Package of Practices for Cotton Cultivation in South Rajasthan

Cotton Research Station, MPUAT, Banswara, Rajasthan

Improved varieties of desi cotton

- **Turrab (PA-255) (2004):** This variety of native cotton (*Arboreum*) matures in 180-200 days. The average length of this type of fiber is 25 to 27 mm and the thickness is 37-38 percent. Its average yield is 12-15 quintals per hectare use 15-20 kg seed per hectare for sowing.

American cotton improved varieties and seed rates

- **Vagad Kalyan (2001):** The average length of the fiber of this early ripening variety of American cotton is 25 mm. And the yield is 33 percent. Its crop gets ready after ripening in 150-160 days. Its average yield is 18-20 quintals per hectare. For sowing use 15 kg seed per hectare.

Hybrid cotton improved varieties and seed rate

- **H-8 (1988):** This hybrid variety of American cotton ripens in 170 to 180 days and its yield potential is 22 to 23 quintals per hectare. The length of fiber in this variety is 26 to 28 mm. And the yield is 33 to 34 per cent. This hybrid variety of irrigated cotton can be sown in the first week of June for a second rabi crop. 2.5 kg of this for sowing use seeds per hectare.

- **DCH-32 (1981):** It is a hybrid variety of cotton developed from a cross of *Hirsutum* and *Barbadense* species with a longer staple. This variety falls in the rains of the division it has proved very beneficial for the declared areas. The ripening period of this hybrid variety is 160-180 days and the average yield is 18-20 quintals per hectare. The average length of fiber is 34-35 mm. And the yield is 36 percent. Compared to other varieties, the farmer gets more market prices for it. Use 2.5-3.0 kg / hectare seed for sowing

FIELD PREPARATION

- Loamy/clay soil is suitable for cotton cultivation. Prepare the land by plowing it once with a soil-turning plow and then 2-3 times with a trifali or harrow.
- While sowing of Bt cotton, keep in mind that sowing of Bt Cotton seed with non Bt Cotton Seed. It is mandatory to plant around 20 per cent area of cotton.

LAND TREATMENT

- To prevent termite infestation, soil treatment with methyl parathion 2% powder at the rate of 25 kg per hectare in the field at the time of field preparation. To reduce termite infestation, collect and burn dry crop residues like complete cleaning of the field. Do not use raw cow dung manure.

MANURE AND FERTILIZERS

- Three to four weeks before sowing, 8-10 tones of well-rotted cow dung manure per hectare

should be plowed and mixed well in the soil.

- Give 75 kg nitrogen and 35 kg phosphate to American varieties of cotton, 50 kg nitrogen and 25 kg phosphate to native varieties and 120 kg nitrogen and 40 to 50 kg phosphate per hectare to hybrid varieties. Give potash fertilizer on the basis of soil test. full of phosphate and potash quantity and half the quantity of nitrogen under the seed at the time of sowing. Give the remaining half quantity of nitrogen in two equal parts at the time of buds and buds formation respectively.
- In soils where sulfur, potash and zinc are below the critical level, the economic benefit level increases by adjusting these fertilizers.
- Spraying 2 percent Murate of Potash at the beginning of boll formation and at the time of maximum boll formation is beneficial in increasing the yield and fiber quality of cotton.
- For cotton-soybean intercrop, application of 25 kg zinc sulphate at the time of sowing and spraying of 0.1% boron (6 kg per hectare) dissolved in water at the time of flowering and maximum tillering, improves yield and fiber quality.

SEED TREATMENT

- Use commercial sulfuric acid as far as possible to remove the fibers from the seeds. One liter of sulfuric acid is sufficient for 10 kg of seeds. Put seeds in an earthen or plastic vessel and add sulfuric acid and stir with a stick for one or two minutes and as soon as it turns black, immediately wash the seeds in water and separate the floating seeds. Germination will be good by treating the seeds with sulfuric acid. After this treatment, there will be no need for seed germination.
- To prevent the crop from seed-borne diseases, soak the seeds in water for 6 to 8 hours and after drying, treat them with Carbendazim at the rate of 2 grams per kg of seeds or 1 gram of Streptocycline or 10 grams of Paushamycin in 10 liters of water for 8 to 10 days. Soak it for an hour and dry it and then use it for sowing.
- Where there is an outbreak of root rot, sow the seeds after treating them at the rate of 2 grams of Carbendazim or 6 grams of Trichoderma per kg of seed. To control early sucking insects, treat seed with Imidacloprid 70 WS @ 5-7.5 gm per kg of seed.

