

## Package of Practice for Cotton: Tamil Nadu State

### CROP IMPROVEMENT

#### SEASON AND VARIETIES

District/Season	Varieties/Hybrids
<b>Irrigated (Main) Winter Irrigated (Aug – Sep)</b>	
Coimbatore, Erode, Madurai, Dindigul, Theni	MCU 5, MCU 5 VT, Suvin, TCHB 213*, MCU 12, MCU 13, Surabhi, Sumangala, Sruthi
Dharmapuri	MCU 5, TCHB 213*, MCU 12, MCU 13, Suvin
Salem, Namakkal	MCU 5, Suvin, TCHB 213*, MCU 12, MCU 13, Sumangala
Cuddalore, Villupuram	MCU 5, MCU 12, MCU13, LRA 5166, TCHB 213*, SVPR 2, Surabhi
<b>Summer – Irrigated (Feb – Mar)</b>	
Erode	MCU 5, MCU 5 VT, SVPR 2, Supriya, MCU 12, MCU 13, TCHB 213
Madurai, Dindigul, Theni	MCU 5, MCU 5 VT, MCU 12, MCU 13, SVPR 2, Supriya.
Ramanathapuram, Virudhunagar, Srivangangai, Tirunelveli, Thoothukudi	MCU 5, MCU 5 VT, SVPR 2, MCU 12, MCU 13
<b>Rainfed (Sep – Oct)</b>	
Madurai, Dindigul, Theni	LRA 5166, K 11, KC 2, SVPR 2
Ramanathapuram, Virudhunagar, Sivagangai	LRA 5166, K 11, KC 2, SVPR 2
Tirunelveli, Thoothukudi, Dharmapuri	LRA 5166, K 11, KC 2, SVPR 2
<b>Rice Fallow</b>	
Thanjavur, Tiruvarur, Nagapattinam, Parts of Trichirapalli, Perambalur, Karur, Cuddalore and Villupuram	MCU 7, SVPR 3, Anjali

\* = Hybrid

#### PARTICULARS OF COTTON VARIETIES/HYBRIDS

Varieties/Hybrids	Parentage	Season	Irrigated/Rainfed	Mean Yield of seed (kg/ha)	Special features
MCU 5	Mutiple cross	Aug-Oct Feb-Mar	Irrigated	1850	Extra long staple (29 mm MHL), Can spun upto 70s, ginning 34%
MCU 7	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 Balck arm
MCU 12	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	It is a multiple cross derivative involving the parents of (TCH 665 x LS 149) x	Aug-Oct Jan-Feb	Irrigated	2200	Early duration Can spun upto 50s

	(TCH 665 x TCH 21) x (TCH 21 x EECH) x (TCH 92-7 x EECH)				
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%
MCU 5 VT	Reselection from MCU 5	Aug-Oct Jan-Feb	Irrigated	2000	Extra long staple Verticillium wilt tolerant
Supriya	MCU 5 x C 1998	Aug-Oct Jan-Feb	Irrigated	2000	White fly tolerant
Anjali	LRA 5166 x (Khandwa 2 x Reba B 50) BC 2	Jan-Feb	Irrigated (Rice fallows)	1800	Dwarf, semi compact plant type
Surabhi	MCU 5 VT (MCU 5 x G.mexicanum)	Aug-Oct	Irrigated	2200	Extra long staple Verticillium wilt resistant
Sumangala	CW 134 x Reba B 50 x Khandwa 2	Sept-Oct Jan-Feb	Irrigated Rainfed	2000 1200	Suitable for rainfed tract
Sruthi	70 E x RSP 4	Sept-Oct	Rainfed	2500	Early duration
K 11	(0794-1-DX H 876) x (0794-1-DX H 450) Multiple Hybrid derivate	Sept-Oct	Rainfed	1100	Better fibre properties with lesser pest incidence than K 10
Suvin	Hybrid derivative from the cross Sujatha x St. Vincent	Aug-Oct	Irrigated	1020	Extra long staple cotton with 28% ginning outturn and 32 mm MHL, spins 100s
TCHB 213	Interspecific Hybrid of TCH 1218 (G.hirsutum) and TCB 209 (G.barbadense)	Aug-Sep	Irrigated	2215	High yielding, early maturing, Tolerant to leaf spot diseases
SVPR 2	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	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
KC 2	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

