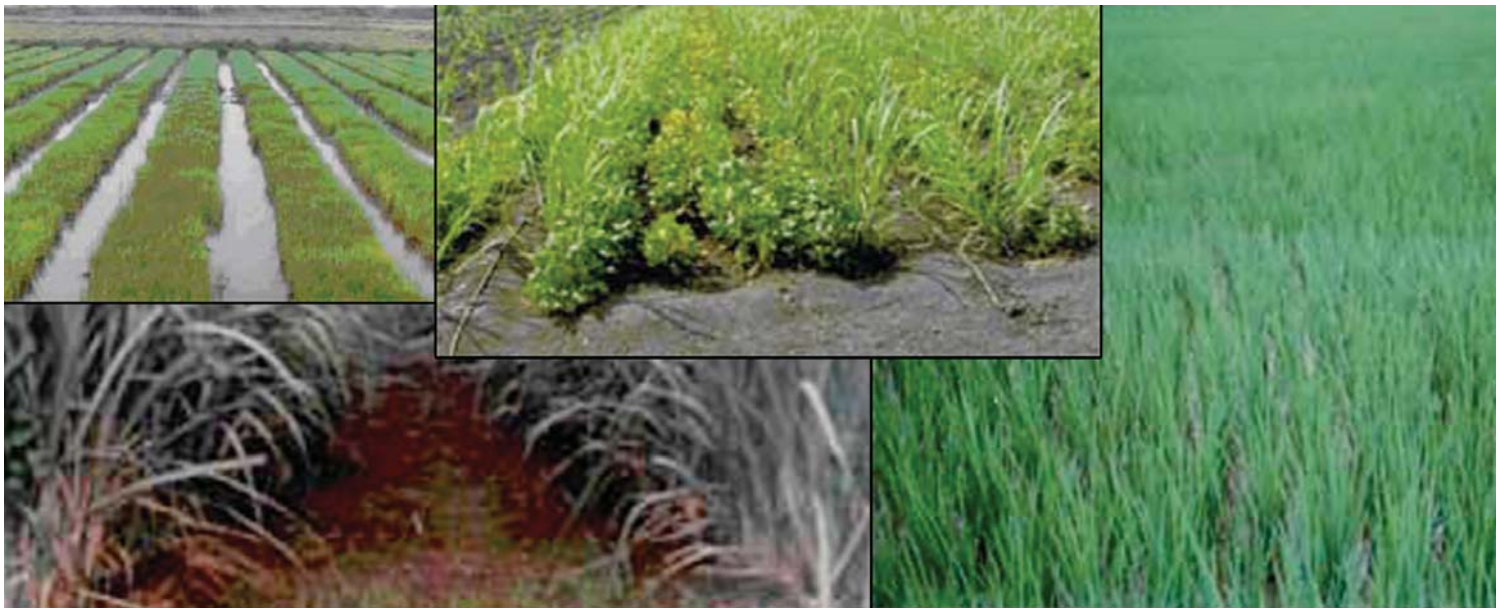
# Package of Organic Practices from Maharashtra

*for*

**Cotton, Rice, Red gram, Sugarcane and Wheat**



Maharashtra Organic Farming Federation (MOFF)

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**Rice**
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*Prepared by*
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*Prepared by Maharashtra Organic Farming Federation (MOFF)*
(June 2006)

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Disclaimer:

*The accuracy of the facts and reporting on which the present study is based is the responsibility of the author/institution alone and not of the FAO or the Ministry of Agriculture, Government of India. However, every care has been taken by the authors to ensure adequate verification.*

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# Acknowledgements

The Maharashtra Organic Farming Federation (MOFF) is a voluntary organization of farmers from across the state who have joined together to protect and improve the economy of organic farms, the environment and the health of the consumer. Organic farmers' choices today vary from natural farming (low intervention type) to farm methods using several external inputs. However, their objective is the same – reduce farming costs, earn sufficient income and ensure that the producer and consumer of food can both lead healthy lives. Keeping this purpose in mind, MOFF members have first tried and tested, and later standardized, a set of 'best practice' techniques that farmers may vary and adapt, depending on the agro-climate of the region or farm ecology. This method of working provides farmers with a variety of practices to choose from, as per their local needs.

