stage. Cloudy weather during flowering and fruiting stages increases incidences of pests and diseases. Germination is adversely affected at temperatures above 30°C and below 10°C, though the crop loves low temperature during vegetative phase. It can be grown in wide range of soils, but, sandy loam to medium heavy soils having plenty of organic matter with better fertility status and pH range 7.0-8.0 are most suitable. Sites where cumin crop has not been cultivated for the past 3 years should be selected.

Varieties

There are a number of good cumin varieties suitable for different agro climate regions. Varieties selection depends primarily on its adaptation to the soil and climatic conditions and preferably should have resistance / tolerance to pests and diseases prevailing in that region. There are many varieties released for cultivation to different areas specially Rajasthan and Gujarat. Some popular varieties include:

- **RZ-19:** It takes 120 –140 days to mature and gives an average yield of 5.0-6.0q/ha.

- **RZ-209:** The variety has shown tolerance to wilt. It takes 140-150 days to reach maturity and gives seed yield of 6.5q/ha.
- **RZ-223:** The variety possesses resistant to wilt. The seeds yield an oil content of 3.23% and gives seed yield of 6.0q/ha.
- **Gujarat Cumin-1:** It matures in 105-110 days and gives an average yield of 7.0q/ha.
- **Gujarat Cumin -2:** It matures in 100 days and gives an average yield of 7.0q/ha.
- **Gujarat Cumin -3:** The variety is resistant to wilt. It matures in 100 days and gives an average yield of 7.0q/ha with essential oil content of 3.5%.
- **Gujarat Cumin -4:** It gives an average yield of 8.75 q/ha and is resistant to Fusarium wilt.

Seed rate

Cumin is propagated through seeds. The seed rate is about 10-12 kg/ha.

Cropping System

Cumin is not recommended for growing as mixed or intercrop. However, in order to manage certain soil borne disease, it is necessary to follow crop rotation involving different crops in some seasons. Some of the suggested cropping systems for cumin growing areas could be:

- Dhaincha - Cumin
- Dhaincha - Cumin-Green gram
- Maize - Cumin - Summer Moong
- Pearl Millet-Cumin

Land preparation

The land should be well prepared for better germination of seeds and growth of plant. A total of 3-4 ploughings are required to bring the soil to a fine tilth. At the time of sowing there should be good moisture in the soil for better germination of seed.

Transplanting and sowing

In Gujarat it is sown during first week of November and in Rajasthan from 15-30th November. In order to protect the crop from seed borne diseases, the seeds are treated with *Trichoderma* (2-3 g/kg seed) or Bavistin (2-2.5 g/kg seed). The seed can also be inoculated with 10 g/kg *Azotobacter* and 10 g/kg Phosphate solubilising bacteria (PSB) to improve the health of the crop. Line sowing with 25 cm row to row and 10 cm plant to plant sowing is ideal. The seed should not be sown deeper than 1.5 cm.

- Treat the seed with PGPR bioformulation i.e. FK 14 (*Pseudomonas putida*) + FL 18 (*Microbacterium paraoxidans*) for better germination, growth and yield.
- *Azospirillum* or *Azotobacter* in combination with 5 t/ha sheep manure is suitable for organic production of cumin.
- Seed inoculation of cumin with fungi *Gigaspora calospora*, *Glomus fasciculatum*, *Glomus mosseae* and *Acaulospora laevis*) not only reduces the incidence of wilt but also enhances nutrient uptake

Manures and fertilizers

FYM 10t/ha or compost 5 t/ha NPK @ 30:20:20 kg/ha (15 kg of N in two equal split dose at 30 at 60 DAS). *Trichoderma* as soil application (2.5 kg/ha) and neem cake as soil application (150 kg/ha) are advisable. Following crop rotation with legumes like black gram/green gram, cluster bean/, green manuring with *Sesbania aculeata*, composting and application of biofertilizers like can also enhance soil quality. General recommendations to be followed are:

- Use soil amendments like castor or mustard cake, poultry manure @ 2.5 t/ha before sowing for control of wilt.