TIME AND METHOD OF SOWING

- Make sure to sow the irrigated crop by the first fortnight of June. Row to row and plant to plant distance is 75 × 30 cm in American varieties, 90 × 45 cm in Shankar varieties and 120×60 cm for indigenous varieties. Keep The desired number of five can be maintained by preparing plants in polythene bags and planting them in empty places.

IRRIGATION AND WEEDING

- A light irrigation 3-4 days after sowing improves germination. After germination, do the first irrigation in 20 to 30 days, due to which the roots of the plants grow deeper. Pruning the plants should also be done at the same time. After giving fertilizer and at the time of flowering, if there is no rain, do irrigation. Do not irrigate the two cropped area after October 15.

- **Irrigation Management:** Poly mulching along with drip irrigation in low water availability helps conserve moisture for the crop as well as control weeds. For this, make bunds according to the rows of crops in the field and put irrigation tubes (lines) drop by

drop. In which drippers of 4 liters of water per hour are installed according to the distance of the plant. After that cover the field with polythene and make holes in the polythene according to the dripper and sow the crop (dibbling) using fertilizer.

- **Weed control:** Immediately after sowing the crop and before germination, spray 3.33 liters of pendimethalin (pendimethalin 30 EC 1 kg active substance / hectare) on moist soil at the rate of 500 liters of water / hectare. After this, after 20-30 days of harvest, Quezalofap Ethyl 5 EC is applied to control the narrow leaf weeds. Use at the rate of @ 50 grams of active ingredient / hectare and for the control of broad leaf weeds, Pyrithiobac sodium 10 E.C. Use @ 62.5 gm or Chlorimuron Ethyl 25 WP @ 4 gm active ingredient / hectare. For the control of both types of weeds (narrow and broad), the above both (Qazalofop Ethyl 5 EC @ 50 g active) ingredients and Pyrithiobac Sodium 10 EC / 62.5 g Active Ingredients (hectares) spray the herbicides together. Use 500 liters of water per hectare for each spraying. If weeds appear, do weeding in the standing crop after 40-45 days.

MIXED FARMING

- Intercrop is suitable in rainfed areas. It is beneficial to sow one row of maize or two rows of soyabean / black gram / green gram between cotton rows.

CROP QUALITY

- Spraying of Magnesium Sulphate 1% Zinc sulphate 0.5% at the time of flowering and boll formation to improve the quality of cotton.

CROP PROTECTION

Disease Control:	
Disease name	Control Method in American / Desi Cotton
Root Rot	• Do deep plowing in summer. • Adopt proper crop rotation. • Use of zinc sulphate at the rate of 25 kg / hectare • *Trichoderma* 6 grams per kg of seed or 0.2 percent solution of Bavistin at the rate of per kg of seed treat the seeds. • 200 kg of *Trichoderma* per hectare at the rate of 10 kg of *Trichoderma* per hectare in the area where root rot is more prevalent. Mix cow dung with manure and put it in the field.
Black arm / bacterial blight	• Before sowing the seeds should be dipped in streptocycline 1 gram per 10 liters of water for 8-10 hours. (If there are naked seeds, then keep the period for 2 hours only.) • Make a solution of 1 gram streptocycline and 25 grams copper oxychloride in 10 liters of water and spray it. • Repeat the second spraying after 10 days.
Alternaria leaf spot Disease	• Before sowing the seeds, treat the seeds with 2 grams of Bavistin solution. • Spray Mancozeb at the rate of 2 grams per liter of water as soon as disease symptoms appear in the standing crop. • Repeat the second spraying after one week.
Parawilt	• In cotton it is a physiological disturbance. After heavy and continuous rains, some plants in the standing crop of Bt cotton dry up in the event of strong sunlight. To prevent this, spray Cobalt Chloride (10 ppm) on the affected plants. 10

	ppm To make a solution, dissolve 2 grams of cobalt chloride in one liter of water and add 75 ml of it. Dissolve the solution in 15 liters of water tank and spray it.