MOFF is grateful to its leading members (listed below) for having documented these diverse practices systematically and for having compiled them into crop-wise packages, for the convenience of ordinary farmers.

| | |
|---|---|
| Cotton: | Ms. Chandraprabha Bokey, Adv. Manohar Parchure |
| Rice: | Mr. Jaywant Wadekar, Mr.Sanjay Patil |
| Red gram: | Ms. Chandraprabha Bokey, Mr. Diliprao Deshmukh |
| Sugarcane: | Mr. Ashish Wele, Mr. Shivraj Ingole, Mr. Suresh Desai |
| Wheat: | Mr. Madhukar Barve, Mr. Padmakar Chinchole, Mr. Ashok Bari |

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| | |
|---|---|
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| Rice: | Mahatma Phule Krishi Vidyapeeth (Agricultural University) Research Station at Karjat, District Thane. |
| Red gram: | MPKV Research Station at Badnapur, District Jalna. |
| Sugarcane: | MKPV Research Station at Padegaon, District Ahmednagar; Vasantdada Sugar Institute (VSI) Research Station at Manjri, Pune district. |
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Vikram Bokey
President

# Preface

Organic farms are mushrooming all over the country, largely due to the desire to get premium prices in the urban and export markets. Organic farming products need to be certified, which in turn demands rigorous documentation and costly inspection by consultants and, sometimes, expensive laboratory testing as well. MOFF, however, is promoting organic farming as a low-cost, expenditure-saving approach to food production and secure livelihoods for small and marginal farmers who can earn more and save more through its methods.

MOFF believes in Low External Input Sustainable Agriculture (LEISA) principles, which basically emphasize that farm nutrition can be managed well by recycling the farm's biomass. This is done through (a) crop rotation; (b) green manure crops, intercrops, and weed mulching; (c) cow dung and cow urine based preparations that act as both nutrients and disinfectants. Emphasis is always on decentralized mulching, i.e., *in situ* composting rather than on constructing costly vermicomposting sheds or tanks.

A fertile soil will result in healthy crops that need little or no pest control measures. However, if intercrops and trap crops in the system cannot reduce pest attacks, herbal pest repellants such as *neem* seed or leaf extract or *dashaparni* may need to be sprayed in the initial years till the ecosystem regains its health.

Market-purchased microbial inputs such as biopesticides and biofertilizers, as well as tricho-cards, etc., may be needed only in the first or second years – after conversion – in order to revive the microbial farm population which may have been obliterated due to the extensive use of chemicals during the past few decades. It may not be necessary to purchase such inputs in the subsequent years.

Seeds used on organic farms should be traditional varieties or improved/selected varieties. In the latter case, the cost is low in the first year and nil thereafter, as the seeds that are saved regenerate on being replanted. Their productivity may appear a little less when compared with the output of hybrid seeds. However, plants grown from hybrid seeds suffer from heavy insect attacks and moreover, require assured and intensive irrigation. Thus, in the long run, they prove to be uneconomical.

# COTTON

## BACKGROUND TO THE CROP

Cotton *(Gossypium spp.)* is one of the most important commercial crops in India and plays a key role in the economic and social affairs of the world. Although it is cultivated in more than 80 countries of the world, only ten of these, i.e., USA, China, India, Brazil, Pakistan, Turkey, Mexico, Egypt and Sudan, account for nearly 85% of the world's total production.

There are four cultivated species of cotton, i.e. *Gossypium hirsutum*, *G. arboreum*, *G. herbaceum* and *G. barbadense*. India is the only country in which all four cultivated species are grown. The maximum area cultivated is covered by hybrids (40%), followed by *G. hirsutum* (36%), *G. arboreum* (16%) and *G. herbaceum* (8%). The area under *G. Barbadense* is negligible (0.2%).

