Package of Practices for Coriander cultivation in Kandhamal District

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PoP for Coriander

Crops	Odia Name	Scientific Name	Family
Coriander	ଧନିଆ	***Coriandrum sativum* L.**	Apiaceae

1. Coriander is an upright and branched annual plant that grows to a height of 80 cm. The leaves of the plant in our rural and urban areas are used to make chutney.

2. The whole plant is aromatic. Fully mature seeds on getting dried turn light brown in colour.

3. The green leaves are also used in salads, soups and prickles. Most of housewives give a generous sprinkling of the green leaves on cooked dishes of meat, pulses and vegetables before they are served.

4. The seeds are also used in thickening and flavouring soups, curries and liquors. It is believed to be a native to southern western Asia to North Africa.

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Export scenario of Indian coriander

- India is the largest producer and exporter of coriander in the global market.
- The exports have increased significantly in the past few years due to strong demand from the overseas market.
- The major importers for Indian coriander are Europe, US, Singapore and Gulf countries.

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Climate and soil

1. Coriander is a tropical crop and can be grown throughout the year (except very hot season i.e. March-May) for leaf purpose.

2. For seed purpose a dry and cold weather, free from frost especially during flowering and fruit setting stage is required.

3. Germination of coriander is severely reduced at temperature above 30°C. Heavy rains are harmful for the crop and continuous cloudy weather invites diseases and aphids.

4. For green, it can be grown throughout the year provided moisture is made available. However, it does not grow well in spring summer season for greens, because it switches over within short time from vegetative growth to reproductive phase as soon as temperature raises beyond 20°C

5. The coriander can be grown in any type of soil suitable for cultivation. It is cultivated both as irrigated and un-irrigated crop. As an irrigated crop, it can be cultivated in almost all type of soils having sufficient organic matter.

6. pH of soil should be near 7.0 for better growth and quality produce of coriander. Saline, alkaline and sandy soils are not suitable for its cultivation.

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Field preparation

1. Coriander is mainly grown as dryland crop on heavy soils. For dryland coriander cultivation, field must be ploughed after rain for conservation of soil moisture.

2. In rainy season, if field is kept fallow or just after harvesting of previous *Kharif* crop, first ploughing should be done with soil turning plough. It should be followed by 2-3 ploughing with cultivator or harrow or *desi* plough to obtain fine soil tilth.

3. To avoid loss of soil moisture and to break the clods, the field should be planked immediately after ploughing.

4. For irrigated coriander if soil moisture is not sufficient, preparatory tillage should be carried out after giving pre-sowing irrigation. Application of pre-sowing irrigation will also encourage the weed seeds germination which will be uprooted, killed and turn in the soil at the time of field preparation. This practice is termed as stale seed bed preparation which will help to minimize the weed competition, particularly during early crop growth period.

5. Less number of ploughing are required in light soils whereas more number of ploughings are required in heavy soils.

6. At the time of sowing, soil must be friable to obtain better seed bed for better seedling emergence and their further establishment.

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Varieties

Sl. No	Variety	Characteristics
1	RCr-41	Resistant to stern gall and tolerant to powdery mildew
2	RCr-435	Moderately resistant to stem gall and wilt
3	RCr-446	Moderately resistant to stem gall and wilt
4	RCr-20	Resistant to wilt, stem gall and nematodes
5	CO-3	Tolerant to wilt, powdery mildew and grain mould
6	CS-287	Tolerant to wilt, powdery mildew and grain mould

Sl. No	Variety	Characteristics
7	GCr-1	Tolerant to wilt and powdery mildew
8	GCr-2	Tolerant to wilt and powdery mildew
9	Rajendra Swathi	Moderately resistant to wilt, stem gall, aphids and weevil.
10	Pant Haritma	Resistant to stem gall, moderately resistant to wilt, aphid and weevil
11	Sadhana	Tolerant to white fly, mites, aphids, wilt and powdery mildew
12	Swathi	Tolerant to white fly, mites, aphids, wilt and grain mould
13	Sindhu	Resistant to powdery mildew, wilt and aphids

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1. **Sowing time**: June-July (*Kharif*), September-October (*Rabi*).
   Spacing: 20 x 15 cm (*Kharif*)) and 15 x 15 cm (*Rabi*)
2. **Manures and fertilizers**
   - ❖ Apply well decomposed FYM @ l0-15 tonnes/ ha three weeks before sowing of the crop.
   - ❖ Apply bioconsortia @ 12 kg/ha inoculated with FYM at the time of final land preparation (*Azotobactor, Azospirillum and PSB* 4 kg each)
   - ❖ Apply NPK @ 30:40:20 kg /ha for proper growth, development and quality yield.
3.
   - ❖ Under *Kharif* condition, full dose of fertilizer may be added to the soil at the time of final field preparation just before sowing.
   - ❖ For *Rabi* condition, one third of N and full dose of P and K should be applied as basal dose and remaining 2/3rdN should be applied in two equal splits as top dressing at 30 and 60 days after sowing.

