



Neem seed kernel (NSK)



Fixing trichocard on lower side of leaf

- Installation of pheromone traps for American bollworm and pink bollworm for regular monitoring @ 2 traps/ acre each at 45 days after sowing.
- For managing American bollworm, any of the following can be undertaken
 - Release egg parasitoid wasps of *Trichogramma chilonis* / *T. bactrae* @ 60,000/acre at 45 DAS **OR**
 - Spray HaNPV @ 250 larval equivalent (LE) immediately after appearance of early instar *H. armigera* larvae **OR**
 - Need based foliar spray of *Bacillus thuringiensis* (Bt) formulation @ 400 g/acre or spray *Beauveria bassiana* @ 5 g/ litres of water for managing bollworm complex.
- Need based foliar spray of *Pseudomonas fluorescens* @ 10 gram/litre of water for managing bacterial blight, leaf spot diseases and boll rot complex.

Operations for September

Mid-season Nutrient supply

- Apply foliar spray of vermiwash @ 50 ml per litre or any other organic source available like Panchgavya @ 5% solution.
- Drench the crop with Jeevamrut @ 200 litre / acre.



Microbial infected larvae

De-topping

- Carry out manual de-topping of cotton plants when the plants are 100-120 cm tall or plant age exceeds 80 days having sufficient boll load. It also helps to reduce egg laying of *H. armigera*, encourage sympodial growth and improve boll weight.

Plant Protection

- Use neem seed kernel extract 5% or Neem oil @ 5 ml/litre as protective spray against bollworm complex.
- Release egg parasitoid *Trichogramma bactrae* / *T. chilonis* @ 60000 parasitized eggs /acre thrice at weekly intervals between

60-100 DAS for managing pink bollworm infestation.

- Take up need based foliar spray of *Pseudomonas fluorescens* WP @ 10 gram/litre of water for managing bacterial blight and leaf spot diseases.

Operations for October

Mid-season Nutrient supply

- Foliar spray of vermiwash @ 50 ml per litre or any other organic source available like Panchgavya.
- Cut sunhemp after 40-45 DAS and use as mulch for soil and water conservation.
- If possible, one life saving irrigation may be provided.

Plant Protection

- Release egg parasitoid *Trichogramma bactrae* @ 60000 parasitized eggs /acre thrice at weekly intervals between 90-120 DAS.
- Need based foliar spray of *Pseudomonas fluorescens* WP @ 10 gram/litre of water or *Trichoderma harzianum* / *T. viride* WP @ 5 g /litre of water for managing grey mildew (Dahiya) and leaf spot diseases.

Operations for November

Picking

- Pick the fully opened bolls at regular intervals.
- In desi cotton, frequent picking is needed i.e. before shedding of seed cotton.

Operations for December

Picking

- Pick the fully opened bolls.
- Timely termination of the crop latest by December end helps in better management of pink bollworm.

Shredding of cotton stalks

- Allow animals to graze on cotton crop after last picking for destroying left over green bolls which could be potential carriers of pink bollworm.
- Standing stalk of cotton to be shredded with tractor operated mobile cotton shredder followed by spray of *Trichoderma harzianum* / *T. viride* WP @ 5 g/litre of water and spread the shredded biomass onto the soil. *Trichoderma* formulation helps in speedy decomposition and bioconversion of cotton residues.



Shredding of cotton



भा.कृ.अनु.प.
ICAR

Technology options for Organic cotton cultivation



Citation : Ramkrushna G I, M V Venugopalan, Rachna Pande, Neelakanth S Hiremani, S P Gawande, D Blaise and Y G Prasad (2022). Technology options for Organic cotton cultivation, CICR-Leaflet 2022/4. ICAR-Central Institute for Cotton Research, Nagpur.

Published by : Y G Prasad, Director



ICAR-Central Institute for Cotton Research

Post Bag No.2, Shankar Nagar P.O., Nagpur- 440010.

