

6. FIBRE CROPS

COTTON (*Gossypium* sp.,)

(i) CLIMATE REQUIREMENT OF COTTON

| T_Max°C | T_Min°C | Optimum °C | Rainfall mm | Altitude m MSL |
|---------|---------|------------|-------------|----------------|
| 40 | 12 | 27 - 32 | 500 - 700 | Up to 1500 |

Tropical warm season crop. A daily mean temperature of 16°C for seed germination, 21 - 27°C for proper vegetative growth and 27 - 32°C for fruiting phase. Abundant sunshine during boll maturation and harvesting is essential to obtain a good quality crop produce. Heavy showers of rain or heavy irrigation during fruiting period cause shedding of flowers and young bolls.

I. SEASON AND VARIETIES

| District/Season | Varieties/Hybrids |
|--|--|
| Irrigated (Main) | |
| Winter Irrigated (Aug – Sep) | |
| Coimbatore, Erode, Madurai, Dindigul, Theni, Salem, Namakkal | MCU 5, MCU 5VT, Suraj, MCU 13, Surabhi, Suvin, CO 14 |
| Dharmapuri | MCU 5, MCU 5VT, Suraj, MCU 13, Surabhi, CO 14 |
| Cuddalore, Villupuram | LRA 5166, SVPR 2, SVPR 4, Surabhi, CO 14 |
| Madurai, Virudhunagar, Tirunelveli, Trichy, Salem, Erode, Dindigul | SVPR 5 |
| Summer – Irrigated (Feb – Mar) | |
| Erode | MCU 5, MCU 12, MCU 13, Surabhi |
| Madurai, Virudhunagar, Dindigul, Tirunelveli, Thoothukudi, Theni, Ramanathapuram, Sivagangai, | MCU 5, SVPR 2, SVPR 4, Surabhi, SVPR 5, SVPR 6 |
| Rainfed (Sep – Oct) | |
| Madurai, Dindigul, Theni, Ramanathapuram, Virudhunagar, Sivagangai, Tirunelveli, Thoothukudi, Dharmapuri, Perambalur, Trichy | LRA 5166, K11, KC 2, SVPR 2, KC 3, SVPR4, K12 |
| Rice Fallow | |
| Thanjavur, Tiruvarur, Nagapattinam, Karur, Cuddalore and Villupuram | MCU 7, SVPR 3 |

II. PARTICULARS OF COTTON VARIETIES/HYBRIDS

| Varieties/ Hybrids | Year of Release | Year of Notification | Parentage | Season | Irrigated/ Rainfed | Mean yield of seed (kg/ha) | Special features |
|-----------------------|--------------------|---------------------------|---|-----------------------------|-----------------------|--|---|
| MCU 5 | 1968 | | Multiple cross | Aug- Oct Feb- Mar | Irrigated | 1850 | Extra long staple (29 mm MHL), Can spun upto 70s, ginning 34% |
| MCU 7 | 1972 | SO.596(E)/ 13.08.1984 | X ray irradiation of X L 1143 EE | Jan- Feb | Rice fallows | 1330 | Medium staple (23.7 mm MHL), Can spun upto 30s, early maturing with 33.2% ginning outturn. Tolerant to Black arm |
| MCU 12 | 1999 | SO.821(E)/ 13.09.2000 | Derivative from the cross LRA 5166 x MCU 11 | Aug- Oct | Irrigated | 2000 | Shorter in duration than MCU 5, GOT 34.8% Can spun upto 50s |
| MCU 13 | 2004 | SO.1177(E)/ 25.08.2005 | It is a multiple cross derivative involving the parents of [(TCH 665 x LS 149) x (TCH 665 x TCH 21)] x (TCH 21 x EECH) x (TCH 92-7 x EECH) | Aug- Oct Jan- Feb | Irrigated | 2200 | Early duration Can spun upto 50s |
| CO 14 | 2016 | SO.2238(E)/ 29.06.2016 | (MCU5/TCH92- 7) x MCU 5-1 | Aug- Oct | Irrigated | 1768 | Extra long stable cotton (2.5% span length - >35.0mm), Ginning outturn: 34.8%, capable for spinning upto 70s count. |
| SVPR 2 | 1996 | SO.360(E)/ 01.05.1997 | TSDT 22 x JR 36 | Feb - Mar Sep- Oct | Irrigated Rainfed | 2000 | High ginning out turn of 36.4%, medium staple (24.3 mm), can spin 30's, suited to summer irrigated, winter rainfed and tankfed rice fallow tracts of Tamil Nadu. |
| SVPR 3 | 2000 | SO.821(E)/ 13.09.2000 | Selection from L.H 900 x 1301 D.D | Jan- Feb | Rice fallows | 1800 | Suitable for rice fallow tract, early duration (135-140 days), Tolerant to drought, leafhopper, alternaria spot, black arm disease. |

| Varieties/ Hybrids | Year of Release | Year of Notification | Parentage | Season | Irrigated/ Rainfed | Mean yield of seed (kg/ha) | Special features |
|-----------------------|--------------------|---------------------------|---|-------------------------------|-----------------------|--|--|
| SVPR 4 | 2009 | SO.2137(E)/ 31.08.2010 | Hybrid derivative of MCU 5x S4727 | Feb- Mar Sep- Oct | Irrigated Rainfed | 1800 | Superior medium staple cotton with good fibre strength. suitable for spinning 40's yarn. |
| SVPR 5 | 2014 | SO.3540(E)/ 22.11.2016 | Cross derivative of ND LH 1658 x Surabhi | Aug - Sep Feb- March | Irrigated | 1845 | Long staple - 29.0mm (UHML), Bundle strength 27.8g/tex(HVI mode), can spin 40 - 50's counts, moderately resistant to Jassid. |
| SVPR6 | 2017 | SO.1379(E)/ 27.03.2018 | Cross derivative of SVPR 2 x BJA 592 | Feb- March | Irrigated | 2312 | Long staple 29.1mm (UHML), Bundle strength 27.3 g/tex(HVI mode), Can spin 40's count, Moderately resistant to Jassid. |
| KC 2 | 1997 | SO.647(E)/ 09.09.1997 | MCU 10 x KC 1 | Sep - Oct | Rainfed | 1000 | High ginning out turn of 37.5%, medium staple cotton - 24.4 mm, Suited for rainfed black cotton soil of Tirunelveli, Thoothukudi and Virudhunagar Districts. |
| KC 3 | 2006 | SO.1178(E)/ 20.07.2007 | Hybrid derivative of TKH 97x KC1 | Sep- Oct | Rainfed | 1080 | Resistant to leaf hopper, medium staple cotton – 26.4 mm, suited to southern districts of Tuticorin, Tirunelveli and Virudhunagar District. |
| MCU 5 VT | | | Selection from MCU 5 | Aug- Oct | Irrigated | 2500 kg/ha | Long staple variety capable of spinning upto 60 's count yarn |
| Suraj | | | LRA 5166 (CCH 326612 x HLS 329) | Aug- Oct | Irrigated | 2500 kg/ha | Long staple and suitable for high density planting system |
| K 11 | 1993 | SO.360(E)/ 01.05.1997 | (0794-1-DX H 876) x (0794-1- DX H 450) Multiple Hybrid derivative | Sept – Oct | Rainfed | 1100 | Better fibre properties with lesser pest incidence than K10 |

| Varieties/ Hybrids | Year of Release | Year of Notification | Parentage | Season | Irrigated/ Rainfed | Mean yield of seed (kg/ha) | Special features |
|-----------------------|--------------------|--------------------------|--|-----------------------------|-----------------------|--|---|
| K12 | 2017 | SO.399(E)/ 24.01.2018 | K11 x K9 | Oct- Nov | Winter rainfed | 1193 | Early duration: 135- 140 days, 2.5% span length 27.7mm, can spun upto 30's counts. Resistance to drought, leaf hopper |
| LRA 5166 | | | Laxmi x Reba B.50 x AC 122 | Aug- Oct Jan – Feb | Irrigated Rainfed | 1800 725 | Medium staple (29 mm), can spun upto 40s, ginning 36.2% |
| Surabhi | | | MCU 5 VT (MCU 5 x <i>G.mexicanum</i>) | Aug- Oct | Irrigated | 2200 | Extra long staple, <i>Verticillium</i> wilt resistant |

Extra long staple : CO 14 and Suvin

Long staple : SPVR 5, SVPR 6, MCU 5, MCU 5 VT, MCU 12 , MCU 13, Surabhi and Suraj

Superior medium staple : LRA 5166, SVPR4, KC 3 and K 12

Medium staple: SVPR 2, SVPR 3, MCU 7 and KC 2

Short staple: K 11

Gossypium hirsutum :CO 14, Surabhi, SPVR 5, SPVR 6, MCU 5, MCU 5 VT, MCU 12, MCU 13, LRA 5166, SVPR 2, SVPR 3, SVPR 4 , MCU 7, KC 3, KC 2, Suraj

Gossypium barbadense: Suvin

Gossypium arboreum : K 11 and K12

Variety suitable for high density planting : Suraj , CO 15, KC 3, Karunganni Cotton K 12

Definition/terminologies

Staple length

Graders estimate the fibre length by hand stapling and is called staple length and expressed in millimeter.

Micronaire

It is the measure of the index of the fibre diameter and is assessed by determining weight per unit length of the fibre. It is expressed in micronaire value ($\mu\text{g}/\text{inch}$).

Fibre strength

Fibre strength is generally considered to be next to fibre length and fineness. It is referred as bundle or tensile strength, essential for high speed spinning. It determines yarn strength. Unit of this parameter was expressed in gms/tex.

Uniformity ratio

It is the ratio of 50% span length to 2.5% span length expressed as percentage.

$$\text{Uniformity ratio} = \frac{50\% \text{ span length} \times 100}{2.5\% \text{ span length}}$$

Maturity - Coefficient:

The maturity of cotton fibres is expressed by the maturity ratio parameter, which is calculated on the basis of the fibre circularity coefficient, defined as the ratio of the cell wall area and that of a circle of the same perimeter as the fibre cross-section.