There are nine major cotton-growing states in the country grouped into three zones – the north zone (Punjab, Haryana and Rajasthan), central zone (Maharashtra, Madhya Pradesh and Gujarat) and south zone (Andhra Pradesh, Karnataka and Tamilnadu). Nearly 65% of cotton is grown under rain-fed conditions. Out of 9 million ha cotton area in India, about 5.7 million ha is dependent on rain, predominantly on vertisols and its associate soils. The rainfall in such rain-fed areas ranges from 450 to 1100 mm during the crop season, distributed over 45 to 50 rainy days with an irregular rainfall pattern and many intermittent dry spells.

The cotton growing Vidarbha region of Maharashtra falls under the drought-prone, semi-arid eco-region, and has varying soil depths. Shallow soils, medium deep and deep soils, account for 35, 50 and 15% area respectively under cotton cultivation.

### Soil

Black cotton soils with an average water content (AWC) ranging from 100–500 mm/m, a slope of 0.5–3%, well to moderately

drained, with a soil depth ranging from 0.6 to 0.9 m and a pH of between 7.0–8.2 are most suitable. Soils having an AWC below 100 mm are not suitable for cotton.

### Cropping season and duration

Cotton is grown from May–June to January–February, with a crop duration ranging from 165–210 days. Under rain-fed conditions, ideal sowing time is from 15 June to 5 July. The field must receive a minimum of 30–40 mm of rainfall by the time of sowing. Delayed sowing after 15 July results in drastic reduction in productivity (up to 40–50%). In areas of assured irrigated in north India, cotton is sown in the middle of May.

### Cropping pattern

In north India's irrigated zone, cotton is grown as a monocrop within a cotton-wheat-sugarcane-cotton rotation, while in the central rain-fed zone, cotton is grown as an intercrop with red gram and sorghum from June to February. The age-old tradition of growing cotton in a cotton-sorghum rotation is no more prevalent.

With the recent spurt in the pest menace, more and more farmers are growing cotton with red gram and sorghum as an intercrop. Intercropping of cotton with green gram, black gram, soybean and red gram is also picking up. For maintenance of soil fertility, cotton should be grown in alternate years, in a cotton + legume-sorghum + legume rotation.

If this is not possible, then in one year cotton may be grown as the main crop (60%), with red gram, cowpea/soybean and maize/sorghum as the intercrop, while in the second year red gram should be grown as the main crop (35%), and cotton, cowpea/soybean and maize/sorghum as the intercrop.

### VARIETIES

Some of the improved varieties, suitable for organic management in Maharashtra are:

*G. hirsutum* – LRA-5166, LRK-516 (Anjali), Rajat (PKV-84635), PKV-081, DHY-286, Dhaval (JLH-168)

*G. arboreum* – AKH-4, AKA-8401, Y-1, PA-183, Namdeo PA-141, Savta PA-181.

PKV Hy2, 3,4 hybrids developed by Dr. P. D. Krishi Vidyapeeth Akola, H6, 8 and 10, Ankur 651, MECH-1,4 and NHH-44 have also been found suitable for organic management.

**Pre-cultivation practices**

Deep ploughing once in three years, and two shallow ploughings every year, are essential during the summer. One to two deep ploughings once in three years are necessary to control deep-rooted weeds and to destroy pest larvae or cocoons. Some farmers graze animals in the cotton fields in summer.

After one or two showers, the soil should be worked with a harrow 2–3 times before the seeds are sown. Crop residues are one of the major sources of nutrients. The entire crop residue from the previous cotton-legume intercrop should be incorporated into the soil at the time of ploughing. Hard, woody twigs of cotton can be used as fuel or should be recycled after composting.