- Application of 50.0- 75.0% of recommended dose (RD) through organic manures *i.e.* FYM, vermicompost and poultry manure + 25-50% of RD through inorganic fertilizers gives higher seed yield and also improves the quality of seed along with improvement in soil health.
- Application of NAA @ 50 ppm / Triacotanol @ 1.0 mL/ L once at 40 days after sowing increases growth and yield of cumin.

Irrigation

- Depending upon soil and weather conditions of the growing area irrigation should be scheduled for cumin. If the crop is sown with pre-sowing irrigation, then the crops should be irrigated at critical stages of growth. However, irrigation depends on variety used and type of soil. Generally cumin requires 4-6 irrigations. Sprinkler irrigation in cumin could significantly save the water.
- Drip irrigation/trickle irrigation/micro irrigation or localized irrigation also save water and fertilizer by allowing water to drip slowly to the root zone, either onto the soil surface or directly into the root zone, through a network of valves, pipes, tubing and emitters. It is done through narrow tubes that deliver water directly to the base of the plant. Micro irrigation has emerged as an appropriate water saving technique especially in water scarce seed spice growing areas. Reduction in water consumption due to drip method of irrigation over the surface method of irrigation varies from 30.0 to 70.0%.
- Application of irrigation with low pressure drip system at a gap of 4-5 days for 40-45 min at (1 kg inch⁻² pressure) is appropriate for better growth of cumin. Inter cultural operations can be performed easily if crops are sown in lines and irrigated by these methods. Weed population will be less; nutrients can be applied through fertigation directly into root zone.

Intercultural operations

- Cumin crop faces severe weed competition at all stages of crop growth because of slow growth and short stature. In rainfed crop, one or two weedings and hoeing should be done so that the moisture and nutrients available in the soil can be efficiently utilized by the crop.
- In irrigated cumin, 2-3 weedings and hoeing operations are necessary to keep the crop weed free. The first weeding and hoeing operation is required at 35-40 DAS and second at 60-65 DAS.
- For chemical weed management pre-plant incorporation of Oxadiargyl @ 1 mL/L, Fluchloralin @ 0.75 to 1.0 kg/ ha or pre-emergence application of Oxyfluorfen @ 0.15 kg/ ha can be done for keeping the crop weed free. Sufficient moisture should be present in the soil at the time of weedicide application.

Pest management

Aphid

- Aphid is a major pest of cumin with heavy infestation occurring between the months of December to March and causing a loss of more than 50% of yield in unprotected crop. During flowering stage a population of 55-70 aphids/5 plants could reduce yield by 50%. When the aphid infestation occurs at flowering and fruit stage, the fruits are not formed and, even if they are formed, they are shriveled and of poor quality.
- Higher losses in yield could be caused by a small number of aphids infesting the crop at the beginning of flowering than by a large number of aphids at the grain filling stage. There are five species of aphids infesting cumin crop. However, *Myzus persicae* and *Aphis gossypii* are the main aphids species reported from Rajasthan and Gujarat. Adults and nymphs suck the sap from plants and also produce honey dew secretion on which the sooty moulds develop resulting in failure of seed production.

Thrips

Thrips is a major sucking pest in cumin. The nymphs are slender, yellowish-brown and look similar to adults but are wingless and slightly smaller in size. The adults are yellowish-brown and measure about 1 mm in length. The males are wingless while the females have long, narrow fringed wings. Usually they congregate at the leaf sheath or in the flowers.

Management:

Aphids are attacked by number of parasitoids under field conditions. Aphid's parasitoids *Aphidius* spp. is found in large number from last week of February to March. The noctuid moth larvae *Spodoptera* and *Helicoverpa* attracted large number of parasitoids in field conditions. The common parasitoids are *Sturmia inconspicuides*, *Actia monticola* and *Euplectrus gopimohani*.

Coccinellids consist of major predator found feeding on various sucking pests of seed spices. Major coccinellid found predating on seed spices crops are *Coccinella septempunctata* L., *Brumoides suturalis* F., *Menochilus sexmaculatus* and *Adonia* sp. Predatory bird myna (*Acridotheres tristis*) was also found feeding on the aphid. The other common predators of aphids are *Chrysoperla carnea*, *Episyrphus balteatus* and *Ischiodon scutellaris*.

