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Conceptual Paper

Cultivation of Dollar Earning Cumin Crop for Higher Income

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Cumin (*Cuminum cyminum*) is an annual herbaceous spice cum medicinal plant. It is belongs to family apiaceae and have basic chromosome number 2n = 14. The total area under cumin is around 0.76 million ha with the production of 0.49 million tonnes during 2016 - 17. A total volume of 1,19,000 tonnes of cumin valued at Rs. 1963 crore was exported from India in 2016 - 17. Cumin seeds are used in cooking and the oil is used to flavor food and scent cosmetics. Cumin is a major component of curry and chili powders and has been used to flavor a variety of commercial food products. The oil, which is derived by steam distillation, is used to flavor alcoholic beverages, desserts, and condiments. It is also used as a fragrant component of creams, lotions, and perfumes. In Ayurvedic system of medicine, dried cumin seeds are used for therapeutic purposes. It is known for its activities like enhancing appetite, taste perception, digestion, vision, strength and lactation. It is used to treat diseases like fever, loss of appetite, diarrhea, vomiting, abdominal distension, edema and puerperal disorders. The typical pleasant aroma of the seeds is due to their volatile oil content, the principal constituent of which is cuminaldehyde. 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.

Cumin field

Improved Varieties

RZ - 19: Erect in growth behavior, bears pink coloured flowers and bold pubescent grains matures in 120-140 days and gives an average yield of 5 - 6 q/ha.

RZ - 209: Variety has shown tolerance to wilt matures in 140 - 150 days and gives average seed yield of 6.5 q/ha.

RZ - 223: Variety possesses resistance to wilt and have essential oil content is 3.23% and gives seed yield of 6.0 q/ha.

RZ - 345: This variety suitable for Rajasthan and Gujarat. Its seeds bold, attractive, higher volatile oil content. Medium maturity group 120 - 130 days and give average yield of 607 kg/ha.

GC- 1: Plants are erect with pink flowers and seeds are bold, linear, oblong and ash brown coloured can withstand shattering and lodging matures in 105 - 110 days and average yield is 7.0 q/ha.

GC- 2: Plants are bushy with good branching habit and attractive grains. Its matures in 100 days and gives average seed yield of 7.0 q/ha

GC- 3: Plants are bushy with good branching habit and attractive grains. Its matures in 100 days and gives average seed yield of 7.0 q/ha. It also wilt resistant variety and matures in 100 days. The variety give gives average yield of 7.0 q/h and have essential oil content is 3.3%.

GC- 4: Very popular variety of cumin because of its capacity to resistant to *Fusarium* wilt and higher yield performance (average yield of 8.75 q/ha).

Soil and climatic requirement: It can be grown in wide range of soil, hence, sandy loam to medium heavy soils having plenty of organic matter with better fertility status are most suitable. The crop is successfully cultivated in moderately cool and dry climate during Rabi season in an area free from severe frost during flowering. It does not prefer humidity in the atmosphere during flowering and seed setting stage. Cloudy weather during flowering and fruiting stages increases incidences of insect-pests and diseases resulting into poor quality produce.

Time of sowing and seed rate: In Gujarat it is sown during first week of November and in Rajasthan from 15 - 30 November. The seed rate is about 10 - 12 kg/ha. The line sowing recommended for the cumin cultivation and 25 cm row to row and 10 plant to plant ideal for the crop. The seed should not sow deeper than 1.5 cm.

Inter crops: Coriander-Cumin, Coriander-cumin-green gram, Maize-cumin-summer moong, Pearl millet-cumin, cluster bean-cumin.

Manure and fertilizers: FYM 10t/h or compost 5 t/h. NPK@ 30:20:20 kg/ha (15 kg of N in two equal split dose at 30 at 60 DAS).

Irrigation: Depending upon soil and weather condition of the growing area irrigation should be scheduled for cumin. First irrigation should be given just after the sowing and second irrigation should be given during seed germination, 8-10 days after sowing. Generally cumin requires 4-6 irrigations based on soil type and crop should be irrigated by giving the 20-25 days intervals. Sprinkler irrigation in cumin could significantly save the water, it is very beneficial on undulated lands.

Intercultural Operations: The 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 weeding and hoeing should be done so that water and nutrients available in the soil can be utilized by the crop efficiently. In irrigated cumin, 2-3 weeding and hoeing operations are necessary to keep the crop weed free. The first weeding and hoeing operation is required 35-40 and second at 60-65 DAS. For chemical weed management pre plant incorporation of Oxydiargyl @ 1 ml/ ltr., Fluchloralin @ 0.75 to 1.0 kg/ ha or pre-emergence application of Oxyfluorfen @ 0.15 kg/ha or Pendimethalin @ 0.75 to 1.0 kg/ha can be used for keeping the crop weed free. At the time of weedicide application sufficient moisture should be present in the soil. Hand/animal operated weeder should be used to reduce the drudgery.

Pests management

Aphids: There are five species of aphids found infesting cumin crop. However *Myzus persicae* and *Aphis gossypii* is main aphids species reported from Rajasthan and Gujarat. The heavy infestation of aphid on cumin occurred between December to march and cause the loss of more than 50% of yield in unprotected crop. During flowering stage a population of 55 - 70 aphids/5 plant could reduce yield by 50%. When the aphid infestation occurs at flowering and fruit stage, the fruits are not formed and, if they are formed, they are shrivelled 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 *Aphis gossypii*. Glover is found attacking cumin in Rajasthan, is vector of mosaic. Adults and nymphs suck the sap from plants and also produce honey dew secretion on which the shooty moulds are developed which results in failure of seed production.