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1. **Seed rate**

❖ Seed rate depends upon seed size, growth habit, irrigation availability (irrigated or unirrigated), soil type and availability of soil moisture at the time of sowing. Seed germination is better in irrigated conditions, which requires relatively less seed rate than rainfed conditions where seed germination is poor due to less availability of water in soil. The seed rate generally required is 10- 12 kg per hectare for irrigated and 20 kg for rainfed cropping system

2.

Seed treatment:

❖ Coriander is propagated through seed (botanically fruits called schizocarp). Being bilocular each schizocarp has two mericarps and thus before sowing fruits are rubbed to split into two halves. After splitting the seeds should be treated with *Trichoderma* @ 4.0- 6.0 g/kg seed. After seed treatment, seed should be inoculated with Azotobacter and phosphate solubilizing bacteria.

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Sowing method:

- The crop is usually sown by broadcasting but line sowing is better which allows proper weeding, hoeing, application of pesticides etc.
- Seed depth should not exceed 2.5 cm otherwise germination will be reduce.
- Soaking of seeds in water for 8-12 hours before sowing hastens germination.
- The field should be prepared well in order to produce fine seed bed.
- For rainfed crop, the field should be prepared before the onset of monsoon so as to make seed loose to absorb maximum of moisture to give good germination.

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Irrigation

- For irrigated crop, depending upon temperature and soil type 3-6 irrigations are required in addition to those given for germination.
- For heavy soils only 3-4 irrigations are sufficient whereas for light textured soils about 6 irrigations are required.
- The critical stages for irrigation are

- Care should be taken that adequate moisture is available to crop after flower initiation, particularly at the time of seed formation.
- Stagnation of water is harmful for the crop; hence proper drainage must be provided especially where it is grown as *Kharif* crop.

Critical Stages	Growth period
Seedling stage	30-40 DAS
Grand growth period	50-60 DAS
Flowering	70-80 DAS
Seed formation stage	90-100 DAS

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Yield reducing factors:

- Though coriander occupies the first position in area and production among all the seed spices, yet the productivity is very low.
- The major reasons for low productivity of coriander are the biotic and abiotic stresses.

Biotic stresses:

- **Weeds**: Being a *Rabi* season irrigated crop, coriander is facing weed problem a lot. The weeds exert competition to the crop with respect to water, nutrients, space, light and air.

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Weed management:

- In Kandhamal the coriander is taken as a *Rabi* season crop.
- Further the crop is slow growing up to 40-45 DAS, therefore crop need to be kept weed free up to 50 DAS.
- Two to three hand weeding and hoeing are necessary for effective management of weeds. Two weedings followed by hoeing should be practiced at 30 and 60 days after sowing. If required, third weeding can be done.
- During first weeding the plants should also be thinned to maintain proper spacing for ensuring recommended plant population, if plant population is higher in the field.
- For Chemical measures, per-emergence application of Oxyflurofen @ 0.15 kg/ha or Pendimethalin @ 0.75 to 1.0 ka/ha after dissolving in 400-500 litres of water is recommended.
- After chemical control of weeds, one had weeding at 50-55 DAS is necessary to ensure weed free condition till harvesting of the crop.
- summer ploughing is also advisable in the crop to alleviate the weed problem.

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Diseases:

Powdery mildew:

- This is one of the important diseases of coriander, which generally appears in all coriander growing areas.
- The disease is caused by *Erysiphepolygoni* .
- The disease symptoms appears as a white powdery mass on the leaves and twigs of the plants in initial stage and later on whole plant is covered with whitish powder.
- It generally appears in the month of February March and causes significant loss to the crop yield.