Each organic farm should have sufficient infrastructure to produce compost and vermicompost. About 20–30 quintals of well-decomposed FYM/compost or 15–20 quintals of on-farm produced vermicompost with 2 kg PSB, 100 kg rock phosphate and 200 kg neem leaf/seed manure can provide sufficient nutrition. About 500 kg bone meal can also be used along with the compost to improve the phosphorus content of the soil. Treatment of the crop residue with *sanjeevak* and *Trichoderma viride* hasten *in situ* decomposition. Legumes need to be intercropped with cotton with a minimum coverage of 30%. Mixing their entire vegetative biomass as mulch maintains high soil fertility.

Green manuring is also an important way of maintaining soil fertility, but this can be adopted only under irrigated conditions or under a cotton-legume crop rotation. Trees of neem, babul, pongamia, sesban, *glyricidia*, etc., planted on farm bunds, will

produce leaf litter for soil nutrition. Trees also attract birds that control pests.

**Seed selection**

As organic cultivation techniques are based on the use of local and improved varieties for self-reliance and for keeping seed cost at its minimum, own seed production is advised. Identify vigorously growing plants with the desired characteristics and mark them with tags. Collect seeds from the prominent, distinct bolls of such identified plants for replanting (Sonawane, 2005). Farmers using improved or hybrid varieties can also adopt the organic techniques described here. Choosing early maturing varieties helps in escaping late bollworm attacks.

**Treatment**

Treat the seeds with a mixture of *beejamrut* (200 gm/kg of seed) and *Trichoderma viride* (8 gm/kg of seed). Dry the seeds in the shade. After this, again treat the seeds with azotobacter and PSB biofertilizer (5 gm each per kg of seed) and dry the treated seeds in the shade. The treated seeds should be sown within 6–8 hours of treatment. In south Indian states, *panchagavya* is used in place of *beejamrut*. Seeds are soaked in diluted *panchagavya* for 20 minutes, dried and then treated with *Trichoderma viride*, PSB and azotobacter.

**Seed rate and sowing**

Cotton is sown using a tractor or bullock-drawn seed drill or by dibbling. Hand dibbling of seeds, at recommended spacing, is commonly practised in rain-fed areas, particularly for hybrid seeds. This system ensures proper plant stand, uniform geometry and utilizes a lesser quantity of seed. Later, the crop is thinned to the recommended population. Recommended seed rate, spacing and required plant population for different varieties in the central cotton zone are as follows:

Table: Seed rate and spacing options for cotton

| Species | Seed rate (kg/ha) | Spacing (Cm) | Population (No/ ha) |
|---|---|---|---|
| *G. hirsutum* | 18–20 | 60 x 30 | 55,600 |
| *G. arboretum* | 10–12 | 60 x 30 | 55,600 |
| *G. herbaceum* | 12–15 | 45 x 30 | 74,074 |
| Hybrids | 2–3.5 | 120 x 40<br>120 x 60 | 20,833<br>13,888 |

## CULTIVATION

As per the biodynamic calendar, sowing should be done around full moon days. Seeds are sown in a north-south direction. A north-south orientation ensures better sun harvesting and prevents loss of carbon dioxide ($CO_2$) that is emitted by the crop during the night. The crop can re-absorb it during the day, resulting in better growth. For better sun-harvesting, some organic farmers in Maharashtra sow only 5–7 kg seed/ha with a spacing of 1 x 1 m or 1 x 0.5 m.

### Intercropping

Intercropping of cotton with red gram is a common practice in the central cotton zone. Besides red gram, intercropping with green gram, black gram and soybean has also been found to be highly effective and beneficial. Planting of a few rows of sorghum or maize helps in the reduction of the insect-pest problem. Multiple-crop intercropping is extremely beneficial to keep insect-pest problems below the economic tolerance level or ETL. Any of the following combinations can be used for optimum output, insurance against crop failure, reduced or no pest problem and maintenance of soil fertility:

One row of maize/sorghum, 2 rows of red gram, 4 rows of cotton, 2 rows of cowpea/soybean, 4 rows of cotton, 2 rows of red gram and one row of maize/sorghum.

