

COTTON

Bt. Cotton Hybrids : Officially identified private Bt. cotton hybrids being cultivated and found suitable for the last 3-4 years.

Soils: Deep black Cotton and Red fertile soils with irrigated or assured rainfall conditions.

Land Preparation

For rainfed cotton, deep ploughing once in 3 years with mould board plough or disc harrow facilitates deep infiltration of water and charging of soil profile with large quantities of water. The land has to be ploughed 2 to 3 times and work with harrow to bring the soil to good tilth. Seeds can be dibbled by maintaining spacing in between plants after running a marker in one or two direction(s). For irrigated crop, ridges and furrows are to be formed at recommended spacings after deep ploughing.

Seed Rate

American Cotton : 2kg / acre

Varieties (*G.hirsutum*.L)

Desi Cotton Varieties : 4-5 kg / acre

(*G.arboreum*.L and *G. herbaceum*.L)

Intra-/Inter-specific : 0.75-1 kg / acre

Cotton Hybrids

Seed Treatment :

Seed treatment with appropriate insecticide(s); imidacloprid 70 WS @ 5.0 g or thiomethoxam 70 WS @ 4.0 g or imidacloprid 48 FS @ 9.0 ml or carbosulfan 25 DS @ 40.0 g/kg of seed. Followed by, treatment with *Pseudomonas fluorescens* @ 10.0 g or

Trichoderma viridae @ 8.0 g or *T. hargianum* @ 8.0 g or carbendazim 50 WP @ 2.0 g or mancozeb 75 WP @ 3.0 g or captan 50 WP 3.0 g or thiram 75 WP @ 3.0 g/kg of seed.

Spacing

Desi Cotton Varieties (cm): 60 x 30

American Cotton : 90 x 60 or 105 x 60
Varieties (cm)

Conventional : 90 x 60 or 120 x 60
Hybrids (cm)

Bt.. Cotton : 90 x 45 or 90 x 60 or
Hybrids (cm) 120 x 45 or 120 x 60

Sowing with Cut-off dates

Red soils : June – July

Black soils : 1st July – 1st Fortnight
of August

Inter Cropping

Inter cropping with green gram / black gram / soybean / cluster bean in 1:2 or 1:3 ratio, and red gram 4:1 or 6:1 or 8:1 ratio.

Gap Filling and Thinning

Gap filling should be done at 10 DAS. Thinning should be done within 2-3 weeks, retaining two plants per hill in case of varieties, one plant per hill in case of hybrids.

Manures and Fertilizers

Apply FYM @ 4 t/acre (10 cart loads) besides the recommended fertilizers.



FeSO₄ along with citric acid should be done twice at weekly interval.

Weed Management

Spray pendimethalin @ 1.5 to 2.0 l/acre immediately or within 48 hours of sowing. Frequent inter cultivation with tined harrow followed by blade harrow till 90 DAS. For control of grasses and broad leaved weeds post emergence spray of quizalofop ethyl @ 400 ml/acre and pyrithiobac sodium @ 250 ml/acre is recommended. Post-emergence directed spray of paraquat @ 5.0 ml/l of water or glyphosate 10.0 ml + 10.0 g of urea or ammonium sulphate/l of water is recommended for control of the weeds in the cotton crop whenever intercultivation or manual weeding is not possible.

Irrigation: Generally cotton crop requires 2-4 irrigations depending upon the soil type.

Pest Management in Cotton

Management of Sucking Pests in cotton:

1. Grow sucking pests resistant/tolerant varieties/hybrids.
2. Seed treatment with imidacloprid 70 WS 5.0 g or thiamethoxam 70 WS 4.0 g or imidacloprid 48 FS @ 9.0 ml or carbosulfan 25 DS @ 40.0 g/kg of seed gives early protection against the sucking pests.
3. Growing of intercrops like greengram or blackgram or soybean or clusterbean or foxtail millet in 1:2 or 1:3 ratio will facilitate the buildup of native natural enemy populations that in turn keep sucking pests under check
4. Growing of cowpea as bund crop to encourage predacious insects like coccinellids, syrphids and chrysopids

Desi Cotton Varieties

8 N + 8 P₂O₅ kg/acre. Entire P as basal. N is in two splits at 30 DAS and 60 DAS by pocketing method.

American Cotton Varieties

36 N + 18 P₂O₅ + 18 K₂O kg/acre. Entire P as basal, N and K in three splits 30, 60 and 90 DAS by pocketing method.

Conventinol Cotton Hybrids

48 N + 24 P₂O₅, 24 K₂O kg/acre. Entire P as basal, N and K in three splits 30, 60, 90 DAS by pocketing method.

Bt. Cotton Hybrids:

25% excess N over recommended N should be applied. The recommended N and K should be given in 3-4 splits at 20 days interval starting from 20 DAS. Foliar application of 2% Urea or 2% DAP or 2% KNO₃ at flowering and boll development stages.