Management strategies:

- Early sowing of coriander is effective for management of powdery mildew.
- Application of sulphur dust @ 25 kg/ha, spray with Wettable Sulphur suspension (0.1%) spray is also effective against powdery mildew control in coriander. The spray should be repeated at 10-15 days interval if required.
- Seed treatment with Thiram proved effective in reducing severity ofthe disease and increased the seed

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Diseases:

Wilt (*Fusarium oxysporiumf.sp. coriandri*):

- Younger plants are more susceptible to wilt.
- Yellowing as well as drooping of leaves and terminal branches are symptoms of this disease.
- The infected plant dries up due to wilting in later stage.

Management strategies:

- The pathogen is coriander specific, thus to follow crop rotation is an important tool for management of this disease.
- Solarization of soil during summer, use of disease free seed, seed treatment with Captan or Thiram @ 3.0g/ kg of seed should also be followed.
- Seed treatment with *Trichoderma viridae* @ 4g/kg seed is also effective in reducing wilt incidence in coriander.

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Diseases:

Stem gall (*Protomycesmacrosporus*):

- The symptoms appear as galls on the stem, leaf stalk and peduncles. The seeds are deformed and the yield is reduced.

Management strategies:

- Seed treatment with Captafol 2g/ kg seed is effective in inhibiting seed borne infection with the disease.
- Spraying 0.1% Carbendazim or Captan 0.2%, 2-3 times at an interval of 10-15 days.
- Soil solarization and use of resistant varieties are effective for the management of disease.

Nematodes (*Meloidogyne incognita*):

Management strategies:

Growing of resistant cultivars like RCr-41, Co-1, Co-2 is recommended

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Insects:

- Coriander crops attracted large number of insect pests and pollinators during its crop growth in the field.
- It also attracts numbers of storage pests during storage of seeds.
- The appearance of pests started at early vegetative stages and lasted till the seed mature.
- Since this crop attract large number of natural enemies of the pests and pollinators, it is important to apply judicious use of insecticides to control the .

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Coriander aphid, *Hyadaphis coriandri*

- The coriander aphid is also known as *Moila*, *Chainpa* or *Manhu*. The Coriander aphid is most abundant on coriander crop during winter season particularly December to March.
- Cloudy and wintry weather is quite favorable for rapid multiplication of this species of aphid.
- Infestation in early stages causes distortion in plant growth, yellowing of leaves and reducing their vigour.
- The heavy infestation of aphid on coriander occurred between December to march and cause the loss of more than 50% of yield in unprotected crop.

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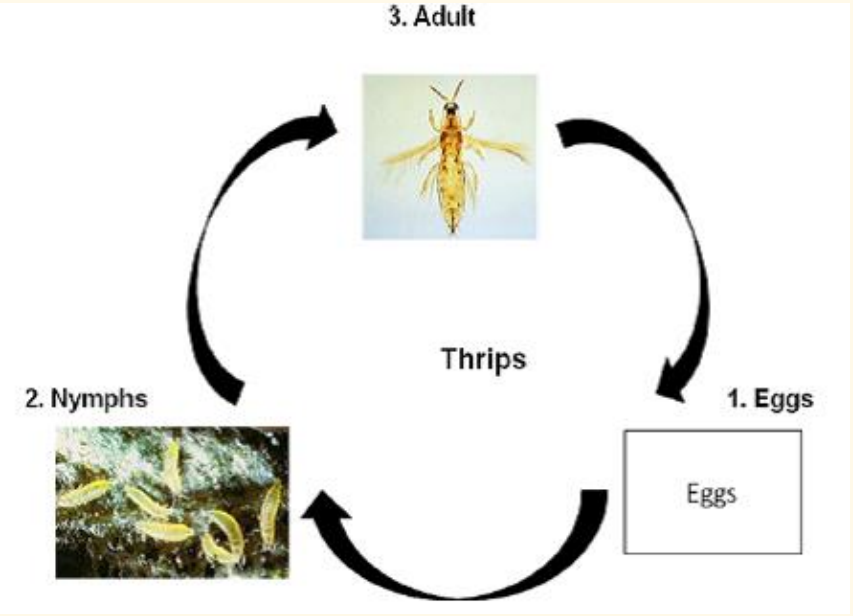
Thrips:

- Thrips are tiny insects. Amongst the species of thrips attacking seed spices, *Thrips tabaci* is the major specie found on most of the seed spice crops.
- Both nymphs and adults feeds on umbel. leaf sheath and stems of plants .
- Both nymphs and adults congregate in between the leaf sheath and stems of plants which results in drying of the leaves.
- Severe infestation results in drying of flowers and production of shriveled fruits