Pest Control:	
INSECT NAME	Control Method in American / Native Cotton
Termite	Do soil treatment with Quinolphos 1.5 percent at the rate of 25 kg per hectare.
Jassids:	ETL (2-3 nymphs / leaf)
Cultural control	Use resistant varieties/hybrids.
Biological control	*Use Chrysoperla* parasite eggs 50,000 per hectare use at the time of flowering if needed
Chemical Control	Imidacloprid 70 WS 5g per kg seeds
	Spray the following at the rate of per hectare: 0.2 ml Imidacloprid 17.8 SL/lit of water or 0.5 ml Thiomethoxam 25 WG /lit of water OR dimetone 1 liter methyl or Monocrotophos 36SL @1 liter Or Buprofezin 25 EC @ 1.25 l or Acetamiprid 20 EC @ 100 ml Or Diafenthiuron 50 WP @625 g per hectare Sulfoxaflor 30 WG @ 437.5 grams per hectare
Whitefly / Thrips:	ETL (6-8 adults / leaf)
Cultural control	Weed control • Early sowing (15th April - 15th May) by reducing the number of Gives ● Use of resistant varieties/hybrids.
Biological control	*Use Chrysoperla* parasite eggs 50,000 per hectare use at the time of flowering if needed
Chemical control	Treat seed with Imidacloprid 70 WS at the rate of 5grams per kg of seed. • Spray the following at the rate of per hectare: 0.2 ml Imidacloprid 17.8 SL/Lit of water or 1 liter Methyl Dimetone or Monocrotophos 36SL @ 1 liter/ha. Buprofezin 25 EC @ 1.25 l or Acetamiprid 20 EC @100 ml Or Diafenthiuron 50 WP @625 g per hectare Pyriproxyfen EC @ 750 ml per hectare Falonicamid 50 WG @200 g or Fipronil 5 SC @ 2 liters /ha
Spotted bollworm	ETL (1 bunch / plant)
Biological control	• Male moth at the rate of 5-7 pheromone trap per hectare use to catch • Use eggs of *Chrysoperla* parasite at the rate of 50,000 per hectare. If necessary, repeat it after flowering. • Use T*richogramma* egg parasite at the rate of 1,50,000 eggs per hectare in the evening. Repeat this 3 times at an interval of 7 days.
Chemical Control	• Spray the following mentioned at the rate of 1 liter Monocrotophos 36 SL per hectare or Fenvalerate 20 EC @450 ml/ha • Quinalphos 25 EC @ 1 ml /liter water or Carbaryl 50 percent

	soluble powder 2.5 kg • Repeat after 15-20 days as needed.
American Bollworm	ETL (at 5 percent flower damage)
Biological control	• Use 5-7 pheromone traps per hectare to catch male moths. • Use eggs of *Chrysoperla* parasite at the rate of 50,000 per hectare. If necessary, repeat it after flowering. • Use *Trichogramma* egg parasite at the rate of 1,50,000 eggs per hectare in the evening. Repeat this 3 times at an interval of 7 days. • Use of NPV @450 LE per hectare. • Spray neem leaves 10 percent.
Chemical Control	• Spray the following at the rate of per hectare: • 1 liter Monocrotophos 36 SL. Or 450 ml/ha Fenvalerate 20 EC Or • 1 ml quinolphos 25 EC per liter of water or 2.5 kg Carbaryl 50% soluble powder, repeat after 15-20 days as per requirement
Pink bollworm:	Economic damage level (one larva/plant or 10% flower loss)
Biological control	Use pheromone trap at the rate of 5-7 per hectare to catch male moth
Chemical control	Spray the following at the rate of per hectare: Cypermethrin 25 EC @ 400 ml/ha or Thiadicarb 75 WP @ 750 g/ha or Lambda Cyhalothrin 5 EC @ 500ml/ha or Carbaryl 50 WP @ 2.5 kg/ha or Profenophos 50 EC @1000 ml/ha

