

THE RECOMMENDED COTTON PRODUCTION TECHNOLOGY

The Recommended Cotton Production Technology

1. Plow and harrow or rebribe the field or cut rice stubbles close to the ground.
2. Treat seeds to facilitate planting and protect them from soil- and seed-borne diseases.
3. Apply basal fertilizer along the furrows before planting.
4. Hill drop or dibble 3-4 seeds per hill at the recommended distance then cover thinly with soil.
5. Replant within 10-22 DAP. Thin within 14-27 DAP leaving two vigorous plants per hill.
6. Off-bar at 35 DAP. Sidedress and hill-up at 42-47 DAP.
7. Irrigate during planting and on the 6th, 8th, 11th and 13th week after planting or when the crops wilt at mid-day.
8. Control weeds by spraying pre-emergence herbicide immediately after planting. When weeds are abundant, spot-weed or apply post-emergence herbicide at the recommended rate and time within 60 DAP.
9. Follow the integrated pest management technology for cotton to ensure good yield and reduce the cost of production.
10. Harvest when 50% of the bolls have opened using jute sacks or crates. Storey harvest for one to two days to reduce moisture content and kill pink bollworm larvae in the seedcotton.

Postharvest:
Cut and plow under or compost all plant debris after harvesting to prevent pest build-up in the next season.



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PHILIPPINE FIBER INDUSTRY DEVELOPMENT AUTHORITY

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FOREWORD

planting garlic (DAG), respectively. The shading effect of cotton to garlic crop would be ready for harvest at the time the cotton rows close in. Rows and hills of cotton should be spaced 75-100 cm x 30-40 cm, with two plants per hill after thinning.

Apply seven bags of 14-14-14 fertilizers as basal to garlic during planting. Topdress one bag urea or two bags ammonium sulfate per hectare to garlic at 40-50 days after planting garlic (DAPG). Sidedress cotton with 3-4 bags urea per hectare at 42-47 days after planting cotton (DAPC). Follow other cultural practices to both crops.

B. Cropping Patterns

Rice/corn-cotton. Rice-cotton is a natural cropping sequence in rice-based lowland areas, and corn-cotton sequence in upland condition and most areas in Mindanao. Cotton-cotton cropping sequence must not be practiced to avoid population build-up of pests during the whole season. Further, ratooning or regrowing cotton must be discouraged.

Cotton is being cultivated for its fiber which is used in the production of fabrics. The cotton production technology has been developed as a result of intensive researches conducted over the years and is continuously updated as more research results become available.

This handbook comprises our latest recommendations for successful cotton production in the country. It is intended for all workers on cotton, keeping in mind the cotton production specialists, the trainers and cotton farmers.

It is hoped that this material will benefit all those involved in cotton production.



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THE RECOMMENDED COTTON PRODUCTION TECHNOLOGY

A. Area selection

Cotton grows best in areas with deep surface soil, high water holding capacity, good internal drainage and pH ranging from 5.5 to 7.0.

B. Planting Schedule

Planting dates vary from one area to another depending on rainfall and existing cropping patterns.

Time of planting is important especially in rainfed areas to optimize available soil moisture. Early planting is recommended to save on irrigation costs. It also allows a longer vegetative period for the crop, thereby, increasing the yield potential. On the other hand, late planting can be done in areas with adequate water source and irrigation facilities. Recommended planting dates for the various cotton growing provinces are based on rainfall data, cropping patterns, and results of field trials.

b.1 Cluster Planting. If applicable, plant within production clusters for a more efficient and effective farm supervision. A production cluster consists of at least 15 hectares within one kilometer radius.

b.2 Synchronized Planting. Planting in a cluster must be done within a 30-day period of the recommended planting schedule to avoid build up of insect pest population especially in late-planted cotton.

C. Resources and Facilities

Irrigation resources and facilities must be adequate and economically available (Table 1).

Production Technology Options

A. Intercropping

1. Cotton-legume

a. Mungbean. Intercropping cotton is feasible in areas suited to mungbean. Prepare the land following the conventional method. For marginal areas, follow - 120 cm x 50 cm (double row) x 25 cm plant spacing. Plant two rows (40 cm x 40 cm) of mungbean in between the 120 cm row, maintaining 18-20 seeds per linear meter. For prime areas, 140 cm x 60 cm should be followed. PAG-ASA or Taiwan green is the recommended mungbean variety. Apply in band 3 bags of 16-20-0 in heavy soils or 4 bags 14-14-14 fertilizer in light soils.