ISO 9001 : 2015

Website: www.cicr.org.in

Published in December, 2022



▪ Ramkrushna G I ▪ M V Venugopalan ▪ Rachna Pande ▪
▪ Neelakanth S Hiremani ▪ S P Gawande ▪ D Blaise ▪ Y G Prasad ▪

भा.कृ.अनु.प.- केन्द्रीय कपास अनुसंधान संस्थान, नागपुर

ICAR-Central Institute for Cotton Research, Nagpur

P.B. No. 2, Shankar Nagar P.O., Nagpur - 440010 India

ISO 9001: 2015

Technology options for Organic cotton cultivation

Cotton is one of the most commonly used fabrics in fashion and textiles. During cotton production and processing, hazardous chemicals are often used. Hazardous synthetic agro-chemicals used in non-organic farming can damage ecosystems, poison waterways and endanger the health of farm workers who cannot always afford safety equipment needed to protect them. All the synthetic chemicals used in cotton cultivation enter the food chain as cotton seed is consumed as edible oil and de oiled cake as animal feed.

Organic farming of cotton is a more holistic farming approach that restores soil health. It is grown without the use of pesticides, herbicides or other chemical fertilizers, and safeguards human health and the environment. By focusing on preventive management, rather than completely eliminating troublesome weeds and insect pests, organic farmers aim to maintain ecological balance and protect the environment. By encouraging biological diversity, organic farmers create conditions which reduce the likelihood of any insect, bird or mammal doing any major damage to their crop.

There are several proponents of organic farming using diverse organic inputs to cultivate cotton. Here, we present some efficient organic cotton production practices that have been validated scientifically for their economic and ecological benefits.

Pre-season operations

• **Soil sample collection and testing** : Medium deep to deep fertile soils with good drainage are suitable for organic cotton cultivation. Soil tests allow supervised use of certain restricted and directly mined sources for limited time to restore soil fertility. Yields are stable under organic conditions when the soil organic carbon content of the top 25 cm is 0.5 % or more.

• **Selection of non-GM varieties** : Select varieties that are tolerant to sucking pests and early maturing.

❖ **G. hirsutum** : Suraj, Suraksha, Anjali (LRK 516) and Surabhi (ICAR-CICR, Nagpur), NH 615 (CRS, VNMKV, Nanded), Suwarna Shubra (Dr PDKV, Akola), ADB 39 (PJ TSAU, Hyderabad).

❖ **G. arboreum** : PA 812, PA 810, PA 740, PA 528 (fibre length of above 28 mm; Cotton Research Station, VNMKV, Nanded); CNA 1032, CNA 1054 (ICAR-CICR, Nagpur).

• If seeds are sourced externally, it is advised to obtain a GM free certificate from competent authority before introducing them into the organic farm.

Crop Calendar – Farm operations

Operations for June

Pre-sowing operations

- Give a deep ploughing with mould board plough once in every three years.
- Prepare the land right after pre-monsoon showers.
- Add well decomposed, farm yard manure (FYM) @ 2-3

tonnes/acre (1-2 tractor trolley) wherever available at least 15 days before sowing and spread it evenly on the entire land area.

Sowing time operations

- After the receipt of soaking rains, just before sowing, take up one harrowing and planking for preparation of stale seed bed for effective weed management.
- The most appropriate time for sowing rainfed cotton is between June 20 to June 30 in Vidarbha region of Maharashtra.

Seed rate

- *G. hirsutum* (American): 2-2.5 kg/acre (delinted)
- *G. arboreum* (Desi): 2.5 kg/acre (delinted)

Seed treatment

- Treat seeds with *Trichoderma harzianum* / *T. viride* WP @ 6 gram/kg seed, Azotobacter @ 25 gram/kg seed and PSB @ 6 gram/kg seed. Treat legume intercrops with *Rhizobium* culture OR
- Treat seeds with microbial liquid consortia (NPK) @ 5 ml/kg seed. Take 5 ml liquid formulation and make solution of 50 ml with water. Mix this solution slowly with 1 kg seed of cotton or legumes to get uniform coating followed by drying the seeds in shade.
- Microbial liquid consortia can also be used for soil treatment. Mix 400 ml microbial liquid consortia in 100 kg soil or compost and spread the mixture in one-acre area just before last harrowing for complete mixing into the soil.



Seed treatment with *Trichoderma harzianum* wettable powder

Spacing

- **G. hirsutum**: 75 cm between rows and 30 cm between plants in a row on medium deep soils. 90 cm between rows and 30 cm between plants in deep fertile soils.
- **G. arboreum**: 60 x 30 cm
- Dibble two seeds/spot for better plant stand.