- Application of neem based commercial formulation like Neemarin at 1.0% and seed extract of neem (*Azadirachta indica*), karanj (*Pongamia* sp.), buken (*Melia* sp.) and pride of India (*Lagerstroemia indica*) reduces the aphids population by 50% within 7 days of application. The aphid population was reduced by more than 50% for 15 days by application of neem seed kernel extract (NSKE) at 5.0%.

Diseases

Wilt

It is an important disease of cumin with incidence ranging from 25.7- 60.0% in some cases. Losses in yield up to 25.0% have been reported from North Gujarat and up to 60% in Rajasthan. The disease is caused by *Fusarium oxysporum* f.sp. *cumini*.

When the plants attacked by this pathogen, the leaves and tip fall and of late whole plant may die. Infected plants show peculiar symptoms of dropping of tips and leaves, leading to mortality of the entire plant. Attack of wilt is severe in younger plants. The disease occurs at all stages of crop. The leaves droop down. The roots exhibit browning of vascular region when split open, when the wilting takes place at reproductive stage fruiting does not occur. The diseased plants usually produce small, thin, shriveled seeds. The pathogen is internally seed borne as well as soil borne associated with diseased plant debris and infected soil with fungus.

The inoculum of the pathogen increases under continuous cultivation of cumin in the same field (monoculture). The pathogen survives in soil through hyphae and chlamydospore which is heat tolerant. Under moist condition the lethal temperature range is 60-62°C and under dry conditions it is 62-65°C. The wilt disease is enhanced when *Meloidogyne incognita* attacks earlier than wilt pathogen. Efficient control of this disease is not possible by the use of chemicals.

Management:

- Few cumin cultivars such as RZ-223 and GC-4 are tolerant to *Fusarium* wilt. Summer ploughing, crop rotation of three years, use of healthy disease free seeds, seed treatment with suitable fungicides or bioagents are helpful for managing wilt of cumin.
- Rotation with non host crop like mustard, pearl millet is useful. It can be reduced by crop rotation or by using neem cakes (5 tons/ha).

- One should be careful during collection of seeds for sowing as they should be collected from disease free plots.
- Application of mustard cake and groundnut cake was found to reduce the disease. Application of castor cake and poultry manure before sowing reduces wilt. Incorporation of mustard residues in soil reduces *Fusarium* propagules.
- The talc based formulations of *Trichoderma viride* followed by *Aspergillus versicolor*, *T. harzianum* and *Pseudomonas fluorescens* reduced the disease incidence. *Trichoderma harzianum* grown on sorghum grains and applied in soil 24 g/ 6m² reduced wilt incidence. Seed treatment with Carbendazim is also useful. Seed treatment with Thiram or Captan @ 2.5-3.0 g/ kg seed or Carbendazim @ 2g/kg is a general practice to reduce the wilt disease incidence.
- Soil solarization + soil application of *Trichoderma* + FYM (5 t/ha) + spray with Mancozeb 0.25% (60 DAS) is recommended for the control of wilt and blight in cumin. Soil application of vermicompost 3.2 t/ha + Soil application of *Trichoderma viride* @10 kg/ha was found effective and economic for the biocontrol management of wilt in cumin.



Alternaria blight

The blight is caused by a fungus *Alternaria burnsii*. Affected plants show minute brownish necrotic spots, which later turn to blackish. It is spread by seed, air and soil. Now, it is a common disease in all the cumin growing areas favored by humid and cloudy weather. In seed as well as in debris the pathogen remains viable for 10-12 months. Temperature ranging from 23-28°C is optimum for disease development. Cumin plants are generally attacked by *A. burnsii* after flowering. The plants infected with blight disease develop tiny

necrotic spots, which becomes blackish later on. Most of the diseased plants do not produce seeds and even if they produce seeds, the quality is inferior. The highest blight incidence occurs in October sown crop.



Management:

- Till date none of the available varieties show resistance to this disease. Crop rotation with non-host crops, deep ploughing and summer fallowing is effective in reducing the disease.
- This disease can be managed chemically by spray of 0.2% solution of Dithane M-45, Dithane Z-78 or Carbendazim (0.1%). Spraying should be done 4 times at 10 days interval starting from 40 days after sowing and treatment of diseased seeds. Mancozeb, Copper oxychloride, Zineb are also recommended as spray.
- Recently, it has been found that spraying with Propiconazole (0.1%) or Carbendazim + Iprodione (0.2%) has reduced disease incidence and fetched higher yield.
- To reduce the pesticide residue of Mancozeb, avoid two continuous sprays of Mancozeb and use alternate chemicals i.e. first spray of Mancozeb, then use another chemical as second spray or use 1:1 ratio of Mancozeb+ Bavistin.