## CROP MANAGEMENT

### **PREPARATION OF FIELD FOR IRRIGATED COTTON CROP**

#### PREPARATION OF THE FIELD

- Prepare the field to get a fine tilth.
- Chiselling for soils with hard pen: Chisel the soils having hard pen 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 farm yard manure or composted coir pith/ha besides chiseling to get increased yield
- 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.

#### APPLICATION OF FYM OR COMPOST

Spread 12.5 t of FYM or compost or 2.5 t of vermicompost per ha if available, uniformly on the unploughed soil.

#### APPLICATION OF BIOFERTILIZER

Seed treatment with 3 packets of Azospirillum (600 g/ha) and 3 packets (600 g/ha) of Phosphobacteria or 6 packets of Azophost(1200 g/ha). In addition apply and 10 packets of Azospirillum (2000 g/ha) and 10 packets (2000 g/ha) of Phosphobacteria or 20 packets of Azophos (4000 g/ha) mixed with 25 kg FYM and 25 kg of soil on the seed line. This save 25% nitrogen besides increasing yield.

#### FORMATION OF RIDGES AND FURROWS

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

Varieties/Hybrids	Spacing between ridges(cm)
MCU 5, SVPR 2, LRA 5166, MCU 12, MCU 13	75
TCHB 213	120
Suvin	90
MCU 7	60

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

#### APPLICATION OF INORGANIC FERTILIZERS

- Apply NPK fertilizers as per soil test recommendations
- If soil test recommendations are not available follow the blanket recommendation for the different varieties.

Varieties/Hybrids	Quantity of fertilizers (Kg/ha)		
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
MCU 7, SVPR 3	60	30	30
MCU 5, MCU 5 VT, MCU 12, MCU 13, Suvin, SVPR 2	80	40	40
TCHB 213.	120	60	60

- If basal application could not be done apply the 25<sup>th</sup> day after sowing.
- Apply 50 per cent of N and K full dose of P<sub>2</sub>O<sub>5</sub> 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
- Foliar application of 2% DAP + 1% KCl will improve kapas yield.
- Apply the fertilizers in a band, two thirds of the distance from the top of the ridge, and incorporate.

#### APPLICATION OF MICRONUTRIENT MIXTURE

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.

#### NUTRITIONAL DISORDERS' CORRECTION

- In the cross of Zinc deficient soils ZnSO<sub>4</sub> @ 50 kg/ha as basal or ZnSO<sub>4</sub> 0.5% spray thrice at 45, 60 and 75 DAS.
- When reddening occurs in leaves apply 5% MgSO<sub>4</sub> Urea(1.0%) and ZnSO<sub>4</sub> (0.10%) as foliar spray on 50<sup>th</sup> and 80<sup>th</sup> day to correct this malady. In Mg deficient areas apply MgSO<sub>4</sub> @ 20 kg/ha basally.

#### **MANAGEMENT OF MAIN FIELD OPERATIONS**

##### 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 5 VT, MCU 7, MCU 12, MCU 13	15.00	7.50	---
SVPR 2	15.00	---	---
KC 2	20.00	15.00	---
SUVIN	---	---	6.00
TCHB 213	2.5	2.0	---

##### 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 5 VT, MCU 12, MCU 13	75	30
LRA 5166, SVPR 2		
KC 2	45	15
SUVIN	90	45
TCHB 213	120	60
MCU 7, SVPR 3	60 or 75*	30

\* Fertile soils

a. 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.

b. For intercropping with Greengram/ Soyabean, complete the sowing and irrigation 20 days prior to cotton sowing on one side of the ridge.