CROP MANAGEMENT**I. PREPARATION OF FIELD FOR IRRIGATED COTTON****CROP FIELD PREPARATION****1.1.1 PREPARATION OF THE FIELD**

- i) Prepare the field to get a fine tilth.
- ii) Chiselling for soils with hard pan: Chisel the soils having hard pan formation at shallow depths with chisel plough at 0.5 M interval, first in one direction and then in the direction perpendicular to the previous one, once in three years. Apply 12.5 t farm yard manure or composted coir pith/ha besides chiselling to get increased yield
- iii) If intercropping of Greengram/Soyabean is proposed, prepare the main field, so as to provide ridges and furrows to take up sowing 20 days prior to cotton sowing.

1.1.2. APPLICATION OF FYM/COMPOST AND BIOFERTILIZERS

- i) Spread 12.5 t of FYM or compost or 2.5 t of vermicompost per ha if available, uniformly on the unploughed soil.
- ii) Apply 2 kg of *Azospirillum* + 2 kg Phosphobacteria (or) 2 kg of Azophos + 2 kg Pink Pigmented Facultative Methyloph (PPFM) with 25 kg of FYM and 25 kg of sand, mix uniformly before sowing as soil application.

1.1.3. PRE-TREATMENT OF ACID DELINTED SEEDS WITH BIOFERTILIZER

- i) Treat one hectare of seeds with 600g of *Azospirillum*, 600g of Phosphobacteria (or) 600 g of Azophos + 600 g of Silicate Solubilizing Bacteria. (SSB)

- II) Liquid formulation** Treat one hectare of seeds with 125 ml of *Azospirillum*, 125 ml of Phosphobacteria and Silicate solubilizing bacteria (SSB) shade dry for 30 minutes before sowing.

1.1.4. FORMATION OF RIDGES AND FURROWS

- i) Form ridges and furrows 10 m long with appropriate spacing depending upon the variety.
- ii) Use ridge plough or bund former to form ridges so as to economise on cost of cultivation.
- iii) In fields with ragi stubbles, just dibble cotton seeds at the specified spacings.
- iv) Adopt the following spacing between ridges for different varieties/hybrids.

| Varieties/Hybrids | Spacing between ridges (cm) |
|--|-----------------------------|
| 1) MCU 5, SVPR 2, LRA 5166, MCU 12, 75 MCU 13 Suvin | 90 |
| 2) MCU 7 | 60 |

NOTE: Adopt higher spacing rows in fertile soils by 15 to 30 cm.

1.1.5. APPLICATION OF INORGANIC FERTILIZERS

- v) If soil test recommendations are not available, follow the blanket recommendation for the different varieties.

| Varieties / Hybrids | Quantity of fertilizers (Kg/ha) | | |
|--------------------------------------|---------------------------------|-------------------------------|------------------|
| | N | P ₂ O ₅ | K ₂ O |
| MCU 7, SVPR 3 | 60 | 30 | 30 |
| MCU 5, MCU 12, MCU 13, Suvin, SVPR 2 | 80 | 40 | 40 |

- ii) If basal application could not be done, apply on the 25th day after sowing.
- iii) Apply 50 per cent of N and K full dose of P₂ O₅ as basal and remaining ½ N and K at 40 – 45 DAS for varieties. For hybrids apply N in three splits *viz.*, basal, 45 and 65 DAS.

Soil test crop response based integrated plant nutrition system (STCR-IPNS) recommendation may be adopted for prescribing fertilizer doses for specified yield targets (ready reckoners are furnished)

Cotton - Variety (1)

Soil : Mixed blackcalcareous
(Perianaickenpalayam series)

FN = 8.81 T-0.62 SN
FP₂O = 2.53T-1.36SP
FK₂O=4.92T-0.25SK

Target : 2.5 - 3.0 t ha⁻¹

| Initial soil test values (kg ha ⁻¹) | | | Yield target – 2.5 t ha ⁻¹ | | | Yield target – 3.0 t ha ⁻¹ | | |
|--|----|-----|---|--------------------------------|-------------------|---|--------------------------------|-------------------|
| | | | NPK (kg ha ⁻¹) + FYM @ 12.5 t ha ⁻¹ + <i>Azospirillum</i> @ 2 kg ha ⁻¹ + PSB @ 2 kg ha ⁻¹ | | | NPK (kg ha ⁻¹) + FYM @ 12.5 t ha ⁻¹ + <i>Azospirillum</i> @ 2 kg ha ⁻¹ + PSB @ 2 kg ha ⁻¹ | | |
| SN | SP | SK | FN | FP ₂ O ₅ | FK ₂ O | FN | FP ₂ O ₅ | FK ₂ O |
| 180 | 10 | 300 | 54 | 20* | 20* | 98 | 30 | 33 |
| 200 | 12 | 340 | 41 | 20* | 20* | 85 | 28 | 23 |
| 220 | 14 | 380 | 40* | 20* | 20* | 73 | 25 | 20* |
| 240 | 16 | 420 | 40* | 20* | 20* | 61 | 22 | 20* |
| 260 | 18 | 460 | 40* | 20* | 20* | 48 | 20* | 20* |

* Maintenance dose

Cotton - Variety (2)

Soil : Red sandy loam (Irugur series)
Target : 2.5 and 3.0 t ha⁻¹

FN = 7.66T-0.43 SN-0.71 ON
FP₂O₅ = 3.22T-3.27 SP-0.87 OP
FK₂O = 5.97T-0.50SK-0.66 OK

| Initial soil test values (kg ha ⁻¹) | | | Yield target – 2.5 t ha ⁻¹ | | | Yield target – 3.0 t ha ⁻¹ | | |
|--|----|-----|---|--------------------------------|-------------------|---|--------------------------------|-------------------|
| | | | NPK (kg ha ⁻¹) + FYM @ 12.5 t ha ⁻¹ + <i>Azospirillum</i> @ 2 kg ha ⁻¹ + PSB @ 2 kg ha ⁻¹ | | | NPK (kg ha ⁻¹) + FYM @ 12.5 t ha ⁻¹ + <i>Azospirillum</i> @ 2 kg ha ⁻¹ + PSB @ 2 kg ha ⁻¹ | | |
| SN | SP | SK | FN | FP ₂ O ₅ | FK ₂ O | FN | FP ₂ O ₅ | FK ₂ O |
| 180 | 10 | 200 | 59 | 20* | 20* | 97 | 32 | 39 |
| 200 | 12 | 220 | 51 | 20* | 20* | 89 | 25 | 29 |
| 220 | 14 | 240 | 42 | 20* | 20* | 80 | 20* | 20* |
| 240 | 16 | 260 | 40* | 20* | 20* | 72 | 20* | 20* |
| 260 | 18 | 280 | 40* | 20* | 20* | 63 | 20* | 20* |

*Maintenance dose

Cotton under Drip fertigation –Bt Hybrid (3)

| | | |
|----------|--|---|
| Soil : | Mixed black calcareous (Perianaickenpalayam series) | FN = 8.51 T-0.40 SN-0.73 ON FP ₂ O ₅ = 4.41T-2.25 SP - 0.75 OP |
| Target : | 3.5 - 4.0 t ha ⁻¹ | FK ₂ O = 6.59T-0.18SK-0.66 OK |

| Initial soil test values (kg ha ⁻¹) | | | Yield target – 3.5 t ha ⁻¹ | | | Yield target – 4.0 t ha ⁻¹ | | |
|--|----|-----|--|--------------------------------|-------------------|---|--------------------------------|-------------------|
| | | | NPK (kg ha ⁻¹) + FYM @ 12.5 t ha ⁻¹ + <i>Azospirillum</i> @ 2 kg ha ⁻¹ + PSB @ 2 kg ha ⁻¹ | | | NPK (kg ha ⁻¹) + FYM @ 12.5 t ha ⁻¹ + <i>Azospirillum</i> @ 2 kg ha ⁻¹ + PSB @ 2 kg ha ⁻¹ | | |
| SN | SP | SK | FN | FP ₂ O ₅ | FK ₂ O | FN | FP ₂ O ₅ | FK ₂ O |
| 200 | 14 | 400 | 163 | 91 | 124 | 205 | 113 | 157 |
| 220 | 16 | 450 | 155 | 86 | 115 | 197 | 108 | 148 |
| 240 | 18 | 500 | 147 | 82 | 106 | 189 | 104 | 139 |
| 260 | 20 | 550 | 139 | 77 | 97 | 181 | 99 | 130 |
| 280 | 22 | 600 | 131 | 73 | 88 | 173 | 95 | 121 |

Note: FN, FP₂O₅ and K₂O are fertilizer N, P₂O₅ and K₂O in kg ha⁻¹, respectively; T is the yield target in q ha⁻¹; SN, SP and SK respectively are available N,P and K in kg ha⁻¹ and ON, OP and OK are the quantities of N, P and K supplied through organic manure in kg ha⁻¹.

Apply 55 kg S as Gypsum basally for a sulphur deficient soil.

- iv) Foliar application of 2% DAP + 1% KCl or polyfeed and Multi k may be sprayed to improve kapas yield
- v) Apply the fertilizers in a band, two-thirds of the distance from the top of the ridge, and incorporate.

1.1.6.APPLICATION OF MICRONUTRIENT MIXTURE

TNAU MN mixture 12.5 kg/ha for variety and 15 kg/ha for hybrid apply as enriched FYM. Enriched FYM is prepared at 1:10 ratio of MN mixture and FYM, mixed at friable moisture and for one month in shade. Need based foliar spray of 2% MgSO₄ + 1% urea during boll formation stage.

Mix 12.5 kg of micronutrient mixture formulated by the Department of Agriculture, Tamil Nadu with enough sand to make a total quantity of 50 kg for one ha.