Powdery mildew

This is caused by *Erysiphe polygoni*. The fungus is ectoparasite on aerial plant parts resulting in yield losses up to 50% under favorable weather conditions. Application of mustard cake/ neem cake before sowing is effective for the reduction of disease. Application of neem oil and garlic extract is also effective to reduce the disease. The disease appears in February and March at flowering. The disease spreads fast under warm (27-35°C) and moist conditions. The incidence is characterized by appearance of whitish spots on surface of leaves, petiole, stem pedicel and seeds in the early stages.

Gradually seeds become white, shrivelled and light in weight. The late sown crop under irrigated condition gets severely affected. The fungus perpetuates as dormant mycelium on the seed. Under severe disease situation total failure of the crop has been observed.

Management:

Prevention of this disease can be done through dusting plants with 300 mesh Sulphur dust @ 25 kg/ ha as soon as the symptoms are noticed. Single dusting of 300 mesh Sulphur 20-25 kg/ha at the time of flowering in January is essential. Dinocap (0.1%), Carbendazim (0.1%), Tridemorph (0.05%) and Wettable Sulphur (0.2%) are also effective.

New emerging problems in cumin

Yellowing

Yellowing a new viral disease reported for the first time in cumin. The virus associated with the disease has been identified as *Vanilla distortion mosaic virus* (Potyvirus). New disease showing root decaying symptoms caused by nematodes *Hoplolaimus* spp and *Tylenchorhynchus* spp in coriander, fennel and nigella has also been reported. Besides, a new viral disease (cumin yellowing) has been reported for the first time in cumin. The virus associated with the disease has been identified as a member of Potyvirus group (*Vanilla distortion mosaic virus*).



Reddening

Reddening of the plants is also seen as a new and emerging problem in all the cumin growing areas. This problem starts since early stage of the growth and continues up to maturity. Primary studies explain that this is a physiological and environmental problem in cumin.



Module for integrated management of destructive cumin diseases

S.No.	Treatment	Treatment details
1.	Selection of variety	Resistant variety against blight and wilt disease should be grown according to agro climatic zones
2.	Selection of seeds	Use certified seeds. If certified seeds are not available then use own seed and treat them
3.	Use of weedicide	Spray of Oxadiargyl 23.5% (Raft) @ 50g a.i/ha or 833ml/ha on moist soil surface (pre-emergence) after sowing to reduce the weeds which served as alternative and collateral hosts of several pathogens.
4.	Practices to minimize the soil borne inoculums of different pathogens	<ul style="list-style-type: none"> a) Burning of crop debris b) Summer ploughing c) Adopt 2-3 years crop rotation with resistant/non-host crop. d) Adopt optimum seed rate, depth of sowing, row spacing, plant to plant distance, fungicides dosage and irrigation time and numbers.
5.	Protective step to prevent the infection.	<ul style="list-style-type: none"> a) First spray schedule start at 35 DAS with Score (Difenoconazole 0.25E.C) @ 0.05% followed by second spray at 45 DAS b) Preventive spray with Dimethoate 0.1% for aphid infestation c) Third spray starts after 55 DAS with Propiconazole 0.1% for control of blight and powdery mildew infection. f) If the environmental conditions are favorable for disease, then the third spray will be repeated. Harvest the crop at proper maturity and thresh it carefully. g) Proper drying of seeds 8-9% seed moisture and then store it.

Harvesting

Cumin crops take 110-120 days to reach at maturity. Under scientific management condition 8-12 q/ha cumin seed of improved varieties can be obtained.

Post-harvest management

- Threshing floor should be neat and clean.
- Threshing should be done on concrete floor.
- Use innovative dryers, which quicken the process of drying.
- Processing and drying should be done on concrete floor.
- Storage at appropriate moisture level.
- Sort and grade the produce.
- Store in a cool and dry place.