Varieties/Hybrids	Spacing for cotton crop (cm)		
	With in Paired row	Between Paired rows	Between plants
MCU 5, MCU 5 VT, MCU 12, MCU 13	60	90	30
SUVIN	80	100	45
TCHB 213	100	140	60

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.

#### ACID – DELINTING OF COTTON SEEDS

- Choose plastic bucket for acid delinting of seeds.
- Do not use earthen wares, metal vessels, porcelain wares or wooden drum for acid delinting as concentrated sulphuric acid will corrode them.
- 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.
- 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.
- Add water to fill the container. Drain the acid water and repeat the washing 4 or 5 times to remove any trace of acid.
- Remove the floating, ill-filled and damaged seeds while retaining the healthy and good seeds which remain at the bottom.
- Drain the water completely and dry the delinted seeds in shade.

NOTE: Acid delinting has the following advantages:

- Eliminate some externally seed borne pathogenic organisms.
- Kills eggs, larvae and pupae of pink boll worm
- Helps to remove immature, ill-filled, cut and damaged seeds.
- Makes seed dressing more effective and easy.
- Facilitates easy sowing and good germination.

PRE-TREATMENT OF ACID DELINTED SEEDS WITH FUNGICIDES

- Treat the delinted seeds with talc formulation of *Trichoderma viride* @ 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.
- 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.

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 m/kg) to increase the germination and vigour.

SOWING

- 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 fertilizers and insecticides are applied, maintaining the correct spacing and then cover seeds with soil.
- 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.
- 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

WEED MANAGEMENT

- Apply Pendimethalin @ 3.3 l/ha three days sowing using a hand operated sprayer fitted with deflecting or fan type nozzle. Sufficient moisture should be present in the soil at the time of herbicide application. This will ensure weed free condition upto 40 days.
- One hand weeding on 45 DAS will keep weed free environment upto 60 DAS.
- Hoe and hand weed between 18<sup>th</sup> to 20<sup>th</sup> day of sowing, if herbicide is not applied at the time of sowing.

GAP FILLING

a. Take up gap filling on the 10<sup>th</sup> day of sowing.

- In the case of TCHB 213, raise seedlings in polythene bags of size 15 x 10 cm.
- Fill the polythene bags with a mixture of FYM and soil in the ratio 1:3.
- Dibble one seed per bag on the same day when sowing is taken up in the field.
- Pot water and maintain.

- On the 10<sup>th</sup> 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.

### THINNING

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

### TOP DRESSING

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

### 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.

### SPRAYING OF NAPHTHALENE ACETIC ACID (NAA)

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

### MANAGEMENT STRATEGIES FOR DELAYED UMMER IRRIGATED COTTON SOWING

KCI 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.

### 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 15<sup>th</sup> node (75 to 80 DAS) and for varieties and hybrids having more than 160 days duration beyond the 20<sup>th</sup> node (85 – 90 DAS).

### 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	1	Immediately after sowing	Immediately after sowing
Establishment	2	Give a life irrigation on	Give a life irrigation on
		5 <sup>th</sup> day of sowing to	5 <sup>th</sup> day of sowing to
		facilitate the seedlings	facilitate the seedlings
		to emerge out	to emerge out

Vegetative phase (16 – 44 days)			
Regulate	1	Irrigate on the 20 <sup>th</sup> or	Irrigate on the 20 <sup>th</sup> or
		21 <sup>st</sup> day of sowing three	21 <sup>st</sup> day of sowing three
		Days after hoeing and	Days after hoeing and
		weeding	weeding
	2	Irrigate again on	Irrigate again on
		the 35 <sup>th</sup> or 36 <sup>th</sup>	the 40 <sup>th</sup> day of
		day of sowing	Sowing
Flowering phase (45 – 100 days for hybrids and 87 days for varieties)			
Irrigate copiously	1	48 <sup>th</sup> day	55 <sup>th</sup> day
	2	60 <sup>th</sup> day	70 <sup>th</sup> day
	3	72 <sup>nd</sup> day	85 <sup>th</sup> day
	4	84 <sup>th</sup> day	100 <sup>th</sup> day
	5	96 <sup>th</sup> day	**

\*\* For TCHB 213 and Suvin only.