For correcting magnesium, boron and zinc deficiencies, foliar application should be given twice MgSO₄ @ 1% each at 45 and 75 DAS, Boron @ 0.15% each at 60 and 90 DAS and ZnSO₄ @ 0.2% at 4-5 days interval. For correcting iron deficiency due to heavy moisture stress in early crop growth stage, foliar application of 0.5%

5. Maize or Sorghum grown as barrier crops in the border prevents the spread of the sucking pests from neighbouring fields.
6. Stem application at 30 & 45 DAS with monocrotophos (1:4) and at 60 DAS with imidacloprid (1:20) for protecting the crop from early season sucking pests.
7. Setting up of yellow sticky traps @ 10 per acre for monitoring whitefly incidence.
8. Economic Threshold Level (ETL) for sucking pests on cotton is presented hereunder :

Leaf hoppers/
Aphids/Thrips

Acephate 75 SP @1.5g/l
Imidacloprid 17.8 SL @ 0.4 ml/l

Acetamiprid 20 SP @ 0.2 g/l
Thiamethoxam 25 WG @ 0.2 g/l
Fipronil 5 SC @ 2.0 ml/l

Whitefly

- Triazophos 40 EC @ 2.0 ml/l

Name of the Pest	ETL
Jassids (Leafhoppers)	Two adults or nymphs per leaf or appearance of second grade injury (yellowing in the margins of the leaves)
Thrips	10 adults per leaf
Aphids	15% affected plants
Whiteflies	6-8 adults per leaf
Mealy bugs	5% affected plants
Mites	10 per cm ⁻¹



Jassids (Leafhoppers)



Aphids

9. ETL based application of Insecticides

Leaf hoppers/ Aphids/Thrips - Monocrotophos 36 SL @ 1.6 ml/l

Whitefly

- Profenophos 50 EC @ 2.0 ml/l
Diafenthiuron 50% WP @ 1.25 g/l



NSKE @ 5% (extract from
10 kg of Neem Powder/acre)

Red mite - Wettable sulphur 80 WP @
3.0 g/l
Dicofol 18.5 SC @ 5.0 ml/l

Integrated Pest Management in Cotton:

1. Avoid monocropping of cotton.
2. Application of chemical fertilizers at recommended doses as supplement to organic and/or biological fertilizers.
3. Growing intercrops/ strip crops/ barrier crops with greengram, blackgram, soybean, cowpea, clusterbean, groundnut, foxtail millet and coriander were found to be better in increasing the effectiveness of natural enemies like coccinellids, syrphids, chrysopids, spiders, *Trichogrammids* and *Apanteleids* etc. Growing fodder maize, sorghum and bajra as barrier crops and castor as ovipositional trap crop with in the cotton was also found to be more advantageous to manage the pests of cotton.
4. Seed treatment with recommended insecticides and fungicides.
5. Stem application of Monocrotophos at 30 and 45 DAS and imidachloprid at 60 DAS.
6. Monitoring pests by using light, sticky and pheromone traps. The adults monitoring

should be supported by egg and larval monitoring following sequential sampling technique at frequent intervals in case of boll worms.

7. Bird perches should be arranged @ 10 per acre for encouraging bird predation on bollworm larvae.
8. The buildup of broad spectrum predators viz., spiders, coccinellids and chrysopids should be synchronised in other cultural operations. Release of *Trichogramma* egg parasite @ 50,000/ha and *Chrysopa* egg larval predator @ 10,000/ha. should be done as soon as the first brood of bollworms are noticed.
9. Topping of cotton plants when maximum egg laying of *Helicoverpa armigera* is noticed (October-November months).
10. Application of HNPV @ 500 LE/ha or neem seed kernel extract (5%) in synchrony with early larvae of *Helicoverpa*. Neem oil formulation to manage initial whitefly.

11. ETLs for Bollworms

American bollworm (*H. armigera*) and Spotted Boll worm (*E. vitella*): Five per cent damaged fruiting bodies or one larva per plant or total three damaged square per plant taken from 20 plants selected at random for counting.

Pink bollworm (*P. gossypiella*): Eight moths per trap per day for three consecutive days or 10 % infested flowers or bolls with live larvae.



Tobacco caterpillar (*S. litura*): One egg mass or skeletonized leaf / ten plants



1. Poison bait (10.0 kg of rice bran + 2.0 kg jaggery + 750 ml of chlorpyrifos or thiodicarb 300g) for the control of grownup larvae of *Spodoptera*.
2. Resorting to chemical insecticides for the control of leaf hoppers, aphids and thrips spray monocrotophos 36 SL @ 1.6 ml or acephate 75 SP @ 1.5 g or fipronil 5% SC @ 2.0 ml or imidacloprid 17.8 SL @ 0.4 ml or acetamiprid 20 SP @ 0.2 g and thiamethoxam 25 WG @ 0.2 g/l. For the management of whitefly spray triazophos 40 EC @ 2.0 ml or profenophos 50 EC @ 2.0 ml or diafenthuron 50 WP @ 1.25 g or neem seed kernel extract @ 5% and neem oil @ 5.0 ml/l; for the control of *Helicoverpa armigera* spray quinalphos 25 EC @ 2.5 ml or chlorpyrifos 20 EC @ 3.0 ml or acephate 75 SP @ 1.5 g or indoxacarb 14.5 SC @ 1.0 ml or thiodicarb 75 WP @ 1.5 g or spinosad 45 SC @ 0.3 ml or flubendamide @ 0.3 m and chlorantraniliprole @ 0.3 ml/l. For managing red spider mites, application of wettable sulphur 80 WP @ 3.0 g and dicofol 18.5 SC @ 5ml/l. Similarly, if mealy

bug spreads in patches to alarming level spray acephate 75 SP @ 2.0 g and profenophos 50 EC @ 3.0 ml/l mixing with sandovit or teepol.

