

Review Article

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Coriander a Potential Seed Spice Crop of Humid South Eastern Plains-Zone of Rajasthan, India

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ABSTRACT

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Coriander is an annual seed spice crop, which belongs to family Apiaceae. It is native of Mediterranean region. The aromatic characters of plants are due to presence of linalool compound in essential oil of seeds. The green leaves of coriander are used in salads and are a good source of vitamin A and vitamin C. Major active constituents of coriander essential oils and fatty oil. The essential oil content of the weight of ripe and a dried fruit of coriander varies between 0.03 and 2.6% and the content of fatty oil varies between 9.9 and 27.7%. Coriander leave showed stronger antioxidant activity than the seeds. Coriander lowered the blood sugar when added to the diet of diabetic patients. The antihyperglycemic action of coriander is associated with stimulation of insulin secretion and enhancement of glucose uptake and metabolism by muscle, reflecting the effects of more than one active constituent.

Introduction

Rajasthan is the largest coriander producing state in India and contribute 62% of India's total production. It is mainly grown in Hadoti region of Rajasthan comprising of Kota, Bundi, Baran and Jhalawar districts and holds the entire production in Rajasthan. However, the productivity of coriander is low compare to its potential yield. Farmers are facing numerous problems in realizing the full production potential of coriander. It is realized that lack of suitable high yielding variety as well as poor knowledge of improved production technologies along with complex disease-pest syndrome, emergence of new biotypes and races of key pests and

pathogens are major impediments in realizing the full potentialities of coriander production. With the development of high yielding, early maturing, fertilizer responsive varieties are a new proposition which would ensure stability and higher profit per unit area of land and has potential to produce 20-25% higher seed yield than other existing varieties (Nagar *et al.*, 2009).

Coriander (*Coriandrum sativum* L.) is an annual seed spice crop, which belongs to family Apiaceae. It is native of Mediterranean region. The aromatic characters of plants are due to presence of linolool compound in

essential oil of seeds. The green leaves of coriander are used in salads and are a good source of vitamin A and vitamin C. The young plant leaves as well as the seed are used for the preparation of chutney and are also used as seasoning in curries, soup, sauces, fish sauce and cream sauce for chicken etc (Janardhan and Thoppil, 2004; Tiwary and Agarwal, 2004). Besides their use in culinary, the seeds and leaves are also used for the treatment of maladies like indigestion, dyspepsia, flatulence and piles (Dimri *et al.*, 1976).

Botanical description

Coriander leaves are small herb having many branches and sub-branches. New leaves are oval but aerial leaves are elongated. Flowers are white, having slightly brinjal like shades while fruit are round in shape (Handa and Kaul, 1996). Macroscopic characteristic of fruit is globular, mericarps usually united by their margins forming a cremocarp about 2-4 mm in diameter, uniformly brownish-yellow or brown, glabrous, sometimes crowned by then remains of sepals and styles, primary ridges 10, wavy and slightly inconspicuous secondary ridges 8, straight, it has aromatic odour. It has spicy and characteristic taste (Handa and Kaul, 1996; Pathak *et al.*, 2011).

Phytochemicals

The general chemical composition present in coriander fruits are described in table 1. Major active constituents of *coriandrum sativum* are essential oils and fatty oil. The essential oil content of the weight of ripe and dried fruits of coriander varies between 0.03 and 2.6% and the content of fatty oil varies between 9.9 and 27.7%, 1% of the major component of which is S-(+)-linalool (60-70%) other minor active constituents present in essential oil are monoterpenes hydrocarbons *viz.* α -pinene, limpinene, γ -

terpinene, p-cymene, borneol, citronellol, camphor, geraniol and geraniol acetate, heterocyclic components like pyrazine, pyridine thiazole, furan and tetrahydrofuran derivatives, isocoumarins, coriandrin, dihydrocoriandrin, coriandronsA-E, flavonoids, pthlides, neochidilide, digustilide phenolic acids and sterols. The composition of the essential oil is described in table 2 (Diederichsen, 1996; Pathak *et al.*, 2011).