Four rows of cotton, 2 rows of cowpea/soybean, 4 rows of cotton and one row of mixed plants of red gram, maize and sorghum.

Two rows of cotton, 2 rows of *moong*/cowpea, 2 rows of cotton,

2 rows of red gram.

One row of maize/sorghum, 4 rows of cotton, 2 rows of red gram, 4 rows of cotton, 2 rows of red gram, 4 rows of cotton and one row of maize/sorghum.

Alternate rows of cotton and *moong* up to 8 rows, one row of maize followed by alternate 8 rows of cotton and *moong*.

One row of marigold/*ambari* (*Hibiscus*) should also be planted every 15–20 rows. Alternatively, 100 marigold/*ambari* plants may be planted at random per acre.

### Cultural operations

Pruning of main and secondary shoot tips encourages growth of branches, resulting in development of many tertiary branches with more flowers and bolls. Proper pruning can increase productivity by 25–30%.

### Weeds

The first 60 days are very important for crop growth. Weeds compete with the crop for nutrients, resulting in poor crop yields if they are not removed in time. In cotton-red gram fields, use of the bullock drawn hoe is commonly used for weeding. The first weeding is done 20–25 days after sowing and the second, 55–60 days after sowing. Mulching of the field with a thick layer of crop residue immediately after sowing reduces weed growth. In multiple cropping systems, weeding is manually done. In some areas, farmers weed only once 25–30 days after sowing and avoid the second weeding, as it can damage the roots. Weed biomass should not be thrown away or burned. It should be used in the same field as mulch or should be recycled after composting.

## MANAGING SOIL FERTILITY

*Sanjeevak* or *jeevamrut* – fermented liquid manures prepared from cattle dung and cow urine are key on-farm inputs in the management of soil fertility on organic farms. *Amrut pani*, a soil tonic, can also be used in place of *sanjeevak* or *jeevamrut*. Around 200 litres of *sanjeevak* or *jeevamrut* or *amrut pani* are applied to

the soil per acre, either along with the irrigation water or sprinkled over the soil surface during or after mild rains. A minimum of three applications is necessary. The first after sowing; the second, 25–30 days after sowing (after the first weeding); and the third, 50–60 days after sowing (after the second weeding).

For better crop growth, diluted *jeevamrut* (life tonic) is used as a foliar spray on at least three occasions, with intervals of 20 days in between. The first application is 20 days after sowing. In the south Indian states, farmers use *panchagavya* in place of *jeevamrut* as foliar spray (Vijayalakshmi *et al*, 2005). Use of diluted *gomutra* or vermiwash (one litre in 15 litres of water) or a mixture of *gomutra* + vermiwash (1 : 1) is also very popular among farmers in Maharashtra.

Use of NSKE (neem seed kernel extract) or neem leaf extract (if the neem seeds are not collected and stored in the summer) with vermiwash (5% each) acts both as growth promoter and pesticide.

## WATER REQUIREMENTS

Depending upon the climate and variety, cotton needs between 700–1200 mm water during its entire growth period. Water requirements are low during the first 60–70 days, and highest during flowering and boll formation stage. The crop needs to be irrigated at 50–70% depletion of available soil moisture. In the sandy loam soils (of north India), the crop is irrigated 3–5 times. In red sandy loam soils, with low water retention capacity, 4–10 light irrigations may be needed. In black cotton soils 'protective irrigation' is provided every 20 days, if rains fail, especially during the boll development stage.

Although cotton is commonly flood-irrigated, irrigation by furrow or by alternate furrow method is more effective and conserves water. In sloping areas, channels running parallel to the contour lines, across the slope, prevent erosion. The alternate rows are watered to reduce weeds and root rot disease. Drip irrigation is

also very effective. Mulching of the soil surface with intercrop biomass 60 days after sowing reduces irrigation requirements by 40–60%. Mulching is very effective under purely rain-fed conditions.