Causes of pink bollworm outbreak

- Cultivation of long duration hybrids.
- Availability of many hybrids in the market with different timing of flowering and boll formation.
- Keeping cotton in the field for a long time.
- Excessive use of urea.
- Development of resistance of pink bollworm to Cry 1 AC and Cry 2 ab.
- Low of Bt toxin during squares, flowers and balls seed formation.
- Keeping cotton in the field for a long time (from November onwards to April May).
- Early sowing which is more likely synchronize with the crop already in field.
- No sowing of refugee crop seeds.
- Not exercising proper control over time.
- Spraying 3-4 of two insecticides like monocrotophos + acephate is also a major reason.
- Not following crop rotation.
- Failure to identify initial pest attack.

Management of Pink Bollworm

- It is necessary to adopt crop rotation which is effective in ending the life cycle of pests.
- It is necessary to adopt crop rotation to end the life cycle of the pest. Do not sow at different times.
- Choose cotton hybrids of short duration (150-120 days) to avoid pink bollworm infestation.
- Choose varieties/hybrids resistant to sucking pests. It is necessary to apply refugee on legal basis.
- Continuous monitoring was done with the help of light/pheromone traps. Make sure that the quality of the lures used in the pheromone traps is good.
- At the time of flowering, Trichogramma eggs should be released on the crop at the rate of 60,000 / acre.
- Be sure not to spray pyrethroids before November.
- In the early days of the crop, use insecticides named Quinalphos and Thiodicarb.
- Finish the crop on time (till the end of November) and do not extend ahead of the crop.
- Burn the crop residues from the field
- After the last cull, the animals are released to graze in the field.
- Timely disposal of cotton and cotton seeds in ginning mills
- Planted pheromone traps in ginning mills and cotton godowns.

IPM in Cotton

- To destroy the different stages of insects hidden in the soil, do summer deep ploughing.
- Sowing by seed treatment: - For this, treat the seeds at the rate of Imidacloprid 70 WS 7.5g or Thiomethoxam 5g per kg of seed.
- Plant a row of ladyfinger around the cotton and if the number of insects is high on it, spray any one of the insecticides given below.
- After every 9 rows of cotton, apply one row of Kangni.
- Sow 3-4 rows of maize or chawla around the cotton, which will increase the number of friendly insects.
- Plant bird perches (15-20/ha) for birds to sit in the fields.
- When the cotton crop is 35-40 days old, sprinkle Imidacloprid by making a solution of 5 ml per 15 liters of water.
- Break and burn the stems affected by Chitakbari Sundi.
- Release 50,000 eggs of Chrysoperla per hectare when sap sucking insects are seen. Repeat it again after 15 days.

- Release 1,50,000 eggs of Trichogramma chilonis per week for 6 weeks when bollworms appear.

- To control American bollworm, spotted bollworm, pink bollworm and tobacco bollworm, apply pheromone traps (6 per hectare, separately for each pest).

- Change the lure every 3-4 weeks. NPV (varies for American bollworm and tobacco bollworm) 450 LE or 1 kg B. Spray T. (Dipel) dissolved in 500 liters of water at the rate of per hectare in the evening.

- Apply any one of the following insecticides as required: Methyl Dimeton (1 Ltr), Pharmathion (1 Ltr), Quinolphos (1 Ltr), Monocrotophos (1 Ltr), Dimethoate (1 Ltr), Profenophos (1 Ltr), Chlorpyriphos (1 Ltr)), Carboryl (2.5 kg), Cypermethrin (400 ml), Fenvalerate (450 ml) should be sprayed per hectare.

- Do not repeat the spraying of any insecticide, and do not tank mix two insecticides.

- Do not apply more than the recommended amount of nitrogen fertilizer.

- Weeds should not be allowed around the cotton field.