Maturity phase (beyond 100 days for hybrids and 88 days for varieties)		For all varieties other than Suvin, and TCHB 213	
Control irrigation	1	108 <sup>th</sup> day	115 <sup>th</sup> day
during maturity	2	120 <sup>th</sup> day	130 <sup>th</sup> day
phase	3	130 <sup>th</sup> day	
	4	144 <sup>th</sup> day	
Stop Irrigation after 150 <sup>th</sup> day			
For Suvin, TCHB 213			
	1	108 <sup>th</sup> day	115 <sup>th</sup> day
	2	120 <sup>th</sup> day	130 <sup>th</sup> day
	3	132 <sup>nd</sup> day	145 <sup>th</sup> day
	4	144 <sup>th</sup> day	150 <sup>th</sup> day
	5	158 <sup>th</sup> day	
Stop Irrigation after 160 <sup>th</sup> day			
NOTE 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.		
ii.	Depending upon the prevailing weather condition and receipt of rains.		
iii.	Adopt alternate furrow or skip furrow irrigation to save irrigation water.		

The futures of the methods are furnished below:

#### *Skip furrow irrigation*

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



### *Alternate furrow irrigation*

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

### HARVESTING

- Harvest at frequent intervals, at less than 7 days interval.
- 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 than market value.
- Pick kapas from well burst boll only.
- Remove only the kapas from the bolls and leaves the bracts on the plants.
- After kapas is picked, sort out good puffy ones and keep separately.
- Keep stained, discoloured and insect damaged kapas with good kapas, as they will

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.

### POST HARVEST OPERATIONS

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

## **RICE FALLOW COTTON - MANAGEMENT OF FILED OPERATIONS**

### PREPARATION OF THE FIELD

- If the seed is in waxy condition, instead of Zero tillage, the seed rows may be tilled and the seed dibbled in Virudhunagar district.
- 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.
- At the lower level of the field dig a trench 15 cm wide and connect the trench to the outside channel to drain off the excess water.

### PRE – TREATMENT OF ACID DELINTED SEEDS WITH FUNGICIDES

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

SOWING THE SEEDS

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

FILLING UP GAPS

- Fill up gaps on the 10<sup>th</sup> day of sowing
- 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

THINNING SEEDLINGS

- Thin out seedlings on the 20<sup>th</sup> day of sowing
- Leave only one healthy and vigorous seedling per hill.

WEED MANAGEMENT

- Pre-emergence application of Pendimethalin 3.3 l/ha ensures weed free condition for 40 – 45 days. This should be followed by one hand weeding and earthing up during 40 – 45 days.
- Take up hoeing and weeding 20 days after sowing.
- Take up this operation when the top soil dries up comes to proper condition.

APPLICATION OF FERTILIZERS

- Apply NPK fertilizers as per soil test recommendations. If soil test is not done follow the blanket recommendation of 60:30:30 kg NPK/ha.
- Apply half the dose of N and K full dose of P<sub>2</sub>O<sub>5</sub> at 35<sup>th</sup> 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.

APPLICATION OF MICRONUTRIENTS

Apply basally 12.5 kg/ha micronutrient mixture prepared by Department of Agriculture. Apply MgSO<sub>4</sub> basally @ 20 kg/ha to prevent reddening.