### Water conservation

Rain-fed cotton yields are generally low due to erratic and uneven rainfall. Moisture stress during boll development stage is highly detrimental to the yield. *In-situ* rainwater conservation is the key to success. Cotton cultivation on ridges across the slope conserves more water, reduces soil erosion and improves yield. Ridge sowing on 0.4% slope and fusion of ridges at 6 m intervals just before the normal withdrawal of monsoon is a recommended practice. The excess water can be collected in farm ponds and recycled at the critical boll development stage in order to improve rain-fed cotton yields significantly.

## PROBLEM INSECTS

Important insect-pests of cotton include the American bollworm, the pink bollworm, the spotted bollworm and the spiny bollworm, cutworms (*Agrotis* sp), aphids (*Aphis gossypii*), white flies, red cotton bugs, spider mites, cotton jassids and thrips. The characteristics and life cycles of some of the important insect-pests are described below:

### American bollworm (*Heliothis armigera*)

The young larvae vary in colour from bright green, pink and brown to black, with a lighter underside. Alternating light and dark bands run lengthwise. The head is yellow and the legs are almost black. The larvae feed on tender leaves, buds and flowers and later bore into the bolls. They deposit faeces at the base of the entrance hole. The eggs are pinhead size, yellowish in colour and found singly laid, on the leaf surface. Mature larvae drop to the ground and pupate in the soil. Adult moths are grey to brown in colour and have dark spots on the front wings.

### Pink bollworm

The young larvae are tiny white caterpillars with dark brown heads.

(*Pectiniphora gossypiella*)

When fully grown, they are to 12 mm long with wide, transverse, pink bands on the back. The eggs are small, elongated and laid at the bottom of the green bolls. The larvae burrow into the bolls through the lint and feed on the seed. They do not deposit faeces at the base of the entrance hole. Adults are small, grayish brown moths.

**Spotted bollworm (*Earias vittella*) and spiny bollworm, (*E. insulana*)**

The young larvae are spindle shaped, grayish brown or greenish in colour. The eggs are small, round and light blue-green in colour. The pupae are enclosed in cocoons shaped like inverted boats. The wings of the adult moths are silvery green to yellow with three transverse lines of a darker shade. The larvae bore into the shoot and bolls of the cotton plant. Infested bolls have small holes with excreta inside.

**Cut worm (*Agrotis* sp.)**

Cut worm larvae live in the soil upto a depth of 5cm near cotton plants and cut off the seedlings at ground level. They always curl up when disturbed. They feed at night. The eggs are tiny, pearl white, round, and have a ridged surface. The full-grown larvae are brown or brownish black with a tinge of orange. The pupae are black or brown. Adults have dark brown forewings with distinctive black spots and a white and yellow wavy stripe.

**Aphids (*Aphis* sp.)**

Aphids are plant-sucking pests. Their mouths are like tiny straws, with which they pierce the plant tissue and suck the sap. They produce a large amount of sugary liquid waste called honeydew. Moulds grow on this honeydew, turning the leaves and branches black. The eggs are very tiny, shiny, black and found in the crevices of the buds, stem and bark of the plant. Winged adults are produced only when they need to migrate.

**White fly (*Bemisia* sp.)**

White fly adults are about 1 mm long with two pairs of white wings and light yellow bodies. They pierce the leaf tissue and suck the sap, causing the leaves to weaken and wilt. Their severe infestation also

causes yellowing, drying and premature dropping of leaves, resulting in the death of the plant. The white fly also produces honeydew and moulds. White flies are the potential carriers of viruses that cause diseases. Tiny white or brownish eggs are laid below the leaves.

**Jassids *(Amrasca devastans, A. biguttula)***

Jassids feed on the upper surface of leaves, resulting in small white circles. Jassids typically damage the lower leaves first and progressively move to the upper leaves.

**Thrips (*Thripidae* sp.)**

Thrips feed by rasping the surface of the leaves and sucking the plant sap that is released. Their attack is characterized by tiny scars on the leaves, fruits and stunted growth of the plant. Damaged leaves may become papery and distorted.