Yield Maximization and reducing reddening in Bt cotton Irrigated

Application of TNAU MN mixture (12.5 kg ha⁻¹ as Enriched FYM for variety and 15 kg ha⁻¹ as EFYM for Bt cotton) along with the recommended NPK to obtain the maximum seed cotton yield with reduced extent of leaf reddening..

1.1.7. NUTRITIONAL DISORDERS

- In the case of Zinc deficient soils ZnSO₄ @ 50 kg/ha as basal or 0.5% ZnSO₄ spray thrice at 45, 60 and 75 DAS.
- When reddening occurs in leaves apply 0.5% MgSO₄ + 1.0% urea + 0.1% ZnSO₄ foliar spray on 50th and 80th day to correct this malady.
- Need based foliar spray of 2% MgSO₄ + 1.0% urea during boll formation stage to reduce magnesium deficiency.

I. Main Field Operations

1.1.1 Seed Rate

Adopt the following seed rates for different varieties/hybrids

| Varieties / Hybrids | Quantity of seed (Kg/ha) | | |
|------------------------------|--------------------------|----------|-------|
| | With fuzz | Delinted | Naked |
| MCU 5, MCU 7, MCU 12, MCU 13 | 15.00 | 7.50 | .. |
| SVPR 2 | 15.00 | .. | .. |
| KC 2 | 20.00 | 15.00 | .. |
| SUVIN | .. | .. | 6.00 |

1.2.2. SPACING

In a pure crop of cotton, adopt the spacing as below for the different varieties.

| Varieties / hybrids | Spacing (cm) | |
|---|---------------|----------------|
| | Between rows | Between plants |
| MCU 5, MCU 12, MCU 13 LRA 5166, SVPR 2 | 75 | 30 |
| KC 2 | 45 | 15 |
| SUVIN | 90 | 45 |
| MCU 7, SVPR 3 | 60 or 75 * | 30 |

* Fertile soils

- If cotton intercropped with other crops, one paired row of cotton is alternated with three rows of intercrop and the total population of cotton crop is maintained at the same level as in the case of pure crop.
- For intercropping with Greengram / Soybean, complete the sowing and irrigation 20 days prior to cotton sowing on one side of the ridge.

| Varieties/hybrid | Spacing for cotton crop (cm) | | |
|---------------------|-------------------------------|---------------------|----------------|
| | Within Paired row | Between Paired rows | Between plants |
| MCU 5, MCU 12,MCU13 | 60 | 90 | 30 |
| SUVIN | 80 | 100 | 45 |

Plant two rows of intercrop between each paired row of cotton

| Intercrop | Seed rate(kg/ha) | Spacing (cm) | |
|-----------|------------------|--------------|--------|
| | | Rows | Plants |
| Blackgram | 12.5 | 30 | 10 |
| Greengram | 12.5 | 30 | 10 |
| Cowpea | 7.5 | 30 | 20 |
| Soyabean | 20.0 | 30 | 10 |

For higher returns, advance sowing of either greengram or soyabean 20 days before sowing of cotton in winter season.

1.2.3.ACID-DELINTING OF COTTON SEEDS

- i) Choose plastic bucket for acid delinting of seeds.
- ii) Do not use earthen wares, metal vessels, porcelain wares or wooden drum for acid de-linting as concentrated sulphuric acid will corrode them.
- iii) Put the required quantity of seeds in the container and add commercial concentrated sulphuric acid at the rate of 100 ml per kg of fuzzy seed.
- iv) Stir vigorously and continuously with a wooden stick for 2 to 3 minutes till the fuzz sticking to the seeds is completely digested and the seed coat attains a dark brown colour of coffee powder.
- v) Add water to fill the container. Drain the acid water and repeat the washing 4 or 5 times to remove any trace of acid.
- vi) Remove the floating, ill-filled and damaged seeds while retaining the healthy and good seeds which remain at the bottom.
- vii) Drain the water completely and dry the delinted seeds in shade.

Advantages of Acid delinting

- i) Eliminates some externally seed borne pathogenic organisms.
- ii) Kills eggs, larvae and pupae of pink boll worm.
- iii) Helps to remove immature, ill-filled, cut and damaged seeds.
- iv) Makes seed dressing more effective and easy

- v) Facilitates easy sowing and good germination.

1.2.4.1. PRE-TREATMENT OF ACID DELINTED SEEDS WITH FUNGICIDES

- i) Treat the delinted seeds with talc formulation of *Trichoderma viridae* @ 4g/kg of seed or with Carbendazim (or) Thiram @ 2g/kg of seed. Biocontrol agents are compatible with biofertilizers. First treat the seeds with biocontrol agents and then with biofertilizers. Fungicides and biocontrol agents are incompatible.
- ii) Treat the delinted fungicide treated seeds with 3 packets (600 g) of Azospirillum and 3 packets of Phosphobacteria 600g (or) 6 packets of Azophos (1200 g) and sow immediately.

1.2.4.2. SEED HARDENING

Soak the seeds in equal volume of Pungam leaf extract (1%) for 8 hours and dry back to original moisture to increase germination and vigour. Dry the seeds in shade.

Seed pelleting: Seeds coated with arappu leaf powder (100 g/kg) along with DAP (40 g/kg), micronutrient mixture (15 g/kg) and Azospirillum (200 g/kg) Phosphobacteria (200 g/ha) or Azophos (400 g/ha) using 5% maida solution or gruel as adhesive (300 ml/kg) to increase the germination and vigour.

1.2.5. SOWING

- i) Dibble the seeds at a depth of 3-5 cm on the side of the ridge 2/3 height from the top and above the band where fertilisers and insecticides are applied, maintaining the correct spacing and then cover seeds with soil.
- ii) In the case of intercropping, sow the seeds of the intercrop in between the paired rows of cotton in a row of 5 cm apart and cover the seeds.
- iii) Sow the required number of seeds in each hole.

| Varieties / hybrids | No. of seeds / hole | |
|---------------------|---------------------|----------------|
| | Fuzzy seeds | Delinted seeds |
| Hybrids | 2 | 1 |
| Varieties | 3 | 2 |

1.2.6. WEED MANAGEMENT

- i) Apply Pendimethalin @ 1.0 litre/ha three days after sowing or Fluchloralin 1.0 kg a.i /ha on 3DAS + power weeding on 45 DAS followed by earthing up or Trifloxy sulfuron @ 10 g/ha on 15 DAS for broad leaved weeds and sedges. or Pre emergence application of Pendimethalin (38.7% CS) 650 ml/ha. Sufficient moisture should be present in the soil at the time of herbicide application. This will ensure weed free condition upto 40 days.
- ii) One hand weeding on 45 DAS will keep weed free environment upto 60 DAS.
- iii) Hoe and hand weed between 18th to 20th day of sowing, if herbicide is not applied at the time of sowing.

1.2.7. GAP FILLING

- a. Take up gap filling on the 10th day of sowing.
 - i) In the case of TCHB 213, raise seedlings in polythene bags of size 15 x 10 cm.
 - ii) Fill the polythene bags with a mixture of FYM and soil in the ratio of 1:3.
 - iii) Dibble one seed per bag on the same day when sowing is taken up in the field.
 - iv) Pot water and maintain.
 - v) On the 10th day of sowing, plant seedlings maintained in the polythene bags, one in each of the gaps in the field by cutting open the polythene bag and planting the seedling along with the soil intact and then pot water.
- b. In the case of all other varieties, dibble 3 to 4 seeds in each gap and pot water.

1.2.8. THINNING

Thin out the seedlings on the 15th day of sowing. In the case of fertile soils, allow only one seedling per hole, whereas in poor soil allow two seedlings per hole.

1.2.9. TOP DRESSING

- iv) Top dress 50% of the recommended dose of N and K on 40 – 45 DAS for varieties.
- v) Top dress 1/3rd of recommended dose of N on 40-45 DAS and the remaining 1/3rd on 60- 65th DAS for hybrids.

1.2.10. RECTIFICATION OF RIDGES AND FURROWS

Reform the ridges and furrows after first top dressing in such a way that the plants are on the top of the ridges and well supported by soil.

1.2.11. SPRAYING OF NAPHTHALENE ACETIC ACID (NAA)

Spray 40 ppm NAA at 60 and 90 days after sowing on the crop to prevent early shedding of buds and squares and to increase the yield.

NOTE: 40 mg of NAA dissolved in one litre of water will give 40 ppm.

1.2.12. MANAGEMENT STRATEGIES FOR DELAYED SUMMER IRRIGATED COTTON SOWING

KCl 1% spray, twice on 50 and 70 DAS for delayed sowing (first fortnight of March) of summer irrigated cotton in rice-cotton cropping system for Srivilliputhur region.

1.2.13. ARRESTING TERMINAL GROWTH

Nip the terminal portion of the main stem as indicated below:

For varieties having less than 160 days duration nip the terminal portion of the main stem beyond the 15th node (75 to 80 DAS) and for varieties and hybrids having more than 160 days duration beyond the 20th node (85 - 90 DAS).