FORMATION OF RIDGES

### Old delta

- If soil in condition give a hoeing with mammutti and form ridges and incorporate the fertilizer in the soil around the plants between 30<sup>th</sup> to 35<sup>th</sup> 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 40<sup>th</sup> 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<sub>4</sub>/ha

### APPLYING OF NAA

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

### TOPPING

Arrest terminal growth by nipping the terminal 15<sup>th</sup> node for controlling excessive vegetative growth (70 – 75 DAS)

### WATER MANAGEMENT

#### ***Regular irrigation according to the growth phases of the crops.***

Stages	No. of Irrigations	Days after dibbling seeds	
		Old delta	New delta
<b>1. Vegetative Phase</b>			
Regulate irrigation during the germination phase	1	One wetting on the 30 <sup>th</sup> to 35 <sup>th</sup> day of sowing after the application of fertilizers	One irrigation on the 20 <sup>th</sup> day after the application of fertilizers
	2	-----	One irrigation on the 40 <sup>th</sup> day after the application of N
<b>2. Flowering Phase</b>			
Irrigate more frequently	1	45 <sup>th</sup> day of sowing after the application of 2 <sup>nd</sup> dose of N	45 <sup>th</sup> day
	2	55 <sup>th</sup> day	51 <sup>st</sup> day
	3	65 <sup>th</sup> day	56 <sup>th</sup> day
	4	75 <sup>th</sup> day	61 <sup>st</sup> day
	5	85 <sup>th</sup> day	66 <sup>th</sup> day
	6	---	71 <sup>st</sup> day
	7	---	76 <sup>th</sup> day
	8	---	81 <sup>st</sup> day
	9	---	86 <sup>th</sup> day
	10	---	91 <sup>st</sup> day
<b>3. Control Irrigation during maturity phase</b>			
	1	99 <sup>th</sup> day	98 <sup>th</sup> day
	2	113 <sup>th</sup> day	105 <sup>th</sup> day
	3	---	112 <sup>th</sup> day

Stop irrigation from the 113<sup>th</sup> day onwards.

Note: 1) The irrigation schedule given above is only a guideline and regulates 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.

HARVESTING |  
POST HARVESTING OPERATION | As that of the irrigated cotton.  
PEST AND DISEASE MANAGEMENT |

## RAINFED COTTON

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

### SEASON AND VARIETIES

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

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

### PREPARATION OF LAND FOR RAINFED COTTON

#### PREPARATION OF FIELD

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

#### APPLICATION OF FYM OR COMPOST

- Spread 12.5 t of FYM or compost or composted coir pith or 2.5t of vermicompost per ha uniformly on the unploughed soil.
- Incorporate the manure in the soil by working the multipurpose implement or country plough.

#### APPLICATION OF INORGANIC FERTILIZERS

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

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

#### APPLICATION OF MICRONUTRIENT MIXTURE

- 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.
- Apply uniformly over the furrows after sowing and cover the seeds
- Do not incorporate in the soil.

### SEEDS AND SOWING

- 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 seed of K 9, K10 & K 11

- 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

### SPACING

- In the case of pure crop of varieties/hybrids, a spacing of 45 cm between rows and 15 cm between plants may be adopted
- 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 is maintained at the same line as that for a pure crop of cotton.

Varieties	Spacing for cotton crop (cm)		
	Within Paired row	Between Paired rows	Between plants
K 11, LRA 5166, SVPR 2	30	60	15

- 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.

### ACID DELINTING

- Adopt procedure for acid delinting as for an irrigated crop

### PRETREATMENT OF ACID DELINTED SEEDS WITH FUNGICIDES

Same as for the irrigated crop

### SOWING

- Use the multipurpose farming implement to sow the seeds and to apply basat fertilizers simultaneously.
  - Fill the hopper in the implement with the fertilizer mixtures and work the implement.
  - 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.

### WEED MANAGEMENT

- Pre-emergence application of Pendimethalin 3.3 l/ha followed by one hand weeding on 40 days after crop emergence. At the time of herbicide application sufficient soil moisture must be there.
- Insufficient soil moisture is not available for applying herbicides hand weeding may be given at 10 – 20 days after crop emergence.

### GAP FILLING

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

### THINNING SEEDLINGS

- Allow two seedlings per hole and thin out on 15<sup>th</sup> day of sowing, adopting proper spacing between plants.
- Thin the pulse crop on the 20<sup>th</sup> day of sowing, adopting a spacing of 15 cm between plants for cowpers and 10 cm for other pulse crop.