Medicinal and pharmacological properties

Coriander, due to its rich aroma because of its essential oils, apart from being an excellent appetizer, helps in proper secretion of enzymes and digestive juices in the stomach, stimulates digestion and peristaltic motion. It is helpful in treating problems like anorexia. Some of the components of essential oils in coriander such as borneol and linalool, aid digestion, proper functioning of liver and bonding of bowels and help to cure diarrhea. It is also helpful to treat diarrhea caused by microbial and fungal action, since components like cineole, borneol, limonene, alpha-pinene and betephelandrene have anti-bacterial effects. In addition, the fresh coriander leaves are excellent appetizers. Citronelol, a component of essential oils in coriander, is an excellent antiseptic. In addition, other components have antimicrobial and healing effects which do not let wounds and ulcers in the mouth go worse. The aid healing up of ulcers and freshen up the breath. The essential oils in coriander are rich in antimicrobial, antioxidant, anti-infectious and detoxifying components and acids. The presence of vitamin C and iron strengthens the immune system too. These properties help, prevent and cure small pox. They also reduce the pain and have a soothing effect on pox patients. Coriander has lots of antioxidants, vitamin-A, C and minerals like phosphorus which prevents aging of eye, muscular degeneration

and soothes eyes against stress. Coriander is a very good disinfectant and has antimicrobial properties which prevent the eyes from contagious diseases like conjunctivitis (Saxena and Rathore, 2016).

Coriander leave showed stronger antioxidant activity than the seeds. In a study cryogenic grinding technology is helpful in retention of flavour and medicinal properties of coriander irrespective of genotypes from diverse origin showed significantly increase in oleoresin content, total phenolic contents, flavonoids and antioxidant properties (Saxena *et al.*, 2015)

Coriander lowered the blood sugar when added to the diet of diabetic mice. The antihyperglycemic action of coriander is associated with stimulation of insulin secretion and enhancement of glucose uptake and metabolism by muscle, reflecting the effects of more than one active constituent. Coriander therefore, represents a possible antihyperglycemic along the inner walls of the arteries and veins (Ertas *et al.*, 2005) Coriander seed essential oil is effective against stored product beetle pests (Pascual and Villalobos, 2003). The essential oil of coriander showed significant inhibitory effects of on the mycelia growth and toxin produced by *A. ochraceus* (Basilico and Basilico, 1999). Essential oils from commercial samples of coriander were showed antibacterial, antifungal and antioxidant activities.

Cultivation

Climate

Although coriander is a tropical crop, it is successfully grown in a wide range of conditions. It requires a cool climate in the early stages of growth and warm dry weather at maturity. The best period for cultivation is from October to March. For leaf purpose, it

can be grown throughout the year but during hot month (April-June) it can grow under shad.

Soils and preparation of land

As an irrigated crop, coriander can be cultivated on all types of soils, provided sufficient organic manure is applied. Black cotton soils with high retentivity of moisture are the best for coriander cultivation, the land is ploughed 3-4 times after kharif crops harvest and pre sowing irrigation done in the month of October, after soil come in tilth, then one ploughing followed by sowing of coriander in second fortnight of October.

Manures and fertilizes

If available, well rotten farmyard manure (10-15 tonnes/ha) and fertilizers at the rate of 20 kg nitrogen, 30 kg Phosphorus, and 20 kg Potassium per hectare are applied at the time of preparation of the field before sowing for a crop in rainfed areas. In the irrigated areas, application of N is increased to 50 kg/ha, half of the dose of N and full dose of P and K is applied as basal dose and the remaining half is applied in two split one at fist irrigation (50-60 days after sowing) and second split at flowering stage of the crop.

Sowing

About 15-20 kg seed is required for sowing in one hectare. Seed are rubbing before sowing, as splits the seed. Seeds are germinated a little earlier than the intact fruits. Before sowing, seeds are treated with suitable fungicides like carbendazim 0.75 g + Thiram 1.5 g or Thiram 3 g per kg of seed as a preventive measure against stem-gall disease. The seeds are sown in lines at a spacing of 30 cm between rows and 10-15 cm between plants. Depending upon the temperature, germination takes place in about 10-15 days.