IMPROVED AGRICULTURAL PRACTICES FOR BT COTTON

RECENT HYBRIDS

- **Ankur - 3224 (BG - II):** This Bt hybrid variety matures in 145-150 days. Its fiber length is 29 - 30 mm. And the yield is 32-33 percent. Under normal conditions, this Bt hybrid of irrigated cotton can be sown in the first week of June for a second rabi crop.

- **NCS - 145 (BG-II) (2007):** This Bt hybrid variety of American cotton ripens in 160-170 days. The fiber length of this Bt cotton is 27 - 32 mm. And the yield is 33-34 percent. Under normal conditions, this Bt hybrid of irrigated cotton can be sown in the first week of June for a second rabi crop.

- **Hybrid - 8 (BG - II) (2012):** This hybrid variety of Bt cotton matures in 170-180 days. The length of this type of fiber is 26-28 mm. And the yield is 33-34 percent.

- **Hybrid - 6 (BG-II) (2012):** This hybrid variety of Bt cotton matures in 170-180 days. The length of this type of fiber is 25-26 mm. And the thickness is 33-34 percent.

- **SWCH-4746 (BG-11) (2010):** This Bt hybrid variety matures in 170-175 days. Its fiber length is 30 mm. And the yield is 32-33 percent.

- **Paras Brahma (BG-11) (2008):** This variety of Bt hybrid matures in 170-180 days. In its plants, 2.5 main pods and 30-35 co-pods (sympodia) are found.

- **Ankur - 3244 (BG - II):** This Bt hybrid variety matures in 160-170 days. Its fiber length is 28 - 30 mm. And the yield is 31-33 percent. This variety is suitable for intensive cultivation.

- **Paras Chetak (BG-11) (9066):** This Bt cotton hybrid variety matures in 165-175 days. The plants of this Bt cotton are straight and this cotton has 2-3 gonopodia and 30-35 sympodia

PREVIOUS HYBRIDS

- **PCH - 9605 (BG-11) (2010): This PT hybrid matures in 160-165 days. The fiber length in this Bt hybrid is 27-32 mm. And the yield is 35-36 percent. Under normal conditions, this Bt hybrid of irrigated cotton can be sown in the first week of June for a second rabi crop.**

- **PRCH - 333 (BG-11) (2009) : This variety of Bt hybrid matures in 150-160 days. The fiber length of this Bt hybrid is 30-32 mm. And the harvesting percentage is 33-34. Under normal conditions, Rabi crop can be taken by sowing this Bt Savankar of irrigated cotton in the first week of June.**

FIELD PREPARATION

Loamy/clay soil is suitable for cotton cultivation. Prepare the land by plowing once with soil turning plow and later 2-3 times with Triphali or harrow. While sowing Bt cotton, keep in mind that sowing of Non Bt with Bt. cotton seeds. Cotton seed of non Bt is mandatory to sow around the cotton.

Land Treatment

To prevent termite infestation, mix methyl parathion 2% powder at the rate of 25 kg per hectare in the field at the time of field preparation. To reduce termite infestation, do complete cleaning of the field, collect dry crop residues and burn them. Do not use raw cow dung manure.

Improved varieties/hybrids

There are more than 1000 Bt varieties approved by the GEAC and the state government approved every year also.

Manure and Fertilizers

Three to four weeks before sowing, apply 8-10 tones of well-rotted cow dung manure per hectare and mix it well in the soil. Like hybrid varieties, give 120 kg nitrogen, 60 kg phosphate and 30 kg potash per hectare in VT cotton varieties. Full quantity of Phosphate and Potash and half quantity of Nitrogen should be given under the seed at the time of sowing. The remaining half quantity of nitrogen should be given in two equal parts at the time of formation of buds and buds respectively. In soils where sulphur, potash and zinc are below the critical level, the level of economic benefit increases by using these fertilizers. 2 percent Murate of Potash or N. P.K. Spraying the mixture at the beginning of boll formation and at the time of maximum boll formation is beneficial in increasing the yield and fiber quality of cotton. Also, spray 3 percent potassium nitrate (KNO_3) at the stage of flowering and bud formation.