### FOLIAR FERTILIZATION

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

### INTERCULTIVATION WITH DHANTHULU/BLADE HARROW

Work dhanthulu or blade harrow on the 30<sup>th</sup> and 45<sup>th</sup> day of sowing.  
NOTE: Other cultivation practices, plant protection measures, harvest etc., are the same as for the irrigated crop.

## **CROP PROTECTION**

### ***Irrigated Cotton***

#### Pest Management

- Remove the cotton crop 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 @ 3 g/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.
- Synchronise 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 125 Watt mercury lamps to determine the prevalence and insect population fluctuations.
- The magnitude of the activity of the moths of the cotton pink bollworm, the cutworm (*Spodoptera litura*) and the American bollworm can be assessed by setting up the species-specific sex pheromone trap each all 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, balckgram, 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*

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

*Pest management strategies*

<b>Pests</b>	<b>Management strategies</b>
American bollworm	Monitoring:
Helicoverpa armigera	Pest monitoring through light traps, pheromone traps and in situ 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 / plant may be adopted
	Cultural practices:
	1. Synchronised sowing of cotton preferably with short duration varieties in each cotton ecosystem.
	2. Avoid continuous cropping of cotton both during winter and summer seasons in the same area as well as rationing.
	3. Avoid monocropping. Growing of less preferred crops like greengram, balckgram, soybean, castor, sorghum etc., along with the cotton as intercrop or border crop or alternate crop to reduce the pest infestation.
	4. Remove 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.
	5. Optimising the use of nitrogenous fertilizers which will not favour the multiplication of the pest.



	6. Judicious water management for the crop to prevent excessive vegetative growth and larval harbourage.
	Biological control:
	1. Application of Nuclear Polyhedrosis Virus (NPV) at $3 \times 10^{12}$ POB /ha in evening hours at 7 <sup>th</sup> and 12 <sup>th</sup> week after sowing
	2. Conservation and augmentation of natural predators and parasitoids for effective control of the pest.
	3. Inundative release of egg parasitoid, Trichogramma spp., at 6.25 cc/ha at 15 days interval 3 times from 45 DAS
	4. Egg larval parasitoid. Chelonus Blackburnii and
	5. Predator Chrysoperia carnea at 1,00,000/ha at 6 <sup>th</sup> , 13 <sup>th</sup> and 14 <sup>th</sup> week after sowing.
	6. ULV spray of NPV at $3 \times 10^{12}$ 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, endosulfan, methyl demeton, monocrotophos and phosalone are comparatively safer to Chrysoperia larva recording low egg mortality.
	Chemical Control:
	1. Discourage the indiscriminate use of insecticides, particularly synthetic pyrethroids
	2. Use of proper insecticides which are comparatively safer to natural enemies such as endosulfan, phosalone etc., at the correct dosage and alternating different groups of insecticides for each round of spray.
	3. Avoid combination of insecticides as tank mix.
	4. 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.
	5. Proper mixing and preparation of spray formation apply endosulfan 35 EC 1 l/ha
	6. During bolling and maturation stage, apply any one of the following insecticide (1000 l of spray fluid/ha); Phosalone 35 EC 2.5 l/ha Quinalphos 25 EC 2.0 l/ha Carbaryl 50 WP 2.5 kg/ha Pyraclofos 50 EC 1.5 l/ha
Pink bollworm	1. Use pheromone trap to monitor the adult moth activity
Pectinophora gossypiella	2. Spray triazophos 40 EC 2.5 l/ha and endosulfan 35 EC 2.0 l/ha in alternation even after 100 DAS.
Tobacco cutworm Spodoptera litura	1. Use of light trap to monitor and kill the attracted adult moths. Set up the sex pheromone trap Pherodin S.L. at 12/ha to monitor the activity of the pest and to synchronise the pesticide application. If need be, at the maximum activity stage.
	2. Growing castor along border and irrigation bunds.
	3. Removal and destruction of early stage larvae found in clusters which can be located easily even from a distance.
	4. Collection and destruction of shed materials.
	5. Hand picking and destruction of growth up caterpillars.