**Other minor pests**

Red cotton bug (*Dysdercus* sp) and spider mites (*Tetranychus* sp) are minor pests and rarely assume threatening proportions on organically managed farms.

**Habitat management and cultural practices**

Biodiversity is the key to keeping pest populations below the ETL. Intercropping of cotton with red gram, cowpea, soybean, *moong*, sorghum/maize and random planting of marigold and *Hibiscus subdariffa* (*lal ambari*) helps in keeping the pest population under the ETL. Sunflower is also an important trap crop for the control of insect pests in cotton. Assassin bugs, predatory beetles, ants, lacewing larvae, parasitic wasps (*Trichogramma*), etc., are some of the important natural enemies of these pests.

Cotton-sorghum, cotton-sunflower and cotton-red gram rotations have also been found to be effective in keeping pests below the ETL. Hand picking of infested buds and bolls and removal of cotton stocks help in control of bollworms.

Jaggery powder (10 kg/ha) sprayed on the soil surface will attract ants that feed on the larvae.

About 10–12 bird perches installed in one hectare attract birds that also consume cotton pests. Yellow rice (one kilo rice cooked

with turmeric powder) kept on or near perches attracts predatory birds. Yellow coloured sticky plates (up to 10/ha) and pheromone traps or light traps (10–12/ha) can also be used for the control of insect pests.

*Fig. Bird perches*

*Fig. Light trap*

Inundated release of 5000 *Chrysoperla* eggs after 15 days of sowing and 50,000 *Trichogramma* sp. eggs (2–3 cards), 15,000 to 20,000 *Trichogramma chilonis* per ha and 15,000 to 20,000 *Apanteles* sp. per ha after 30 days of sowing can keep the problem of pests below the ETL.

### Economical threshold limits

- American and spotted bollworm: one larva/5 plants or 5–10% damage to bolls
- Pink bollworm: 5% rosette flowers
- Aphids: 20% infested plants
- Jassids: 5–10 insects per plant
- Thrips: 5–10 nymphs per plant
- Mites and white fly: 5% infested plants

### General control measures

Spotted bollworms (brown) damage the shoots. The American bollworm (green) or the pink bollworm damage flowers and fruits when the crop is about 40–45 days old.

To control these insects, the following measures are recommended:

a) Foliar spray of 5% NSKE (neem seed kernel extract) is quite effective.

b) Use of *dashaparni* and *gomutra* (2.5 litres *dashaparni* extract and 2.5 litres cow urine in 200 litres water) can also effectively control these bollworms.

c) A garlic-chili-ginger extract has been found effective and is used by a large number of farmers in Maharashtra. To make this extract, crush 1 kg green chili in 3 litres of water, crush 1 kg garlic in 3 litres of water and crush 0.5 kg ginger in 2 litres of water, all separately. Boil each solution individually, till each is reduced to half. Filter and collect extracts. Mix the three extracts at the time of use. About 50 to 70 ml of this solution is mixed with an equal quantity of cow urine, diluted in 15 litres of water and used as a foliar spray.

d) In case of a severe attack of bollworm, use alternate sprays of *dashaparni* and garlic-chili-ginger extract.

e) A 5–10 % spray of HNPV can also control attacks of bollworms.

f) Some other control measures adopted by farmers in Maharashtra include the following:

- Onion (20–25 kg) is crushed and applied as soil treatment through irrigation to control soil-borne pests and diseases.
- The hairy/woolly caterpillar is controlled by spraying one litre juice of aloe vera mixed in 200 litres of water per ha.
- In the fourth month, two litres of lemon juice and 200 litres of water are sprayed over 1 ha to reduced bollworm incidence.

- Crush tamarind and mahua tree bark, 10 kg each, in 50 litres of water. The filtered and diluted extract can be

sprayed over one hectare area to control the worms.