SEED TREATMENT

For the prevention of seed and soil borne diseases, sow the seeds after treating them with 2 grams Carbendazim or *Trichoderma* @ 8 grams per kilogram of seed before sowing. Imidacloprid 70 WS for the control of sap sucking insects at the initial stage of the crop or treat with Thiomethoxam 5-7.5 grams per kg of seed.

SEED RATE, TIME AND METHOD OF SOWING

Make sure to sow the irrigated crop by the first fortnight of June. Row to row and plant to plant distance of 90×45 or 90×90 cm for sowing T. cotton varieties. Keep By preparing extra plants in polythene bags and planting them in empty places, the desired number of plants can be maintained. BT 90x90 cm in cotton varieties. 1.2 to 1.5 kg per hectare for crop geometry and 90×45 cm. Use 2 to 2.5 kg seed for crop geometry. Along with the sowing of Bt cotton varieties, non Bt cotton seeds (refugee seeds) are sown around the field and necessarily.

IRRIGATION AND WEEDING

A light irrigation 3-4 days after sowing improves germination. After germination, do the first irrigation in 20 to 30 days, due to which the roots of the plants grow deeper. Prune the plants at the same time. After giving fertilizers and at the time of flowering, if there is no rain, do irrigation. Do not irrigate the two cropped area after October 15. Spray the moist soil at the rate of 3.33 liters of pendimethalin (pendimethalin 30 EC is 1 kg of active ingredient) in 500 liters of water immediately after crop sowing and before germination. After this, after 20-30 days of harvest, Quzalofap Ethyl 5 EC is applied to control the narrow leaf weeds. Use at the rate of 50 grams of active ingredient / hectare and for the control of broad leaf weeds, pyrithiobac sodium 10 E.C. / 62.5 gm or use Chlorimuron Ethyl 25 WP / 4 gm active ingredient hectare. For the control of both types of weeds (narrow and broad), the above mentioned elements (Quzalofap ethyl 5 EC / 50 grams active) and Pyrithiobac sodium 10 EC @62.5 grams of active ingredient

hectare) Spray the weedicides together and use 500 liters of water per hectare for each spraying. If weeds appear again, do weeding in the standing crop for 40-45 days.

CROP QUALITY

To increase the quality of cotton, spray Magnesium Sulphate 1 kg, Zinc Sulphate 500 grams by preparing a solution of 750 grams of slaked lime at the time of flowering and boll formation.

IMPORTANCE OF REFUGIA IN Bt COTTON

According to the recommendation of the Genetic Engineering Approval Committee (GEAC) of the Government of India. It is essential to sow 20 percent of the area or 5 rows (whichever is more) of the same type of non-BT seed around the main crop. With each Bt variety, its non-B. T. Seeds (120 g) come with the same packet. Now-a-days, in place of non Bt, pigeon pea seeds have also started coming in some varieties. Often, if this refugia seed is not planted, there can be a possibility of outbreak of doda borer insects and if they stay here continuously, resistance can develop in dendu borer insects.

CROP PROTECTION

Disease Control:

Disease name	Control Measures in Bt Cotton
Root rot disease	• Do deep plowing in summer. • Adopt proper crop rotation. • Use Zinc Sulphate at the rate of 25 kg/ha. • Seed treatment with Trichoderma @ 8 gm per kg seed or Carbondazim @ 2 gm per kg seed. • To prevent disease in standing crops, do trenching at the rate of Dithane M-45, 3 g per liter of water. • In areas where root rot is more prevalent, 10 kg of *Trichoderma* per hectare mixed 200 kg with cow dung and put in the field.
Black Arm / bacterial blight	• Spray a solution of 1 gram streptocycline and 25 grams copper oxychloride in 10 liters of water in the standing crop. • If necessary, repeat the second spray after 10 days.
Alternaria leaf spot disease	• Spray mancozeb or propineb at the rate of 2 grams per liter of water as soon as disease symptoms appear in the standing crop. • Repeat second spray after one week
Parawilt or new drought	• It is a physiological disorder in cotton. In case of strong sunlight after heavy and continuous rains, some of the standing crop of Bt cotton plants dry let's go To prevent this, spray Cobalt Chloride (10 ppm) on the affected plants. 10 ppm To make a solution, dissolve 2 grams of cobalt chloride in one liter of water and add 75 ml of it. Dissolve the solution in 15 liters of water tank and spray it.
Crazy top	• 2,4.D, Atrazine or other weedicides are commonly used in the fields to which cotton crops are very sensitive. Even very small amounts of these