Irrigation

Depending upon the soil and climatic conditions, irrigation is given. Generally two irrigation in addition to pre sowing irrigation is require for obtaining higher yield of coriander crop. First irrigation is give at branching stage at 50 to 60 days after sowing and second at grain filling stage 90-100 days after sowing of crop. Coriander crop are also irrigate by mini sprinkler at 12-15 days intervals, mini sprinkler run 2.5-2.5 hours three times in a day and for ordinary sprinkler

4.5 hour per day or 1.5-1.5 hours run for three times in a day for getting higher yield from coriander crop.

Intercultural

For a good crop, weeding and hoeing is necessary. Generally one hoeing and weeding are enough for normal crop. Pre emergence application of pendimethalin at 0.75 to 1 kg a.i. per ha to kill emerging weeds and crop grow under weed free environment condition.

Table.1 Chemical composition of *Coriander sativum* seed (Diederichsen, 1996)

Component Content	Percentage (%)
Water	11.37
Crude protein	11.49
fat	19.15
Crude fibre	28.43
Starch	10.53
Pentosans	10.29
Sugar	1.92
Mineral constituents	4.98
Essential oil	0.84

Table.2 Composition of essential oil in seed of *Coriander sativum* (Diederichsen, 1996)

Main components	% of Total Essential oil	Minor components (all with less than 2%)*
Linalool	67.7	β- pinene
α- pinene	10.5	Camphene
γ- terpine	9.0	Myrcene
Geranylacetate	4.0	Limonene
Camphor	3.0	p-cymol
Graniol	1.9	Dipentene
		α- terpinene
		n-decylaldehyde
		Borenol

Diseases and pest

Among disease, the wilt, powdery mildew, stem-rot and stem-gall are important, causing damage to the crop.

Wilt disease

Fusarium oxisporum f. Sp. *coriandri* is a fungus which causes wilt, affect root system of the plants. To prevent the crop from infection of

fungus, deep ploughing should be done during summer season. Crop rotation may also be followed. In those plots, where effect of this disease has been noticed, coriander crop should not be taken for 2-3 years. Sowing should be done after seed treatment with carbendazim at 1.5 g per kg seed or Thiram 1.5 g per kg seed (Govt. of Raj., 2014 and Sharma *et al.*, 2016)

Powdery mildew

The pathogen *Erysiphe polygoni* attacks on coriander plants. It appears as small, white circular patches on young parts of stems and leaves. The increases in size, often coalesce to cover extensive areas of leaf surface. Affected leaves are reduced in size and distorted. Premature sterility is also common. In severe cases, the umbels dry up. Sometimes, the seeds are attached.

Attack of this disease is seen during cloudy weather condition. White powdery growth appears on the leaves and buds during its primary stage. Seed formation may not take place in affected plants due to this disease. To control this disease, dusting of sulphur dust at 20-25 kg per hectare should be done. Spraying of wettable sulphur 0.25 % or karathane 0.05 % can also control this disease (Sharma *et al.*, 2016 and Govt. of Raj., 2014)

Stem gall

Galls appear on the leaves and stems of the plants affected by this disease. Shape of coriander seeds change due to affect of this disease. To prevent this disease 2-3 year crop rotation should be done with non host crops. To control this disease, sowing can be done only after treating the seeds with 4 g Thiram and 2 g carbendazim per kg seeds.

Spray 0.1 % solution of carbendazim when the symptoms start appearing and repeat the spraying at an interval of 20 days till the disease is completely controlled (Sharma *et al.*, 2016 and Govt. of Raj., 2014)

Blight

In this disease dark brown spots appears on the stem and leaves of infected plants. To control this disease spraying of 0.2 % solution of Mancozeb should be used to control this disease (Sharma *et al.*, 2016)

Among insect pest, aphids, white fly, leaf eating borer and mite are important, causing damage to the coriander crop.