II. WATER MANAGEMENT

Regulate irrigation according to the following growth phases of the crop.

| Stages | No. of Irrigations | Days after dibbling seeds | |
|--|--------------------|---|---|
| | | Light soil | Heavy soil |
| Germination Phase (1-15 days) | | | |
| Irrigate for germination and establishment | 1 | Immediately after sowing | Immediately after sowing |
| | 2 | Give a life irrigation on 5 th day of sowing to facilitate the seedlings to emerge out | Give a life irrigation on 5 th day of sowing to facilitate the seedlings to emerge out |
| Vegetative phase (16-44 days) | | | |
| Regulate | 1 | Irrigate on the 20 th or 21 st day of sowing, Three days after hoeing and weeding | Irrigate on the 20 th or 21 st day of sowing, three days after hoeing and weeding |
| | 2 | Irrigate again on the 35 th or 36 th day of sowing | Irrigate again on the 40 th day of Sowing |
| Flowering phase (45-100 days for hybrids and 87 days for varieties) | | | |
| Irrigate copiously | 1 | 48 th day | 55 th day |
| | 2 | 60 th day | 70 th day |
| | 3 | 72 nd day | 85 th day |
| | 4 | 84 th day | 100 th day |
| | 5 | 96 th day | ** |

| Maturity phase (beyond 100 days for hybrids and 88 days for varieties) | For all varieties other than Suvin | | |
|---|---|-----------------------|-----------------------|
| | Control irrigation during maturity phase | 1 | 108 th day |
| 2 | | 120 th day | 130 th day |
| 3 | | 130 th day | |
| 4 | | 144 th day | |
| Stop Irrigation after 150 th day For Suvin | | | |
| | 1 | 108 th day | 115 th day |
| | 2 | 120 th day | 130 th day |
| | 3 | 132 nd day | 145 th day |
| | 4 | 144 th day | 160 th day |
| | 5 | 158 th day | ... |
| Stop irrigation after 160 th day | | | |
| NOTE: i. | <i>If irrigation is given on climatological approach, Schedule the irrigation at 0.40 and 0.60 IW/CPE ratio during vegetative and reproductive phases respectively.</i> | | |
| ii) | <i>The irrigation schedule given above is only a guideline and regulate the irrigation depending upon the prevailing weather condition and receipt of rains.</i> | | |
| iii) | <i>Adopt alternate furrow or skip furrow irrigation to save irrigation water.</i> | | |

The features of the methods are furnished below:

Skip furrow irrigation

- a) Suited to heavy soils like clay and loam
- b) Alternate furrows should be skipped and may be converted to ridges having a wide bed formation.
- c) Short term crops like pulses may be raised in wider bed without exclusive irrigation.
- d) Water saving is 50% when compared to control.

Alternate furrow irrigation

- a) During any one run of irrigation a particular set of alternate furrows is irrigated.
- b) The interval of irrigation should be shortened when compared to the conventional furrows.
- c) During the next run, the left over furrows be irrigated.
- d) Suited to heavy soils like clay and loam.

III. HARVESTING

- a) Harvest at frequent intervals, at less than 7 days interval.
- b) Harvest in the morning hours upto 10 to 11 a.m only when there is moisture so that dry leaves and bracts do not stick to the kapas and lower the market value.
- c) Pick kapas from well burst bolls only.
- d) Remove only the kapas from the bolls and leave the bracts on the plants.
- e) After kapas is picked, sort out good puffy ones and keep separately.
- f) Keep stained, discoloured and insect attacked kapas separately.

NOTE: Do not mix stained, discoloured and insect damaged kapas with good kapas, as they will spoil the good kapas also and lower the market value of the produce.

IV. POST HARVEST OPERATIONS

- 1) Immediately after picking, dry the kapas in shade. If it is not dried immediately the colour will change which will lower the market value.
- 2) Do not dry the kapas under direct sun as the fibre strength and luster will be lost.
- 3) Grade the kapas into good and second quality ones, if it is not sorted out at the time of picking.
- 4) Spread a thin layer of dry sand on the ground and keep the kapas over it.

2. RICE FALLOW COTTON

2.1. PREPARATION OF THE FIELD

- i) If the soil is in waxy condition, instead of Zero tillage, the seed rows may be tilled and the seed dibbled in Virudhunagar district.
- ii) If the soil is dry and not in condition to take up sowing, let in water and then allow the soil to dry till soil comes to waxy condition.
- iii) At the lower level of the field dig a trench 15 cm wide and connect this trench to the outside channel to drain off the excess water.

2.2. PRE-TREATMENT OF ACID DE-LINTED SEEDS WITH FUNGICIDES

- iv) Same as for the irrigated crop.
- v) Treat the acid delinted and fungicide treated seeds with 3 packets (600g) of Azospirillum and sow immediately.

2.3. SOWING THE SEEDS

| Particulars | Varieties | |
|---------------------------|-----------|-----------|
| | MCU 7 | SVPR 3 |
| a) Seed rate (kg/ha) | | |
| i) Fuzzy seed | 15.0 | 15 |
| ii) Acid delinted | 7.5 | 7.5 |
| b) Spacing (cm) | | |
| i) Between rows | 60 | 60 or 75* |
| ii) Between plants | 30 | 30 |
| c) Number of seeds / hole | | |
| i) Fuzzy seeds | 4 | 4 |
| ii) Acid delinted | 2 | 2 |
| d) Depth of sowing (cm) | 3 | 3 |

* In fertile soils

2.4. FILLING UP GAPS

- vi) Fill up gaps on the 10th day of sowing.
- vii) Dibble 2 to 3 acid delinted seeds or 4 to 5 fuzzy seeds in the gaps in the case of MCU 7 and SVPR 3

2.5. THINNING SEEDLINGS

- viii) Thin out seedlings on the 20th day of sowing
- ix) Leave only one healthy and vigorous seedling per hill.

2.6. WEED MANAGEMENT

- i) Pre-emergence application of Pendimethalin 1.0 litre/ha ensures weed free condition for 40 - 45 days. This should be followed by one hand weeding and earthing up during 40 - 45 days.
- ii) Take up hoeing and weeding 20 days after sowing.
- iii) Take up this operation when the top soil dries up and comes to proper condition.

2.7. APPLICATION OF FERTILIZERS

- a) Apply NPK fertilisers as per soil test recommendations. If soil test is not done follow the blanket recommendation of 60:30:30 kg NPK/ha.
- b) Apply half the dose of N and K full dose of P₂O₅ at 35th day in old delta and balance in 55 days the rows of cotton plants. In the case New delta apply full P and 1/3 of N and K at 20 DAS and 2/3 N and K at 40 DAS.

2.8. APPLICATION OF MICRONUTRIENTS

Apply basally 12.5 kg/ha micronutrient mixture prepared by Department of Agriculture. Apply $MgSO_4$ basally @ 30 kg/ha to prevent reddening.

2.9. FORMATION OF RIDGES

Old delta

- If soil is in condition, give a hoeing with mammutti and form ridges and incorporate the fertilizer in the soil around the plants between 30th to 35th day of sowing.
- If soil is not in condition, give one hoeing and weeding and cover the fertilizers.
- Form long ridges and furrows from one end of the field to the other without forming any separate channels for carrying water to prevent excessive soaking of water.
- Form ridges and furrows on alternate rows of plants. Skip furrow method of irrigation to prevent excessive irrigation

New delta

- Give a hoeing with mummutti and form ridges and incorporate the fertilizer in the soil around the plants on the 40th day of sowing.
- If soil is not in condition give one hoeing and weeding and cover the fertilizers.
- Form long ridges & furrows on alternate rows of plants to adopt skip furrow irrigation.

Note: In case of zinc deficient soils, apply 50 kg $ZnSO_4$ /ha

2.10. APPLYING OF NAA

Spray 40 ppm of NAA (40 mg of NAA dissolved in one litre of water) at 40/45th day using high volume spray. Repeat the same dose after 15 days of first spraying.

2.11. TOPPING

Arrest terminal growth by nipping the terminal 15th node for controlling excessive vegetative growth. (70-75 DAS)

2.12. WATER MANAGEMENT

Regulate irrigation according to the growth phases of the crops.

| Stages | No. of Irrigations | Days after dibbling seeds | |
|--|--------------------|--|---|
| | | Old delta | New delta |
| 1. Vegetative Phase | 1 | | |
| Regulate irrigation during the germination phase | | One wetting on the 30th to 35th day of sowing after the application of fertilisers | One irrigation on the 20th day after the application of fertilisers |

| | | | |
|----------------------------|----|---|---|
| | 2 | ... | One irrigation on the 40 th day after the application of N |
| 2. Flowering Phase | | | |
| Irrigate more frequently 1 | | 45 th day of sowing after the application of 2 nd dose of N | 45 th day |
| | 2 | 55 th day | 51 st day |
| | 3 | 65 th day | 56 th day |
| | 4 | 75 th day | 61 st day |
| | 5 | 85 th day | 66 th day |
| | 6 | ... | 71 st day |
| | 7 | ... | 76 th day |
| | 8 | ... | 81 st day |
| | 9 | ... | 86 th day |
| | 10 | ... | 91 st day |
| 3. Control | 1 | 99 th day | 98 th day |
| Irrigation during | 2 | 113 th day | 105 th day |
| maturity phase | 3 | ... | 112 th day |

Stop irrigation from the 113th day onwards.

Note: 1) The irrigation schedule given above is only a guideline and regulate irrigation depending upon the prevailing weather conditions and receipt of rains.

2) Observe the crop and if the plants show wilting symptoms in the afternoon and in the evening hours, give an additional irrigation.

2.13. Harvesting and Post Harvest Operations

As that of irrigated Cotton

2.14. Pest and Disease Management

As that of irrigated Cotton

3. RAINFED COTTON

Follow water harvesting techniques and raise a successful crop of cotton.

3.1. SEASON AND VARIETIES

For Thirumangalam in Madurai district, Sattur in Virudhunagar district and parts of Kovilpatti in Thoothukudi district, where the seasonal rainfall is 375 mm and most of it is received during September or first week of October. Select LRA 5166 (or) SVPR 2 (or) KC 2, KC 3.

In places, where rains are received during October or November, Select K 11 for Ramanathapuram, Virudhunagar, Tirunelveli and Thoothukudi districts.

3.2. PREPARATION OF LAND

3.2.1. PREPARATION OF THE FIELD

- i) Start preparation of the land immediately after harvest of the previous crop.
- ii) Adopt permanent broad ridges system.

3.2.2. APPLICATION OF FYM OR COMPOST

- i) Spread 12.5 t of FYM or compost or composted coir pith or 2.5 t of vermicompost per ha uniformly on the unploughed soil.
- ii) Incorporate the manure in the soil by working the multipurpose implement or country plough.
- iii) Apply TNAU MN mixture @ 7.5 by as enriched FYM.