- Flour spray (2 cups of fine white flour and half a cup of soap in water) and soft soap spray (15 gm soft soap powder in 15 litres of water) have been found to be effective in control of aphids, jassids, spider mites, thrips and white fly.
- Fermented buttermilk spray: ferment buttermilk in a bottle/can for 3–4 weeks; 300 ml fermented buttermilk is diluted in 15 litres of water) and is effective in control of bollworms, caterpillars and spider mites.
- Crush 5 kg lantana leaves in 5 litres of water and 10 litres of cow urine and ferment for 4 days. Dilute thereafter with 60 litres of water and spray on 1 ha to control fungal and viral diseases. The solution also repels white flies.

### Control of diseases

Root rot, wilt and browning of leaves are common diseases of cotton. For their control, the following measures are often adopted:

a) Deep ploughing during summer prevents the occurrence of soil borne pathogens.

b) Use of *Trichoderma viride* as seed treatment can effectively control the incidence of root rot and *Fusarium* wilt.

c) Use of neem leaf/seed manure (10 q/ha) has also been found to be effective in the control of soil borne pathogens.

d) For the control of rust and root rot, fermented (sour) buttermilk (5 litres) in lime water (100 litres) per ha may be sprayed.

e) Foliar spray of *Trichoderma viride* powder (25 gm), milk (50 ml) and water (10 litres) can reduce the incidence of brown leaf patches.

## HARVESTING, YIELD, STORAGE AND

In organic farming, the yield of cotton varies from 8–10 q/ha in

## MARKETING

rain-fed areas to 20–25 q/ha under irrigated conditions. Alongside, the farmer obtains between 50 to 250 kg of intercrop legume grains. According to studies conducted by the Central Institute of Cotton Research, Nagpur (Kairon *et al*, 1998), cotton yields on new organic farms do not fall below 30% in the first year when compared to conventional, irrigated and hybrid cotton. However, since the cost is 70% less, this compensates for the loss in yield. Reduced attacks of bollworm, jassid, aphid and white fly are also an added advantage in organic farming, which contributes to yield increase. In subsequent years, the yield keeps on increasing and stabilizes in about 3–4 years, without any increase in expenditure as compared with the first year.

### Economics

Cotton is profitable only if it is grown using organic farm inputs. *Jeevamrut* spray (5–6 times) costs Rs.500 per ha, seeds (5 kg, improved type) cost Rs.200 per ha, and labour costs Rs.3,500 per ha. If we add azotobacter, PSB and trichoderma at Rs.500 each, then another Rs.1,500 is required to avoid productivity loss in the first year of organic conversion. The total expense is thus Rs.5,000 in the first year. This expense is reduced after 2–3 years, once the soil is enriched with microbes and humus. The yield of 10 q/ha earns Rs.20,000, i.e., a profit of over Rs. 16,000. Even if sold in the open market, the profit is not less than Rs.12,000. Intercrops provide 50–80% bonus income and fodder.

Other cash crops – pulses, oilseeds, spices (chili, turmeric, ginger) – are better options to cotton or intercrops with it, as they yield 5–10 q/ha if grown singly at returns of Rs.1,800 per quintal. Thus, crop diversity ensures distance from debt and death. Organic farming is more viable than chemical farming.

With the latter, fertilizer cost is Rs.2,500, pesticides Rs.4,000,

and labour Rs.1,000, totalling Rs.7,500 on rain-fed farms. Electricity costs another Rs.4,500 per ha/year.

CASE STUDY

**Manohar Parchure, Ambora village, Wardha**

Manohar Parchure is a Nagpur city based individual who bought land two decades ago at a location two hours from the city. He cultivates about 20 crops on his farm and thus gets income practically each month: eight quintals of organic cotton per acre and in the first few months, two quintals each of cowpea, green gram, and soybean. He also gets two quintals of red gram later. In addition, he cultivates fodder and advocates intercropping and mulching all over the farm, rather than going in for vermicompost shed construction or other similar costly activities.