Aphids

Aphids are major yield reducing factor in coriander crop. The heavy infestation of aphid on coriander occurred between Decembers to March and causes the loss of more than 50 % of yield in unprotected crop. During flowering stage a population of 55-70 aphids per 5 plants could reduce yield up to 50 %. The population of aphids in coriander crop at more than 200 aphids per plants can reduce the yield of 2.0 qt per ha. The maximum multiplication of aphid on coriander has found when the existed between 20-25 degree Celsius (maximum), 2-6 degree Celsius (minimum) and 60-65 % relative humidity. When the aphid infestation occurs at flowering and fruiting stage, the fruits are not formed and, if they 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.

To control aphid infestation on coriander crop, application of neem based commercial formulation like Neemarin at 1 % and seed extract of neem (*Azadirachata 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 (Kant *et al.*, 2016). Spraying of Dimethoate 30 EC or Methyl demeton 25 EC 1 l per ha before flowering can control aphid population considerably. This spray may be repeated in 10 days intervals (Govt. of Raj., 2014)

White fly

White fly (*Bemisia tabaci*) a polyphagous pest found serious pest of coriander crop. Nymphs and adults of white fly causes damage the crop. They remain underside the leaves and suck the sap. Continuous sucking the sap from the leaves results in chlorotic spots and later on leaves coalesce and become brittle and finally drop down from the plant prematurely. The honey dew secreted by the pest drop on the upper surface of the lower leaves and helps in development of shooty moulds which interferes with photosynthesis of leaves (Kant *et al.*, 2016). Spraying of Dimethoate 30 EC or Methyl demeton 25 EC one litre per ha before flowering can control aphid population considerably. This spray may be repeated in 10 days intervals. (Govt. of Raj., 2014)

Mite

The brown wheat mite [*Petrobia lateens* (Muller)] was first reported feeding on coriander. It remains active during winter with peak activity in March. It is a minute, non webbing and swift moving mite and has a tendency to dislodge from the plant which disturbed. The larva, nymphs and adults feed on upper as well as the lower surface of leaves, leaf sheaths and floral parts. Infested leaves started withering from top downwards. The plants become chlorotic due to loss of cell sap, resulting in poor seed formation. Heavily infested plants show sickly yellowish or bronzing appearance (Kant *et al.*, 2016).

Reasons for low yield of coriander at farmer's fields

Optimum sowing time is not followed due to delay in kharif crop harvest, field preparation, pre sowing irrigation etc. Sometimes non availability of quality seed or improved variety seed, farmers go for the local seed in hand. More than 90 per cent of farmers, coriander seed sown in closer spacing through tractor drawn wheat seed drill and in most of the situation the plant population at farmer's field is

high or two-three times high of the recommended stand. Lack of popularization of seed cum fertilizer drill for sowing and use of inadequate and imbalance dose of fertilizers especially the phosphatic fertilizers by farmers does not make possible to fetch potential yield. The problem of aphids and stem gall cause substantial loss in the coriander crop and farmers do not adopt the adequate control measure well in time. Mechanical weed control is costly and chemical control is quite uncommon because lack of post emergence herbicide for coriander crop.

Specific constraints with marginal/sub marginal farmers

The adoption of well proven technology is constrains due to small size of holding and poor farm resources. Small and marginal farmers have less capability to take risk and do not dare to invest in the costly inputs due to high risk and the poor purchase capacity of small farmer. Traditional implements and tools are still in practice due to small holdings which have poor working efficiency. The lack of simple modern tools for small holdings also hinders the adoption of improved technologies for coriander crop in zone.

In conclusion thus, the cultivation of coriander crop with improved technologies including suitable varieties, weed management, nutrients and pest management has found more productive and remunerative in the zone, which has high potential in coriander production, processing and export. The present literature supports the potential of Coriander as a medicinal and Pharmacological importance. In view of the nature of the plant, more research can be done to investigate the unexplored and unexploited potential of this crop in humid south eastern plains zone of Rajasthan

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