3.2.3. APPLICATION OF INORGANIC FERTILIZERS

- a) Apply NPK fertilizers as per soil test recommendation as far as possible.
- b) If soil tests are not done, follow the blanket recommendations for the different varieties.

| Varieties | Quantity of fertilizers (Kg/ha) | | |
|-----------|---------------------------------|-------------------------------|------------------|
| | N | P ₂ O ₅ | K ₂ O |
| K 11 | 20 | 0 | 0 |
| SVPR 2 | 40 | 20 | 40 |
| KC 2 | 40 | 20 | 40 |

Soil test crop response based integrated plant nutrition system (STCR- IPNS) recommendation may be adopted for prescribing fertilizer doses for specified yield targets. (ready reckoners are furnished)

3.2.5 SEEDS AND SOWING

iii) Adopt the following seed rates for different varieties/hybrids.

| Varieties | Quantity of seeds (kg/ha) | |
|------------------|---------------------------|----------------|
| | Fuzzy seeds | Delinted seeds |
| K 11 | 20 | .. |
| LRA 5166, SVPR 2 | 20 | 15 |

Note: Delint only LRA 5166 and SVPR 2 seeds. Do not delint seeds of K 11

- i) In the case of mixed crop of cotton, maintaining the same seed rates as for a pure crop and adopt the following seed rate for the pulses crop.
Blackgram/greengram 10 kg/ha Cowpea 7.5 kg/ha

3.2.6. SPACING

- i) In the case of pure crop of varieties/hybrids, a spacing of 45 cm between rows and 15 cm between plants may be adopted.
- ii) In the case of cotton, intercropped with pulses, one paired row of cotton is alternated with two rows of pulses and the total population of cotton crop is maintained at the same line as that for a pure crop of cotton.
- iii) Adopt a spacing of 30 x 10 cm for the pulse crop in between each paired row of cotton. APK 1 Blackgram is best suited for this situation.

3.2.7. ACID DELINTING

Adopt procedure for acid delinting as for an irrigated crop.

3.2.8. PRETREATMENT OF ACID DELINTED SEEDS WITH FUNGICIDES

Same as for the irrigated crop.

3.2.9. SOWING

- i) Use the multipurpose farming implement to sow the seeds and to apply basal fertilizers simultaneously.
- ii) Fill the hopper in the implement with the fertilizer mixtures and work the implement.
- iii) Engage 3 persons for dropping the seeds, 2 for cotton and one for pulses.

In one operation, placement of fertilizer, sowing of seeds and covering will be completed.

NOTE: Cotton and pulses can be sown at a depth of 5 cm in black cotton soil even before the onset of monsoon rains in dry bed sowing. When light rains are received, the moisture will not penetrate deeper and the seeds will not germinate and die away. Only when good rains are received, the moisture level will be sufficient to penetrate to the level of the seed and facilitate germination and proper establishment.

3.2.10. WEED MANAGEMENT

- i) Pre-emergence application of Pendimethalin (38.7% CS) 650 ml/ha followed by one hand weeding on 40 days after crop emergence. At the time of herbicide application sufficient soil moisture must be there.
- ii) If sufficient soil moisture is not available for applying herbicides hand weeding may be given at 10 - 20 days after crop emergence.
- iii) Integrated weed management in cotton: Post emergence application of Pyriithiobac sodium @ 62.5g a.i./ha + Quizalofop ethyl @ 50 g a.i./ha at 2 to 4 leaf stage or 45 DAS.

3.2.11. GAP FILLING

Dibble 3 to 4 seeds in each gap if sufficient moisture is available.

3.2.12. THINNING SEEDLINGS

- i) Allow two seedlings per hole and thin out on 15th day of sowing, adopting proper spacing between plants.
- ii) Thin the pulse crop on the 20th day of sowing, adopting a spacing of 15 cm between plants for cowpea and 10 cm for other pulse crop.

3.2.13. FOLIAR FERTILIZATION

Spray 0.5% urea and 1% KCl on the 45th and 65th day of sowing if sufficient moisture is available.

In site water harvesting and crop resident addition for rainfed cotton in black soil.

Broad Bed Furrow (BBF) system with coirpith application @ 5 t/ha for higher soil moisture retention, seed cotton yield and enhanced the carbon storage under vermisols.

3.2.14. INTERCULTIVATION WITH DHANTHULU/BLADE HARROW

Work dhanthulu or blade harrow on the 30th and 45th day of sowing.

NOTE: Other cultivation practices, plant protection measures, harvest etc., are the same as for the irrigated crop.

A. CROP PHYSIOLOGY

Foliar spray of TNAU Cotton Plus @ 2.5 kg/acre in 200 litres of water at flowering and at boll formation stages reduces flower and square shedding, improves boll bursting, increases seed cotton yield and imparts drought tolerance.

B. CROP PROTECTION

PEST MANAGEMENT

- Remove the cotton crop and dispose off the crop residues as soon as harvest is over.
- Avoid stacking of stalks in the field.
- Avoid ratoon and double cotton crop.
- Adopt proper crop rotation.
- Use optimum irrigation and fertilizers.
- Grow one variety throughout the village as far as possible.
- Treat the seeds with imidacloprid or use designer seed (Delinted seed + polykote @ 3g / kg + Carbendazim @ 2 g / kg + Imidacloprid @ 7 g / kg + *Pseudomonas fluorescens* 10 g / kg + Azophos 40 g / kg). When the treated seeds are used, it protects against sucking pests upto 45 days after sowing and promotes early vigour of the crop.
- Synchronize the sowing time in the villages and complete the sowing within 10 to 15 days.
- Avoid other malvaceous crops in the vicinity of cotton crop.
- Timely earthing up and other agronomic practices should be done.
- Hand pick and burn periodically egg masses, visible larvae, affected and dropped squares, flowers and fruits and squash pink bollworm in the rosettes.
- Use locally fabricated light traps (modified Robinson type) with 125W mercury lamps to determine the prevalence and insect population fluctuations.
- The magnitude of the activity of the moths of the cotton Pink bollworm, Tobacco cutworm (*Spodoptera litura*) and the American bollworm can be assessed by setting up the species-specific sex pheromone trap each at the rate of 12 per ha.
- Apply insecticides only where it is absolutely necessary when pest population or damage reaches ET level.
- Intercropping with pulses viz., Cowpea, Greengram, Blackgram, Soybean and Maize reduces the bollworm incidence and population of sucking pests of Cotton, viz., Aphid and leafhopper with the highest activity of natural enemies viz., spiders and predatory lady bird beetles.

Economic threshold level for important pests

| Pest | ETL |
|--------------------|---------------------------------------|
| Thrips | 50 nymphs or adults / 50 leaves |
| Aphids | 15% of infested plant |
| Leafhopper | 50 nymphs or adults / 50 leaves |
| Mite | 10 mites / cm ² leaf area |
| Boll-worms | |
| Spotted | 10% infested shoots / squares / bolls |
| Spiny | 10% infested shoots / squares / bolls |
| Pink | 10% infested fruiting parts |
| <i>Helicoverpa</i> | One egg or one larva / plant |
| Whiteflies | 5-10 / leaf |
| Stem weevil | 10% infestation |
| Tobacco cutworm | 8 egg masses / 100 m row |

| | |
|---|--|
| <p>American bollworm <i>Helicoverpa armigera</i></p> | <p>Monitoring: Pest monitoring through light traps, pheromone traps and <i>in situ</i> assessments by roving and fixed plot surveys has to be intensified at farm, village, block, regional and State levels. For management, an action threshold of one egg per plant or 1 larva per plant may be adopted.</p> <p>Cultural practices:</p> <ul style="list-style-type: none"> • Synchronized sowing of cotton preferably with short duration varieties in each cotton ecosystem. • Avoid continuous cropping of cotton both during winter and summer seasons in the same area as well as rationing. • Avoid monocropping. Growing Soyabean of less preferred crops like Greengram, Blackgram, Soyabean, Castor, sorghum etc., along with the cotton as intercrop or border crop or alternate crop to reduce the pest infestation. • Removal and destruction of crop residues to avoid carry over of the pest to the next season, and avoiding extended period of crop growth by continuous irrigation. • Optimizing the use of nitrogenous fertilizers which will not favour the multiplication of the pest. • Judicious water management for the crop to prevent excessive vegetative growth and larval harbourage. |
|---|--|

Biological control:

- Application of Nuclear Polyhedrosis Virus (NPV) at 3×10^{12} POB / ha in evening hours at 7th and 12th week after sowing.
- Conservation and augmentation of natural predators and parasitoids for effective control of the pest.
- Inundative release of egg parasitoid, *Trichogramma* spp., at 6.25 cc / ha at 15 days interval 3 times from 45 days after sowing
- Egg- larval parasitoid, *Chelonus blackburnii* and predator, *Chrysoperla carnea* at 1,00,000 / ha at 6th, 13th and 14th week after sowing.
- ULV spray of NPV at 3×10^{12} POB / ha with 10% cotton seed kernel extract, 10% crude sugar, 0.1% each of Tinopal and Teepol for effective control of *Helicoverpa*.

Note: Dicofol, Methyl demeton and Monocrotophos are comparatively safer to *Chrysoperla* larva recording low egg mortality.

Chemical control :

- Discourage the indiscriminate use of insecticides, particularly synthetic pyrethroids.
- Use of proper insecticides which are comparatively safer to natural enemies at the correct dosage and alternating different groups of insecticides for each round of spray.
- Avoid combination of insecticides as tank mix.
- Adopt proper delivery system using spraying equipments like hand compression sprayer, knapsack sprayer and mist blower to ensure proper coverage with required quantity of spray fluid and avoid ULV applications or Akela spray applications.
- Proper mixing and preparation of spray fluid for each filling of spray fluid tank.