3. Removal of cotton stubbles after last picking without opting for ratoon crop or prolonging the crop growth with irrigations and fertilizer applications. This is essential to break the cycles of problem pests in the system as a whole.

Management of Cotton Diseases

Bacterial blight: Angular leaf spots develop and spread through veins causing vein blight. Under severe conditions disease spreads to branches causing black arm. Dark green spots develop on bolls which turn black and rotting of bolls.



Control: Seed treatment with *Pseudomonas fluorescens* @ 10.0 g/kg of seed. Spraying of copper oxy chloride 3.0 g/l + streptomycin 0.1 g/l starting from 50 DAS, 2-3 times at fortnightly intervals.

Alternaria leaf spot: Brown spots with concentric rings develop on leaves, join together and dry, defoliation occurs. Lesions on stem extend and break.

Helminthosporium leaf spot: Light brown spots with ashy centres and red margins.

Cercospora leaf spot: Dark brown circular spots with white centres and purple margins develop on leaves.

Control: For the control of leaf spots seed treatment with *Pseudomonas fluorescens* @ 10.0 g or carbendazim 2.0g or thiram 3.0g or vitavax 2.0 g/kg of seed. Spraying copper oxy chloride 3.0 g or mancozeb 3.0 g or propiconazole 1.0 ml or captan + hexaconazole 1.0 g/l starting from 50 DAS, 2-3 times at fortnightly intervals.

Grey mildew: Angular, white, powdery spots develop on leaves, spread and defoliation occurs.

Control: Spraying water soluble sulphur 3.0 g or carbendazim 1.0 g/l, 2-3 times at 10-15 days interval.

Rust: Yellowish brown to reddish brown pustules develop on both sides of the leaves.

Control: Spraying water soluble sulphur 3.0 g or tridemorph 1.0 ml or propiconazole 1.0 ml/l, starting from 70 DAS, 2-3 times at fortnightly intervals.

Boll Rots: Dark spots or lesions develop on bolls.

Control: Spray copper oxy chloride 3.0 g + streptomycin 0.1 g or carbendazim 1.0 g/l of water.

Root rot: Sudden death of young plants in patches, roots become sticky and bark shreds in grown up plants.

Fusarium wilt: Damping off symptoms at seedling stage, lower leaves wilt early and drop. Brown streaks are visible in split open branches or stems, sometimes with black spores.

Verticillium wilt: Interveinal chlorosis and dark lesions develop on leaves with appearance of tiger

stripes, brown discoloration is visible in split open stems, branches and also inside the bark, plants die in the centre of infected patch.

Control: Seed treatment with *Trichoderma viride* @ 10.0 g or *Pseudomonas fluorescens* @ 10.0 g or carbendazim 2.0 g or thiram 3.0 g or vitavax 2.0 g/kg of seed. Soil application of *Trichoderma viride* or *Pseudomonas fluorescens* @ 2.0 kg/acre developed in 100kg FYM or vermicompost along with 20 kg of neem cake. Balanced Nitrogen application and correcting micronutrient deficiencies. Soil drenching at the base of infected plants with copper oxy chloride 3.0 g or carbendazim 1.0 g or benomyl 1.0 g/l of water.

Harvesting:

1. Seed cotton from fully opened bolls should be collected during cooler times of the day.
2. Seed cotton picked should be free from debris like dried leaves, dried bracts etc.,
3. Seed cotton from the first and last pickings should not be mixed with middle pickings.
4. Seed cotton damaged by bollworms should be picked separately.
5. The seed cotton should be graded and stored in heaps or in gunny boras in dry and well ventilated godowns.

Post Harvest Handling of Seed Cotton:

Proper care should be taken at various stages of handling and processing the seed cotton to ensure that the quality is not adversely affected so that the price realized is not reduced.

1. Watering the seed cotton before weighing should be avoided.

2. Mixing of seed cotton of different varieties should be avoided. The admixture of the inferior type lowers the quality of the superior type, due to differences in the fiber quality traits.
3. To maintain high quality of cotton, proper packing should be done to protect from contamination, dampness and fiber quality.
4. The seed cotton should be thoroughly graded from insect infested and immature bolls to avoid staining of the lint during the ginning process.
5. Care should be taken during the transportation of the seed cotton.
6. Adequate storage facilities both at farmer's level and market level should be provided for safe storage.