Thrips: Thrips are other important sucking pests of many seed spice crop particularly 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. Female live for 12 - 30 days and lay 50 - 60 kidney shaped eggs singly inside leaf tissue with its sharp ovipositor. The incubation period is 4 - 10 days and the nymphs feed on the plant sap by lacerating the leaf tissues. Usually they congregate at the leaf sheath or in the flowers. Nymphs mature in 4 - 5 days after passing through four instars and pupate in the soil. There is a prepapal stage, which lasts for 1 - 2 days, and pupal period is 2 - 4 days. Several generations are completed in a year.

Management

Application of neem based commercial formulation like Neemarin at 1% and seed extract of neem (*Azadirachta indica*), karanj (*Pongamia* sp.), buken (*Melia* sp.) and pride of India (*Lagerstroemia indica*) reduce the aphids population by 50 per cent within 7 days of application. In cumin crop aphid *M. Persicae* population was reduced more than 50% for 15 days by application Neem Seed Kernel Extract (NSKE) at 5%. In cumin crop spraying of 0.03% phosphamidon, 0.03% monocrotophos at 2 week intervals after first appearance of aphids give effective protection. The seed yield o treated plot was 4.7 q/ha in compared to 3.0 qt/ha on untreated plot. It has also been found two application of dimethoate 0.03%, thiamethoxam 0.025%, Imidacloprid 0.005% and acephate 0.037% reduce more than 90% of aphid (*Myzus persicae*) in cumin in 3 days of treatment and give 40% more yield in comparison to untreated plot. Application of thiamethoxam @ 12.5 g ai/ha give significant control of *Aphis gossipy* in cumin, and there was no significant difference observed in application of double dose of thiamethoxam i.e. @ 25 g ai/ha. The yield was also at par in both the treatments. Two spray of carbosulfan 25 EC at 1250 ml/ha was found an optimum dose for effectively control of sucking pest population in cumin especially aphids and white fly. Carbosulfan did not showed any adverse effect on natural enemy population and also leave no phytotoxic effect on plant.

Disease management

Wilt: The disease in causes by fungus known as F*usarium 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 inoculum of the pathogen increases under continuous cultivation of cumin in the same field (monoculture). 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 for managing wilt of cumin. Organic amendments of soil with mustard cake (1%), Incorporation of mustard residues in soil reduce *Fusarium* propagules. The talc based formulations of *Trichoderma viride* followed by A*spergillus versicolor, T. harzianum* and *Pseudomonas fluorescens* reduced the disease incidence. *Trichoderma harzianum* grown on sorghum grains and applied in soil 24 g/6m2 reduced the wilt incidence. Seed treatment with carbendazim is also better. Seed treatment with thiram or captan @ 2.5 - 3.0g/kg seed or carbendazim @ 2g/kg is a general practice to reduce the wilt disease incidence.

Alternaria Blight: The blight caused by a fungus *Alternaria burnsii*. Cumin plants are generally attacked by fungus after flowering. 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 favoured by humid and cloudy weather. It has since been observes to be widespread and causing serious losses in Rajasthan and Gujarat states. In seed as well as in debris the pathogen remains viable around 10 - 12 months. Temperature around 23 - 28°C is optimum for disease development. December sown crop had least disease incidence. The highest blight incidence was in October sown crop.

Till date none of the varieties available which is resistance to this disease. Crop rotation with non-host crops, deep ploughing and summer fallowing is effective to reduce the disease. This disease can be managed chemically by spray of 0.2% solution of Dithane-M-45 Dithane Z-78, Carbendazim (0.1%). Its spraying can be done 4 times at 10 days interval starting 40 days after sowing and treatment of diseased seeds. Mancozeb, copper oxychloride, zineb are recommended as spray. Recently propiconazole (0.1%), carbendazim + iprodione (0.2%) chlorothalonil (0.2%) are giving least disease incidence and higher yield. A schedule comprising foliar application of mancozeb followed by propiconazole proves effective to combat blight disease of cumin. To reduce the pesticide residue of Mancozeb, avoid two substituent spray of Mancozeb and use alternate chemicals i.e. first spray of Mancozeb than second spray of another chemical for the control of blight or use 1:1 ratio of Mancozeb+ Bavistin to control the blight.

Powdery mildew: PM is caused by fungus a *Erysiphe polygoni.* The disease appears in February and March at the flowering time. The disease spreads fast under warm (27 - 35°C) and moist conditions. In this disease, whitish spots appear on surface of leaves, petiole, stem pedicel and seeds of diseased plants in their early stages. Gradually seeds become white, shrivelled and light in weight. The late sown crop under irrigated condition gets severely affected. Under severe disease situation total failure of the crop has been observed. Prevention of this disease can be done through dusting plants with 300 mesh sulphur dust @ 25 kg per hectare as soon as the symptoms are noticed. Single dusting of 300 meshes 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.

Harvesting time and methods: Harvesting of cumin started from first week of March depending upon sowing date (110-120 DAS). Seed can be separated by beaten and trampled on clean threshing floor of by cumin threshing machine.

Yield/ha: 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.

Processing and post-harvest technology: The dried seed used for steam distillation and it yields 2.5 - 4.5% of volatile oil depending upon variety and location. The processed products include essential oil, cumin power, oleoresins and fixed oil.

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