At early stages of square formation apply one of the following insecticides

Acephate 75% SP 780g/ha

Azadirachtin 0.03% EC 2500ml/ha

Chlorpyrifos 20% EC 1250ml/ha

Diflubenzuron 25% WP 300 - 350g/ha

Emamectin benzoate 5% SG 190-220g/ha

Fipronil 5% SC 2000ml/ha

Flubendiamide 20% WG 250g/ha

Flubendiamide 39.35% SC 100-125ml/ha

| | |
|--|---|
| | <p>Indoxacarb 14.5% SC 500ml/ha Novaluron 10%EC 1000ml/ha NPV of <i>H. armigera</i> 0.43%AS 400-600ml/ha Profenofos 50% EC 1500-2000ml/ha Pyridalyl 10% EC 750-1000ml/ha Chlorantraniliprole 18.5% SC @150 ml/ha Lufenuron 5.4% EC @600 ml/ha Spinosad 45.0% SC 165-220ml/ha Thiodicarb 75%WP 1000g/ha Monocrotophos 36% SL @1125-2250 ml/ha</p> <p>Biological control: <i>Bacillus thuringiensis</i>-k750-1000g/ha <i>Bacillus thuringiensis</i> var. kurstaki (3a,3b,3c) 5%WP 750-1000g/ha <i>Beauveria bassiana</i> 1.15%WP 400g/ha</p> |
| <p>Spotted bollworm <i>Earias vitella</i>; <i>E. insulana</i></p> | <p>Spraying any one of the following insecticides Flubendiamide 39.35%SC100-125ml/ha Chlorantraniliprole 18.5% SC @150 ml/ha Indoxacarb 14.5%SC 500ml/ha Diflubenzuron 25%WP 300-350g/ha Profenophos 50%EC 1500-2000ml/ha Fipronil 5% SC 2000ml/ha Spinetoram 11.7 % SC @420-470 ml/ha</p> <p>Biological control: <i>Bacillus thuringiensis</i> var kurstaki (3a,3b,3c) 5%WP 750-1000g / ha</p> |
| <p>Pink boll worm <i>Pectinophora gossypiella</i></p> | <ul style="list-style-type: none"> • Use pheromone traps to monitor the adult moth activity @ 12 / ha • Inundative release of egg parasitoid <i>Trichogrammatoidea bactrae</i> @ 40,000 / ha at 15 days interval 3 times from 45 days after sowing with coinciding the incidence of the pest. <p>Spraying any one of the following insecticides: Emamectin Benzoate 5% SG 190 – 220 g/ha Chlorpyriphos 50% EC 1000 – 1200 ml / ha Profenofos 50%EC 1500 – 2000ml/ha Diflubenzuron 25%WP 300-350g/ha Thiodicarb 75% WP 1000 g /ha</p> |
| <p>Tobacco cutworm <i>Spodoptera litura</i></p> | <ul style="list-style-type: none"> ➤ Use of light trap to monitor and kill the attracted adult moths. ➤ Set up the sex pheromone trap at 12/ha to monitor the activity of the pest and to synchronize the pesticide application, if need be, at the maximum activity stage. |

| | |
|--|---|
| | <ul style="list-style-type: none"> ➤ Growing castor along border and irrigation bunds. ➤ Removal and destruction of egg masses in castor and cotton crops. ➤ Removal and destruction of early stage larvae found in clusters which can be located easily even from a distance. ➤ Collection and destruction of shed materials. ➤ Hand picking and destruction of grownup caterpillars. <p>Spray any one of the following insecticides</p> <p>Chlorpyrifos 20 EC 3750 ml/ha Diflubenzuron 25%WP 300-350g/ha Chlorantraniliprole 18.5% SC @150 ml/ha Spinetoram 11.7 % SC @420-470 ml/ha</p> <ul style="list-style-type: none"> ➤ Spraying of insecticides should be done either in the early morning or in the evening. ➤ Spraying nuclear polyhedrosis virus at 1.5×10^{12} POB per ha. |
| <p>Stem weevil <i>Pempherulus affinis</i></p> | <ul style="list-style-type: none"> • Basal application of FYM 25 t/ha and 250 kg/ha of neem cake. • Seed treatment with Chlorpyrifos 20EC @ 10ml/kg of seed + Drenching collar region with Chlorpyrifos 50 EC @ 1200 ml/ha on 15 and 30 days after sowing + Earthing up. |
| <p>Whitefly <i>Bemisia tabaci</i></p> | <ul style="list-style-type: none"> • Avoid alternate or cultivate host crops of the whitefly in the vicinity of cotton crop. • Growing cotton only once a year either in winter or in summer season in any cotton tract. • Adopting crop rotation with non-preferred hosts such as Sorghum, Ragi, Maize, etc., for the whitefly to check the buildup of the pest. • Removal and destruction of alternate weed hosts like <i>Abutilon indicum</i>, <i>Chrozophore Rottlari</i>, <i>Solanum nigrum</i> and <i>Hibiscus ficulensus</i> from the fields and neighbouring areas and maintaining field sanitation. • Timely sowing with recommended spacing, preferably wider spacing and judicious application of recommended dose of fertilizers, particularly nitrogenous and irrigation management is essential to arrest the excessive vegetative growth and pest build up. Late sowing may be avoided and the crop growth should not be extended beyond its normal duration. |

- Field sanitation may be given proper attention.
- Cultivation of most preferred alternate host crops like Brinjal, Bhendi, Tomato, Tobacco and Sunflower may be avoided. In case their cultivation is unavoidable, plant protection measures should be extended to these crops also.
- Monitoring the activities of the adult white flies by setting up yellow pan traps and sticky traps at 1 foot height above the plant canopy and also in situ counts.
- Collection and removal of white fly infested leaves from the plants and those which were shed due to the attack of the pest and destroying them.

Chemical control:

Acetamiprid 20%SP 100g/ha

Azadirachtin 0.15% 2500-5000ml/ha

Buprofezin 25% SC 1000ml/ha

Chlorpyrifos 20%EC 1250ml/ha

Clothianidin 50%WDG 200-250 g/ha(Soil drenching)

Clothianidin 50%WDG 40-50 g/ha (Foliar spray)

Diafenthiuron 50%WP 600g/ha

Dinotefuran 20% SG 150 g/ha

Fipronil 5%SC 1500-2000 ml/ha

Flonicamid 50% WG @ 150 g/ha

Imidacloprid 17.8% SL 100-125 ml/ha

Profenophos 50%EC 1000 ml/ha

Thiacloprid 21.7%SC 500- 600ml/ha

Thiamethoxam 30% FS @10 g/Kg seed (Seed dresser)

Thiamethoxam 70% WS @430 gm/ha

Thiamethoxam 25%WG 200 g/ha

Pyriproxyfen 10% EC @ 500- 700 ml/ha

Spiromesifen 22.9% SC @600 ml/ha

Spray any one of the following plant products alone or in combination with the recommended dose of insecticide

Neem seed kernel extract 5% or Neem oil at 5 ml/l of water

Fish oil rosin soap 25g / lit of water

Notchi leaves 5% extract

Catharanthus rosea extract 5%

Spray any one of the following in early stage (500l) mid and late stages (1000l spray liquid/ha)

In the early stages with high volume sprayer, use a goose neck nozzle to cover the under surface of the foliage to get

| | |
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| | <p>good control of the pest. If high volume sprayers are not available, 375 litres of spray fluid may be used per hectare for application in the low volume motorized knapsack mist blower.</p> <ul style="list-style-type: none"> • The use of synthetic pyrethroids should be discouraged in cotton to avoid the problem of white fly. Cypermethrin, fenvalerte and deltamethrin cause resurgence of whiteflies. So avoid repeated spraying of pyrethroids. • The plant protection measures should be adopted on a community basis in specified cotton areas. <p>Biological control:</p> <ul style="list-style-type: none"> • <i>Verticillium lecanii</i> 1.15%WP 2500g/ha |
| <p>Thrips <i>Thrips tabaci</i></p> | <ul style="list-style-type: none"> • Seed treatment with imidacloprid 70WS at 7g / kg protect the crop from aphids, leafhoppers and thrips upto 8 weeks. <p>Spray any one of the following insecticides (500l spray fluid/ha)</p> <ul style="list-style-type: none"> Methyl demeton 25EC 500ml/ha Dimethoate 30EC 500ml/ha Buprofezin 25%SC 1000ml/ha Diafenthiuron 50%WP 600g/ha Clothianidin 50%WDG 200-250 g/ha (Soil drenching) Dinotefuran 20% SG 150 g/ha Fipronil5% SC 1500-2000ml/ha Flonicamid 50% WG @ 150 g/ha Imidacloprid 70%WG 30-35g/ha Imidacloprid 48%FS/100 kg seed 500-900g/ha Imidacloprid 17.8%SL 100-125ml/ha Profenophos 50% EC 1000ml/ha Thiacloprid 21.7% SC 100-125ml/ha Thiamethoxam 70% FS 430 g/ha Thiamethoxam 25%WG 100 g/ha Spinetoram 11.7 % SC @420-470 ml/ha |