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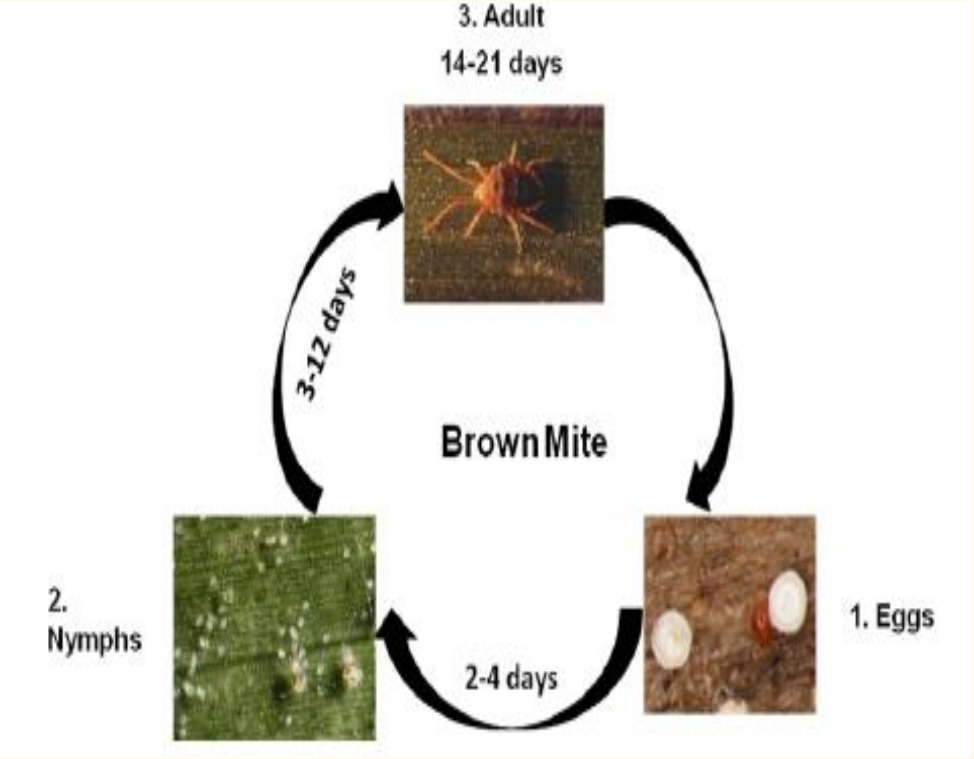
Mite:

- Among the other sucking pests the tetranychidae mite *Petrobialatens* is another serious pest on coriander and cumin.
- It remains active during winter with peak activity in March.
- The larva, nymphs and adults feed on upper as well as the lower surface of leaves, leaf sheaths and floral parts.
- Infested leave 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.



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Management of Aphids/Thrips/Mites

- Use botanicals Neem seed kernel extract (NSKE) 5.0%, Neem oil 2.0%, Azadirachtin 10000 ppm @ 2.0ml/lire and bio-pesticides like *Verticillium lacanii* 5.0 g. /litre of water as foliar spray on the crops

- For mite control use bio pesticide *Hirsutellsthompsoni* 5.0 g. /litre of water as foliar spray on the crops

- In case of severe infestation need based use of chemical insecticides i.e.Emamectin benzoate @ 10 g ai/ha or Thiacloprid @ 0.24% or Dimethoate 30 EC @ 0.03% to prevent losses

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Abiotic stress

Frost:

- It damages the crop frequently under unirrigated conditions.
- Burning of waste materials on the bunds of field in night is useful in protecting the crop during the frost prone period.
- Spraying of 0.1% sulphuric acid at flowering stage protect the crop from frost.
- Irrigation may be applied if possible.

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Harvesting:

- Coriander crop matures in about 100-150 days of sowing depending upon varieties and climate.
- The green leaves are normally harvested 60-75 days after sowing and left for flowering and seed formation; whereas coriander crop grown exclusively for green leaves is harvested after 30-45 days of sowing.
- The coriander compound leaves with stem are prepared in bunches of desirable size for marketing.
- The stage of harvest depends upon the market requirement. For green coriander seeds, the crop is harvested when seeds are green and have attained full size.
- The green seed crop is dried under shade for retaining the green colour.
- Keeping in view, the market requirement, the crop can be harvested at yellow or brown colour of seeds.
- Delay in harvesting should be avoided, otherwise shattering and splitting of seeds may occur.
- Harvesting should be done by cutting the whole plant when 60% of seeds in main umbels attain desired size and colour and piled into small stacks in partial shade to dry for 2-3 days.