	6. Spray any one of the following insecticides per ha using a high volume sprayer covering the foliage and soil surface: Chlorpyriphos 20 EC 2.0 l Dichlorvos 76 WSC 1.0 l Phenthoate 50 EC 2.0 l Chlorpyriphos 20 EC 1.25 l Fenitrothion 50 EC 6.25 l
	7. Spraying nuclear polyhedrosis virus at $1.5 \times 10^{12}$ POB per ha.
	8. Spraying of insecticides should be done either in the early morning or in the evening and virus in the evening
	9. Use of poison bait pellets prepared with rice bran 12.5 kg, jaggery 1.25 kg, carbaryl 50% WP 1.25 kg and water 7.5 litres. This bait can be spread in the fields in the evening hours so that the caterpillars coming out of the soil, feed and get killed.
Stem weevil <i>Pempherulus affinis</i>	1. Soil application of carbofuran 3 G 30 kg/ha on 20 days after sowing and earthing up on 45 <sup>th</sup> day.
	2. Basal application of FYM 25 t/ha and 250 kg/ha of neem cake.
Whitefly <i>Bemisia tabaci</i>	1. Avoid the alternate, cultivated host crops of the whitefly in the vicinity of cotton crop
	2. Growing cotton crop once a year either in winter or summer season in any cotton tract.
	3. Adopting crop rotation with non-preferred hosts such as sorghum, ragi, maize etc. for the white fly to check the build up of the pest.
	4. 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.
	5. 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.
	6. Field sanitation may be given proper attention.
	7. Cultivars 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.
	8. Monitoring the activities of the adult white files by setting up yellow pan traps and sticky traps at 1 foot height above the plant canopy and also in situ counts
	9. Collection and removal of whitefly infested leaves from the plants and those which were shed due to the attack of the pest and destroying them
	Chemical Control:
	1. Spray any one of the following plant products along or in combination with the recommended dose of insecticide (at 2 ml/l or water)

	<p>Neem seed kernel extract 5% (50 kg) and neem oil at 5 ml/l of water                  Fish oil rosin soap 25 kg at 1 kg in 40 lit of water                  Notchi leaves 5% extract                  Catharanthus rosea extract 5%</p>
	<p>2.Spray any one of the following in early stage (500 l of spray fluid/ha)                  Methyl demeton 25 EC 500 ml                  Phosphamidon 40 SL 600 ml/ha</p>
	<p>3.Spray any one of the following in mid and late stages (1000 l spray liquid /ha)                  Phosalone 35 EC at 2.5 l/ha                  Quinalphos 25 EC at 2.0 l/ha                  Ethion 50 EC 1.0 l/ha                  Monocrotophos 36 SL 1.25 l/ha                  Triazophos 40 EC 2.0 l/ha                  Acephate 75 SP 1.30 kg/ha</p>
	<p>4. In the early stages with high volume sprayer, use a goose neck nozzle to cover the under surface of the foliage to get 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>
	<p>5. The use of synthetic pyrethroids should be discouraged in cotton to avoid the problem of whitefly. Cypermethrin, fenvalerte and delamethrin cause resurgence of whiteflies. So avoid repeated spraying of pyrethroids.</p>
	<p>6. The plant protection measures should be adopted on a community basis in a specified cotton area.</p>
Thrips Thrips tabaci	<p>1. Seed treatment with imidacloprid 70 WS at 7 g/kg protect the crop from aphids, leafhoppers and thrips upto 8 weeks.</p>
Aphids Aphids gossypii	<p>Spray any one of the following insecticides (500 l spray fluid /ha)                  Imidacloprid 200 SL at 100 ml/ha                  Methyl demeton 25 EC 500 ml/ha                  Dimethoate 30 EC 500 ml/ha                  Phosphamidon 40 SL 600 ml/ha                  Monocrotophos 36 SL 1000 ml/ha                  NSKE 5% 25 kg/ha</p>
Leafhopper Amrasca devastans	
	<p>2. Where the leafhopper is a big menace apply Neem oil formulation 0.5% or neem oil 3% thrice a fortnightly intervals</p>
Red spider mite Tetranychus cinnabarinus	<p>Apply any one of the following;                  Wetttable sulphur 1.25 kg/ha                  Dicofol 1.10 l/ha</p>

### Insecticide resistance

In case of control failures monitor the insecticides with following discriminating dose screen.