| | |
|--|--|
| <p>Aphids <i>Aphis gossypii</i></p> | <p>Seed treatment with imidacloprid 70WS at 7g / kg protect the crop from aphids, leafhoppers and thrips upto 8 weeks.</p> <p>Spray any one of the following insecticides</p> <p>Acetamiprid 20%SP 50g/ha Azadirachtin 0.03%EC 2500ml/ha Buprofezin 25%SC 1000ml/ha Clothianidin 50%WDG 200-250 g/ha(Soil drenching) Carbosulfan 25% DS 60g/kg seed Chlorpyrifos 20% EC 1250ml/ha Diafenthiuron 50%WP 600ml/ha Dinotefuran 20% SG 150 g/ha Fipronil 5% SC 1500-2000 ml/ha Flonicamid 50% WG @ 150 g/ha Imidacloprid 70% WG 30-35kg/ha Imidacloprid 17.8% SL 100-125ml/ha Malathion 50% EC 1000ml/ha Profenophos 50% EC 1000ml/ha Thiacloprid 21.7%SC 100-125ml/ha Thiamethoxam 25%WG100 g/ha Thiamethoxam 70% WS @430 gm/ha Thiamethoxam 30% FS @10 g/Kg seed (Seed dresser)</p> |
| <p>Leaf hopper <i>Amrasca devastans</i></p> | <p>Spray any one of the following insecticides</p> <p>Imidacloprid 200SL at 100ml/ha Imidacloprid 70% WG @30-35 g/ha Imidacloprid 17.8% SL @ 100 – 125 ml/ha Acetamiprid 20%SP 50g/ha Azadirachtin 0.03%WSP 2500- 5000g/ha Buprofezin 25%SC 1000ml/ha Clothianidin 50%WDG 30- 40 kg/ha (Foliar spray) Clothianidin 50%WDG 200-250 g/ha(Soil drenching) Diafenthiuron 50%WP 600g/ha Dinotefuran 20% SG 150 g/ha Fipronil 5%SC 1500-2000ml/ha Profenophos 50%EC 1000ml/ha Thiacloprid 21.7%SC 100-125ml/ha Flonicamid 50% WG @ 150 g/ha Thiamethoxam 25%WG 100g/ha Thiamethoxam 30% FS @10 g/Kg seed (Seed dresser) Thiamethoxam 70% WS @430 gm/ha NSKE 5% 25kg/ha</p> |

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| | <ul style="list-style-type: none"> Where the leaf hopper is a big menace, apply Neem oil formulation 0.5% or neem oil 3% thrice at fortnightly intervals. |
| Cotton mealy bug <i>Phenacoccus solenopsis</i> | <ul style="list-style-type: none"> Remove the alternate Weed hosts. Monitor the incidence regularly and look for crawler emergence. Take up the management at initial stage to get maximum control. Use of encyrtid parasitoids, <i>Acerophagus papayae</i> @ 100 per village against <i>Paracoccus marginatus</i> and <i>Aenasius bambawaeli</i> against <i>Phenacoccus solenopsis</i> are recommended. (Consult the specialists for effective chemicals for individual species). Wherever necessary use botanical insecticides like neem derivatives such as neem oil 2%, NSKE 5% and Fish oil rosin soap 25 g/lit. of water. Use of profenophos @ 2000 ml / ha may be adopted as an alternative |
| Yellow mite <i>Polyphagotarsonemus latus</i> | Spiromesifen 22.9% SC 600 ml/ha |
| Red spider mite <i>Tetranychus cinnabarinus</i> | Spray Spiromesifen 22.9% SC 600 ml/ha or Dicofol 18.5% EC @ 2700ml/500 lit. of water |

Pest management strategies

Resurgence

Repeated application of the following insecticides can cause resurgence of the insect pest of cotton

- Amrasca devastans* : Deltamethrin
- Aphis gossypii* : Cypermethrin, deltamethrin, fenvalerate, monocrotophos
- Bemisia tabaci* : Cypermethrin, deltamethrin, fenvalerate, monocrotophos
- Ferrisia virgata* : Cypermethrin, deltamethrin, fenvalerate, permethrin
- Tetranychus urticae* : Acephate, fenvalerate

Disease Management

| Name of the disease | Recommendations |
|--|--|
| Bacterial leaf blight: <i>Xanthomonas axonopodis</i> <i>pv. malvacearum</i> | <ul style="list-style-type: none"> Avoid stacking of infected plants Spray <i>streptomycin sulphate</i> @ 300 ppm + copper oxychloride @ 2.0 kg/ha immediately after the symptom appearance and repeat at 10 days later. |

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| <p>Alternaria leaf spot: <i>Alternaria macrospora</i></p> | <p>Spray any one of the following fungicides / biocontrol agent</p> <ul style="list-style-type: none"> • Copper oxychloride @ 2 kg or Mancozeb @ 1 kg or Chlorothalonil @ 500 g/ha or Difenaconazole @ 0.05% or Krexoxym methyl @ 0.1% or tebuconazole @ 1 ml/l or Trifloxystrobin +Tebuconazole @ 0.6 g/l or Propiconazole @ 1 ml/l or Metiram 55% + Pyraclostrobin 5% WG @ 0.1% at 60, 90 and 120 days after sowing. • <i>Bacillus subtilis</i> (BSC5) @ 0.04% on 60, 90 and 120 days after sowing can also be applied. |
| <p>Grey mildew: <i>Ramularia areola</i></p> | <p>Spray any one of the following fungicides</p> <ul style="list-style-type: none"> • Carbendazim @ 250 g/ha or Mancozeb @ 1000g or chlorothalonil @ 500 g/ha or Difenaconazole @ 0.05% or Krexoxym methyl @ 0.1% or Tebuconazole @ 1ml/l or Propiconazole @ 1ml/l or Metiram 55% + Pyraclostrobin 5% WG @ 0.1% at 60, 90 and 120 days after sowing. |
| <p>Boll rot: <i>Fusarium moniliforme</i>, <i>Colletotrichum capsici</i>, <i>Aspergillus flavus</i>, <i>A. niger</i>, <i>Rhizopus nigricans</i>, <i>Nematospora</i>, <i>Botryodiplodia</i></p> | <p>Spray any one of the following fungicides</p> <ul style="list-style-type: none"> • Carbendazim @ 500 g or Mancozeb @ 2000 g or Copper oxychloride @ 2500 g/ha along with an insecticide recommended for bollworm from 45th day at fortnightly interval. |
| <p>Cercospora leaf spot: <i>Cercospora gossypii</i></p> | <ul style="list-style-type: none"> • Spray Propiconazole @ 1 ml/l or Metiram 55% + Pyraclostrobin 5% WG @ 0.1% at 60, 90 and 120 days after sowing. |
| <p>Damping off and Fusarium wilt: <i>Rhizoctonia solani</i> and <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i></p> | <ul style="list-style-type: none"> • Seed treatment with <i>Pseudomonas fluorescens</i> + <i>Bacillus subtilis</i> + <i>Trichoderma asperellum</i> mixture @ 10 g/kg and soil application of <i>P. fluorescens</i> + <i>B. subtilis</i> + <i>T. asperellum</i> mixture @ 2.5 kg/ha during sowing and at 90 days after sowing. |
| <p>Root rot: <i>Macrophomina phaseolina</i> (<i>Rhizoctonia bataticola</i>)</p> | <p>Cultural method</p> <ul style="list-style-type: none"> • Soil application of neem cake @ 150 kg/ha <p>Biological control</p> <ul style="list-style-type: none"> • Seed treatment with <i>T. asperellum</i> @ 10 g/kg followed by basal application of zinc sulphate @ 50 kg/ha. • Seed treatment with <i>Bacillus</i> (BSC5) @ 10g/kg followed by soil application @ 2.5 kg/ha with 250 kg of compost at the time of sowing. • Seed treatment with <i>P. fluorescens</i> @ 10 g/kg and soil application @ 2.5 kg/ha with 250 kg of compost at the time of sowing. |

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| | <ul style="list-style-type: none"> Seed treatment with <i>P. fluorescens</i> + <i>B. subtilis</i> + <i>T. asperellum</i> mixture @ 10g/kg and soil application of <i>P. fluorescens</i> + <i>B. subtilis</i> + <i>T. asperellum</i> mixture @ 2.5 kg/ha during sowing and at 90 days after sowing. <p>Chemical control</p> <ul style="list-style-type: none"> Spot drench with Carbendazim @ 1 g/l at the base of affected plants as well as surrounding healthy plants Soil drenching with Trifloxystrobin + Tebuconazole @ 0.75g/l |
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Integrated Pest and Disease Management (IPDM) technology for cotton

- Seed treatment with Imidacloprid 70 WS @ 10 g/kg seed
- Soil drenching with Chlorpyrifos 20 EC @ 1.25 l/ha on 25 days after sowing
- Soil application with *Bacillus subtilis* (BSC5) on 30 days after sowing
- Foliar application of *B. subtilis* (BSC5) @ 10g/l on 60 days after sowing
- Monitoring with yellow sticky traps for whitefly @ 12 numbers / ha
- Monitoring with pheromone trap for *Spodoptera* @ 12 numbers / ha
- Need based application of Imidacloprid 17.8SL @ 25 g.a.i./ha
- Need based application of 0.1 per cent Trifloxystrobin (25%) + Tebuconazole (50%) WG or Mancozeb 75 WP @ 0.25 per cent
- Raising of trap crop (castor and maize) along the bunds

Nematode Management

- ❖ Seed treatment with *Pseudomonas fluorescens* @ 20 g/kg followed by soil application @ 2.5kg/ha reduces reniform nematode, *Rotylenchulus reniformis* in cotton.

RAINFED COTTON

CROP PROTECTION

A. PEST MANAGEMENT

< The control measures recommended for irrigated cotton will hold good.