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Yield

- An average seed yield of 4.5 to 6.0 q / ha can be obtained from rainfed crop, whereas average seed yield of 8-12q/ ha along with additional marketable leaf yield of about 5-7q/ha can be obtained from irrigated crop.

- The crop grown exclusively for leaf purpose yielded green leaves of about 50-80q/ha with 3-4 cuttings depending upon situations.

Processing for green and dehydrated leaves

Processing

- The fresh greens consisting edible portions are the tender leaves and stem which are cut to length of about 5-7 cm above ground.
- The yellow, diseased and damaged leaves are trimmed off and weed plants and straw is culled during cleaning and dressing.
- Healthy and disease free leaves are tied into small bunches for the convenience in handling, transportation and marketing.
- The leaves of coriander are sun dried or dehydrated in a suitable dehydrator, for further use in off-season.

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Storage

- The fresh coriander leaves are highly perishable and deteriorates rapidly at temperature above 5°C. Therefore the fresh leaves bunch should be marketed soon after harvesting. The leaves can be sorted only for about 24-36 hours after harvesting under ambient condition. However in cold store at 0°C temperature and 90% relative humidity, the storage period can be extended for one week.

For seed purpose

- Harvested plants are dried in the sunlight for 1-2 days to bring the moisture level down to 18%.
- The dried plant is then trashed to remove the seeds.
- Seeds are further dried in the shade to bring the moisture level down to 9%.
- Coriander seed is mainly processed into powder by crushing and the powder which enjoy an aroma, is used as food ingredient. Seeds which contain 0.1-1.5% of oil are used to extract essential oils.

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Storage

- The dried seed is filled in plastic bags or in gunny bags lined with plastic sheet. Each bag is sealed and stored under clean dry and ventilated place.

Grading

- Coriander is classified into different gardes based on quality of the produce. In general, coriander has been classified into grades like Badami (Brown), Eagle/ Scooter (Medium Green), Single/Double Parrot (Green Colour).

Green seed

Badami (Brown) seed

Medium Green seed

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Powder

- The coriander seeds are washed, manually to remove dirt, soil and any other adhereing materials. It is then dried.
- Sun drying is widely used being cheaper. Drying is followed by powdering in disintegrator and micropulverizer.
- The powder is then shifted and tested according to standard procedures.

For essential oil

- The mature dried seed of coriander are distilled to obtain the essential oil. Hydro or steam distillation method is generally used for extraction of essential oil. On an average, the dried seeds yield 0.1-1.7% volatile oil depending upon variety and location.
- The volatile oil is used chiefly as a flavoring agent for liquors, cocoa and chocolate industry and it is also valuable ingredient in perfumes. Good quality oleoresin can be extracted from coriander seeds. The oleoresin is used for flavouring, beverages, pickles, sweets and sausages. The other important product is Dania Dal, which is a major adjunct in Supari and Pan masala.

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Good agricultural practices

- Deep ploughing is to be done on bright sunny days during summer.
- Do not plank or irrigate the field just after ploughing.
- The field should be kept exposed to sun light at least for 2 to 3 weeks.
- Grow varieties suitable for the season or region.
- Grow only recommended pest / disease tolerant /resistant varieties.
- Do not use seed without seed treatment with biocide chemicals.
- Always treat the seeds with approved chemicals for the control of seed borne disease.
- Don't grow in disease affected fields in subsequent years.
- Practice crop rotation in severely infected fields.
- Don't spray insecticides which are harmful to the honey bees.
- Spray during the evening hours when honey bees activities are minimum because honey bees are major pollinators in coriander crop.
- Don't grow coriander continuously for more than three years in the same field to avoid wilt disease.
- Survey the field regularly to monitor pest/ disease appearance.
- Use cement concrete threshing yard or tarpaulin during processing of harvested material.
- The quicker the drying time, the better the final microbial quality of the product.

Marketing Strategy

- ✓ There is a huge market demand for this spice both in local and outside market
- ✓ International market can be accessed through APEDA
- ✓ Other government agency can be linked for marketing
- ✓ The growers should be linked with KASAM, other co-operative societies and NGOs
- ✓ Establishment of spice corner at block level for easy marketing

Thank You