A. *Helicoverpa armigera*

(Topical assay with III instar larva weighing 30 – 40 mg)

1. Cypermethrin	0.1
2. Cypermethrin	0.1
3. Fenvalerate	0.2
4. Endosulfan	10
5. Quinalphos	0.75
6. Chlorpyrifos	1.0

B. Tobacco caterpillar – *Spodoptera litura*

(early III instar 8 day old larva weighing 30 – 40 mg and measuring 12 ± 0.5 mm length)

1. Endosulfan topical	2.0
2. Profenofos topical	3.0
3. Chlorpyrifos topical	0.15
4. Fenvalerate topical	0.2

C. Cotton leafhopper – *Amrasca devastans* (Distant)

(III instar larva of 0.14 mg weight, 1.30 mm length)

1. Dimethoate	IRAC method VIII (leaf disc)	400 ppm
2. Methyl demeton	IRAC method VIII (leaf disc)	800 ppm
3. Acephate	IRAC method VIII (leaf disc)	850 ppm

Resurgence

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

- *Aphis gossypii* : Carbaryl, cypermethrin, deltamethrin, endosulfan, fenpropathrin, fenvalerate, flucythrinate, fluvalinate, monocrotophos, permethrin, phorate
- *Amrasca devastans*: Deltamethrin, dimethoate, disulfoton, methylparathion, phorate
- *Bemisia tabaci*: Cypermethrin, deltamethrin, dimethoate, endosulfan, fenvalerate, monocrotophos, phosalone
- *Ferrisia virgata*: Cypermethrin, deltamethrin, fenvalerate, permethrin
- *Tetranychus cinnabarinus*: Acephate, carbaryl, cypermethrin, deltamethrin, endosulfan, fenvalerate, fluvalinate, phosphamidon.

**CROP PROTECTION**

***Rainfed Cotton***

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:
  - Endosulfan 4 D
  - Carbaryl 5 D
  - Phosalone 4 D

## Disease Management

Name of the Disease	Management
Bacterial blight Xanthomonas axonopodis pv. Malvacearum	1. Avoid stacking of infected plants
	2. Spray Streptomycin sulphate + Tetracycline mixture 100g + Copper oxychloride 1250 g/ha
	3. Repeat spraying at 10 days interval twice or thrice if drizzling continues.
Alternate leaf spot Alternaria macrospora	Spray any one of the following:
	1. Copper Oxychloride 1250g
	2. Mancozeb 1000g
	3. Chlorothalonil 5000 g/ha
Grey Mildew Ramularia areola	Spray Carbendazum 250 g/ha
Boll rot Fusarium monilifrone, Collectorichum capsici, Aspergillus flavus, A. niger, Rhizopus nigricans, Nematospora, Botryodiplodia	Spray any one of the following
	1. Spray Carbendazim 500 g.
	2. Mancozeb 2000 g.
	3. Copper oxychloride 2500 g/ha along with an insecticide recommended for bollworm from 45 <sup>th</sup> day at fortnightly interval.
Root rot Macrophomina phaseolina Rhizoctonia bataticola	Cultural Method Apply Neem cake @ 150 kg/ha to the soil and treat the seeds with talc based T viride @ 4 g/kg to reduce the root rot incidence.
	Biological Control Seed treatment with T. viride @ 4 g/kg followed by basal application of zinc sulphate @ 50 kg/ha
	Chemical Control Spot drench Carbendazim @ 1 g/lit at the base of affected plants as well as surrounding healthy plants.

Source: Tamil Nadu Agricultural University

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