< **When water is not available, use any one of the following insecticides for the control of bollworms at 25 kg/ha :**

Carbaryl 5 D

Phosalone 4 D

B. DISEASE MANAGEMENT

| Name of the disease | Recommendations |
|--|---|
| Bacterial leaf blight: <i>Xanthomonas axonopodis</i> <i>pv. malvacearum</i> | <ul style="list-style-type: none"> • Avoid stacking of infected plants • Spray <i>streptomycin sulphate</i> @ 300 ppm + Copper oxychloride @ 2.0 kg/ha immediately after the symptom appearance and repeat at 10 days later. |
| Alternaria leaf spot: <i>Alternaria macrospora</i> | Spray any one of the following fungicides / biocontrol agent <ul style="list-style-type: none"> • Copper oxychloride @ 2 kg or Mancozeb @ 1 kg or chlorothalonil @ 500 g/ha or Difenaconazole @ 0.05% or Krexoxym methyl @ 0.1% or Tebuconazole @ 1 ml/l or Trifloxystrobin + Tebuconazole @ 0.6 g/l or Propiconazole @ 1 ml/l or Metiram 55% + Pyraclostrobin 5% WG @ 0.1% at 60, 90 and 120 days after sowing. • <i>Bacillus subtilis</i> (BSC5) @ 0.04% on 60, 90 and 120 days after sowing can also be applied. |
| Grey mildew: <i>Ramularia areola</i> | Spray any one of the following fungicides <ul style="list-style-type: none"> • Carbendazim @ 250 g/ha or Mancozeb @ 1000g or Chlorothalonil @ 500 g/ha or Difenaconazole @ 0.05% or Krexoxym Methyl @ 0.1% or Tebuconazole @ 1ml/l or Propiconazole @ 1ml/l or Metiram 55% + Pyraclostrobin 5% WG @ 0.1% at 60, 90 and 120 days after sowing. |
| Boll rot: <i>Fusarium moniliforme</i> , <i>Colletotrichum capsici</i> , <i>Aspergillus flavus</i> , <i>A. niger</i> , <i>Rhizopus nigricans</i> , <i>Nematospora</i> , <i>Botryodiplodia</i> | Spray any one of the following fungicides <ul style="list-style-type: none"> • Carbendazim @ 500 g or Mancozeb @ 2000 g or Copper oxychloride @ 2500 g/ha along with an insecticide recommended for bollworm from 45th day at fortnightly interval. |
| <i>Cercospora</i> leaf spot: <i>Cercospora gossypii</i> | <ul style="list-style-type: none"> • Spray Propiconazole @ 1 ml/l or Metiram 55% + Pyraclostrobin 5% WG @ 0.1% at 60, 90 and 120 days after sowing. |
| Damping off and <i>Fusarium</i> wilt: <i>Rhizoctonia solani</i> and <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> | <ul style="list-style-type: none"> • Seed treatment with <i>Pseudomonas fluorescens</i> + <i>Bacillus subtilis</i> + <i>Trichoderma asperellum</i> mixture @ 10 g/kg and soil application of <i>P. fluorescens</i> + <i>B. subtilis</i> + <i>Tasperellum</i> mixture @ 2.5 kg/ha during sowing and at 90 days after sowing. |
| Root rot: <i>Macrophomina phaseolina</i> <i>(Rhizoctonia bataticola)</i> | Cultural method <ul style="list-style-type: none"> • Soil application of neem cake @ 150 kg/ha Biological control <ul style="list-style-type: none"> • Seed treatment with <i>T. asperellum</i> @ 10 g/kg followed by basal application of Zinc sulphate @ 50 kg/ha. |

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| | <ul style="list-style-type: none"> • Seed treatment with <i>Bacillus</i> (BSC5) @ 10g/kg followed by soil application @ 2.5 kg/ha with 250 kg of compost at the time of sowing. • Seed treatment with <i>P. fluorescens</i> @ 10 g/kg and soil application @ 2.5 kg/ha with 250 kg of compost at the time of sowing. • Seed treatment with <i>P. fluorescens</i> + <i>B. subtilis</i> + <i>T. asperellum</i> mixture @ 10g/kg and soil application of <i>P. fluorescens</i> + <i>B. subtilis</i> + <i>T. asperellum</i> mixture @ 2.5 kg/ha during sowing and at 90 days after sowing. <p>Chemical control</p> <ul style="list-style-type: none"> • Spot drench with Carbendazim @ 1 g/l at the base of affected plants as well as surrounding healthy plants • Soil drenching with Trifloxystrobin + Tebuconazole @ 0.75g/l . |
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C.Nematode management

Seed treatment with *P.flouresecens* @20g/Kg and soil application @ 2.5 kg/ha
Application of consortia formulation of Pfbv 22 + Bbv 57@ 2.5 Kg/h

COTTON – VARIETAL SEED PRODUCTION

Land requirement

- Land should be free of volunteer plants and designated diseases especially the wilt disease. The previous crop should not be of the same variety or other varieties of the same crop. It can be the same variety if it is certified as per the procedures of certification agency.

Isolation

- Leave a distance of 50 m for foundation seeds and 30 m for certified seeds all around the field from the same and other varieties / hybrids of the crop.

Season

- Summer crop : February - March
- Winter crop : August - September

Acid delinting of fuzzy seeds

- Delint the fuzzy seeds with commercial Sulphuric acid @ 100 ml / kg of seed for 2 - 5 minutes depending upon the variety (2 minutes for MCU 5 and 5 minutes for MCU 12).
- After acid delinting remove the floaters and insect damaged seeds and separate the brown colour and well filled sinkers.
- Wash the collected seeds thoroughly for 3 to 4 times with fresh water and neutralize with 0.5 % lime solution for removal of traces of acid.

Pre-sowing seed treatment

- Seed hardening with 2 % KCl for 10 hrs in the seed to solution ratio 1:1 and dry back to original moisture content.
- Seed coating with polymer @ 3 g / kg + imidachloprid @ 2 ml / kg + *Pseudomonas fluorescens* @ 10 g / kg + Azophos @ 120 g / kg of seed.
- The above two treatments can be integrated as designer seed treatment.

Foliar application

- Spray 1 % Diammonium phosphate on 70th, 80th and 90th days after sowing.

Roguing

- The crop should be rogued for off-types from vegetative stage to harvesting stage based on plant stature, leaf size, leaf colour, stem colour, flower colour, petal spot, pollen colour, number of sympodia, boll size and shape to maintain genetic purity.

Harvesting

- Pick the fully bursted kapas periodically in six pickings at weekly intervals.
- Consider first five pickings in winter crop and first four pickings in the summer crop for seed purpose, the seed from the subsequent pickings are inferior in quality.
- Do not retain the kapas unpicked in the field for more than a week as it reduces seed quality.

Pre-storage seed treatment

- Treat the seeds with Carbendazim @ 2 g / kg of seed.
- Treat the seeds with halogen mixture ($\text{CaOCl}_2 + \text{CaCO}_3 + \text{arappu}$ (*Albizzia amara*) leaf powder mixed in the ratio of 5:4:1 @ 3 g / kg of seed as eco-friendly treatment.

Storage

- Store the seeds in gunny or cloth bags for short term storage (8 - 9 months) with a seed moisture content of 8 - 10 %.
- Store the seeds in polylined gunny bag for medium term storage (12 - 15 months) with a seed moisture content of 7 - 8 %.
- Store the seeds in 700 gauge polythene bag for long term storage (more than 15 months) with a seed moisture content less than 6 %.

COTTON - HYBRID SEED PRODUCTION

Land requirement

- Land should be free from volunteer plants. The previous crop should not be the same variety or other varieties of the same crop. It can be the same variety if it is certified as per the procedures of certification agency.

Isolation

- For certified / quality seed production, leave a distance of 30 m all around the field from the same and other varieties / hybrids of cotton.
- Between the parental lines leave an isolation distance of 5 m.

Seeds and sowing

- Male : 2 kg / ha
- Female : 4 kg / ha

Fertilizer requirement

- Compost : 12.5 t / ha, NPK : 20:60:50 kg / ha as basal application

Top dressing

- Top dress @ 12.5 kg N / ha at 60 and 90 days after sowing.
- Earthing up the crop adequately after first top dressing.
- Irrigate the crop immediately after every top dressing.

Foliar application

- Foliar spray of 100 ppm Boric acid or 0.5 % Zinc sulphate to the male parent at initiation of flowering to improve the pollen viability and pollen production.
- Foliar spray of Salicylic acid @ 250 ppm at 90 days after sowing for increased seed set.
- Foliar spray of 2 % DAP 4 times at 10 days interval during boll development period (60, 70, 80 and 90 days after sowing) for better development of bolls.

Emasculation and dusting for cross pollination

- Emasculate and dust as far as possible all buds appearing during the first six weeks of reproductive phase to ensure good seed setting and development of bolls.
- Emasculate the female buds on the previous day evening.
- Smear pollen dust to the stigma of all the emasculated flowers for good number of boll formation.

- Restrict emasculation to each day evening to 3 pm to 6 pm and pollination to morning between 10 am to 1 pm to ensure highest purity of hybrid seeds.
- Choose optimum size of bud and avoid too young or too old buds for emasculation.
- Cover the male buds with paper cover during previous day evening for their use on next day.
- Cover emasculated buds with butter paper cover to avoid out crossing.
- Close the crossing programme after 9th week (from commencement of crossing) and remove all buds and flowers appearing subsequently to facilitate the development of crossed bolls.

Topping

- Top the plants either manually or spray Maleic Hydrazide @ 100 ppm at 90th and 105th days after sowing to enhance the sympodial branches formation.

Harvesting

- Harvest only fully bursted bolls.
- Harvest the crop as 4 - 6 pickings depending on the cultivar.
- Avoid later pickings (after 4 - 5 pickings) for seed purpose.

Ginning

- Gin the crossed kapas in separate gins erected in seed processing units or farm gins under the close supervision of the authorities concerned to ensure purity and avoid damage.
- Remove hard locks and stained kapas.
- After ginning, clean the seeds by hand picking to remove small, shrivelled and broken seeds.

Pre-storage seed treatment

- Treat the seeds with carbendazim @ 2 g / kg of seed.
- Treat the seeds with halogen mixture ($\text{CaOCl}_2 + \text{CaCO}_3$ + arappu (*Albizzia amara*) leaf powder mixed in the ratio of 5:4:1 @ 3 g / kg of seed as eco-friendly treatment.

Storage

- Store the seeds in gunny or cloth bags for short term storage (8 - 9 months) with a seed moisture content of 9 - 10 %.
- Store the seeds in polylined gunny bag for medium term storage (12 - 15 months) with a seed moisture content of 7 - 8 %.
- Store the seeds in 700 gauge polythene bag for long term storage (more than 15 months) with a seed moisture content less than 6 %.