Sowing depth

- 3.0 - 4.0 cm

Thinning

- Keep one healthy plant per hill at 15 days after sowing or after first interculture and drench the crop with *Trichoderma harzianum* / *T. viride* WP @ 5 g/litre of water.

Intercropping and Crop rotation

- Intercropping and crop rotation are the key components of organic farming to ensure disruption of the life cycles of

different insect pests and diseases besides enhancing microbial diversity. Inclusion of legumes in rotation and as an intercrop improves soil health.

- Randomly sow *ambadi*, castor, *jowar*, cowpea, etc. in cotton rows as IPM practice @ one plant after every 15 to 20 plants of cotton for nurturing eco-friendly natural enemy populations: insect parasitoids (hymenopteran wasps) and predators (coccinellid beetles, lace wings).
- Green gram and black gram are considered suitable intercrops in cotton in 1:1 ratio and after picking of pods they provide good biomass for mulching to conserve soil moisture.
- Cotton + pigeon pea with 6:1 or 6:2 ratio or Cotton + Soybean (2:4 ratio) intercropping is recommended for enhanced system productivity.
- Cotton should be rotated with legume crops (soybean) or legume crop sequences (chickpea / groundnut / linseed / lentil in *rabi* season, wherever possible). Crop rotation is essential in alternate years or at least once after every two years.



Red gram intercrop in cotton



Chickpea after Cotton

Operations for July

Intercultural and weeding operation

- Implement three inter-cultures at 25, 45 and 60-65 days after sowing (DAS) followed by hand weeding to remove left over weeds keeps the crop weed free.
- Mulching with biomass of legume intercrops or green manure crop helps in suppressing weeds and conserving soil moisture. Apply mulch after final weeding. It is advised to control weeds before they flower to prevent the succession of weeds through seeds.
- Make compost from weeds and farm wastes in the field/farm itself.
- Use fully decomposed compost / FYM as partial or un-decomposed compost / FYM could be a major source of weeds.

Early-season Nutrient supply

- Drench the crop with Jeevamrut @ 200 litre/acre



Biomass mulching with dhaincha stalk in cotton rows after last weeding

Plant Protection

- Erect T bird perches (resting place of birds) in the field at least 10/acre so that birds can prey on caterpillars and other harmful insects.
- Install yellow sticky traps for monitoring whitefly @ 10 traps / acre.
- Spray neem seed kernel extract 5% or Neem oil @ 5 ml/litre of water as protective spray against sucking pest. This also acts as oviposition deterrent and repellent for bollworm.
- Spray biopesticides *Lecanicillium lecanii* 1.15% WP or *Metarhizium anisopliae* @ 5 g/ litres of water if sucking pest crosses economic threshold level (ETL) (Jassid: 6 per 3 leaves; whitefly adults: 10 per 3 leaves).
- Manually remove rosette flowers to control pink bollworm damage.
- Spray *Beauveria bassiana* or *Metarhizium anisopliae* @ 5 g / litres of water against bollworm complex (notice for flower or green boll damage).
- Carry out foliar spray of *Pseudomonas fluorescens* @ 10 gram/litre of water at 30 days after sowing (DAS) as protective spray for effective management of bacterial blight, leaf spot diseases and boll rot complex.



Adults of friendly Coccinellid beetle



Cowpea rows – Eco feast crop for natural enemies

Operations for August

Soil moisture conservation

- After 3rd inter-culture at 60 days, ridges (six inch high) can be made using ridger. Alternately, ridges can also be made by running a blade harrow to loosen soil and repeating the same operation by covering the blade with a nylon rope so that the loose soil get accumulated on the sides and forms a ridge. Furrows between ridges would help in storing late season rain water in-situ or in draining out excess rain water after a heavy rain.
- If legume intercrop has not been sown, sunhemp may be sown as intercrop after third hoeing and earthing up (60 DAS).



Earthing up for soil water conservation

Mid-season Nutrient supply

- Application of oilcakes or vermicompost @ 200 kg/acre.

Plant Protection

- Spray of Neem seed kernel extract 5% or Neem oil @ 5 ml/lit or Dashparni @ 10% solution as protective spray against sucking pest and bollworms.