	weedicides can have adverse effects on the cotton crop. It is often observed that atrazine or 2,4. D or other weed killer wind sown Bt in the nearby field. It falls on cotton plants, causing the infected leaves to shrivel up and take the form of a claw, which also has thin fingers. Leaves take distorted form. Apart from this, if the equipment used for spraying weedicide is not cleaned systematically and used in cotton crop, then a deformity called crazy top is formed. For its control, irrigate the crop and give urea solution to the roots and sprinkle 1 percent urea solution or make a solution of calcium carbonate (1.5%) or gibberellic acid 0.1 ml / 10 liters of water (50 ppm).

Pest Control:

Insect name	Control Measures in Bt Cotton
Termite	• Treat soil at the rate of methyl parathion 2 percent 25 kg per hectare.
Sucking pests	Jassids ETL (2-3 nymphs/leaf) White fly: ETL (6-8 adults/leaf) their the control measures are as follows
Biological control	• Apply eggs of *Chrysoperla* parasite under the leaf at the rate of 50,000 per hectare. If necessary, repeat this after flowering.
Chemical ontrol	Spray the following chemicals: • Imidacloprid 17.8 SL @0.2 ml / liter of water or • Thiomethoxam 25 WG @ 0.5 ml / liter of water or • Dimethoate 30 EC @400 to 600 ml per hectare or • Monocrotophos 36SL @1 liter / ha or • Buprofezin 25SC @ 1.25 liters / hectare or • Acetamiprid 20 SP @ 100 ml/ha or • Difenthuron 50WP @ 625 g/ha • Acephate 75 SP650-700 gm/ha or • Falonicamid 50 WG @200 g or Fipronil 5 SC @ 2 liters /ha
Mealy bug	• Spray the following insecticides at the rate of per hectare. • Chlorpyriphos 20 EC @1 liter / hectare or • Profenophos 50 EC @ 1.25 litres/ha or • Dimethoate 30 EC @ 1 litre/ha. • Quinolphos 25 EC @1 liter / hectare and dissolve one spoon of washing powder at the time of sprinkling.
Spodoptera	• The hybrid/variety of Bt cotton (BG-I) is not effective for controlling tobacco caterpillar. This caterpillar is omnivorous. Insect the larval stage of (*Spodoptera*) causes damage from August to October. In the young stage, the larva is blackish gray hairless. When grown, it turns dark green and black triangular shaped spots are formed on the body. The butterfly of the insect lays eggs in clusters on the lower surface of the leaves and the clusters of

	eggs are covered with hairs remains covered. For effective control of tobacco caterpillar in Bt cotton (**a). Crop and mechanical control: -** • Sowing only BT BG-II and recommended hybrids/varieties of cotton. • Don't plant Castor, Moong, Dhaincha and Bhindi near Bt cotton field because these are the favorite plants of tobacco caterpillar. • Keep the field clean from weeds / Pattharchata and Congress grass should not be allowed to flourish. • Collect and destroy the eggs of *Spodoptera* moth which are present on the underside of the leaves. • Use light trap. **(B). Chemical control :-** 1. Thiodicarb 75SP @ 750 grams/ha 2. Chlorpyrifos 20 E.C. 5 ml / liter of water or 3. Quinalphos 20 EC @ 2 ml / liter of water or 4. Acephate 75 SP @ 2 gm/Lit of water or 5. Nuvoluron 10 EC @ 1 ml/Lit of water or 6. Emamactan Benzoate 5SG @0.5 gm/Lit of water or 7. Flubendiamide 480 SC @ 0.4 ml/Lit of water or 8. Indoxacarb 15.8 SE @ 350ml/ha or 9. Chloranthranilprole 18.5 SE @150 ml/ ha

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