Replant cotton within 10-22 DAP and 7-10 DAP for mungbean. Thin the cotton plants at 14-27 DAP. Sidedress cotton with 2.5 bags urea for heavy soils or 2 bags for light soils at 42-47 DAP.

Follow the recommended cultural practices for both crops. Harvest the matured mungbean pods at 60 DAP or when the pods turned brown or black.

b. Cowpea - Follow the planting distances of mungbean: 120 cm x 50 cm for marginal areas and 140 cm x 60 cm for prime areas. Plant 2-3 seeds per hill at 20 cm between hills. Early maturing varieties are recommended as planting materials.

c. Peanut - Follow distances of mungbean and cowpea. Plant 2-3 seeds per hill with a distance of 15 cm between hills.

Apply in band (as basal) 3 bags of 16-20-0 in heavy soils or 4 bags 14-14-14 fertilizer in light soils. Sidedress cotton with 2.5 bags urea for heavy soils or 2 bags for light soils at 42-47 DAP. Follow other cultural practices for both crops.

2. Garlic-cotton

In garlic growing areas in Ilocos Norte and Ilocos Sur, intercropping cotton with garlic is feasible. For upland areas, plant garlic in October, and November for lowland areas and intercrop cotton 40-50 and 30-40 days after

K.2. Disease Management

k.2.a. Major Diseases of Cotton.

The four major diseases of cotton are: damping-off caused by *Rhizoctonia solani* Kuh and *Sclerotium rolfsii* Sacc.; Fusarium wilt caused by *Fusarium oxysporum* f. sp. *vasinfectum*; boll rot caused by *Diplodia gossypina* Cke; and bacterial blight caused by *Xanthomonas malvacearum*.

k.2.b. Management options for diseases

- a) use resistant variety such as UPL-C₂, CRDI-1, CRDI-2, Navkar 5
- b) use fungicide as seed treatment
- c) remove infected plants.

L. Harvesting and Post-harvest Practices

I.1. Harvesting. Harvest flossed cotton bolls 3-4 days after bursting. Harvesting containers like flour sacks or bamboo crates should be used. Do not use plastic sacks to avoid polypropylene ("PP") contamination.

I.2. Drying and packaging of seedcotton. Sun drying for one to two days after harvesting is recommended to reduce the moisture content to 10-12% and kill pink bollworm larvae in the seedcotton.

Use jute sacks or other packaging materials made of natural fibers such as flour sacks. Plastic sacks and string cause "pp" contamination of the lint resulting in reduction of quality and price.

I.3. Cutting/uprooting and burning or plowing under of cotton debris. After harvest, all plants debris must be either cut or uprooted and burned. A tractor-drawn plow may also be employed to incorporate the cotton stalks into the soil. This kills insect pests and prevents pests population build-up. Plant debris turned-under by deep plowing returns organic matter to soil.

Table 1. Minimum farm equipment requirement.

Farm size	Minimum number of equipment
1 hectare or less	1 knapsack sprayer Water source for irrigation Water pump (at least 5 hp) Irrigation hose (100 m long size 1¼' to 2' dia.)

D. Varieties

The recommended varieties for commercial planting are UPL-C₂, CRDI-1, CRDI-2, PSB-Ct₈, PSB-Ct₉, PSB-Ct₁₀, NSIC-Ct₁₁, NSIC-Ct₁₂, and NSIC-Ct₁₃ (Table 2).

E. Land Preparation

Prepare the field either through the conventional or minimum tillage method.

e.1. Conventional Tillage. For typical upland and lowland field, plow at least 15 cm deep (6 inches) then harrow two or three times or rotavate once or twice for good soil tilth, weed control, uniform seed germination and better plant stand. Then make furrows based on recommended row distances.

e.2. Minimum Tillage. In lowland field, cut stubbles close to the ground immediately after rice harvest so as not to interfere with cotton seedlings. Hand weed or apply the appropriate herbicide if weeds are present in the field (Table 3). In saline areas, make furrow slices at recommended row distances.

Table 2. List of varieties recommended for commercial planting.

VARIETY	POT. YIELD (t/ha)	LR ¹ (%)	FIBER PROPERTIES			REACTION TO INSECTS & DISEASES
			LENGTH (mm)	STRENGTH (g/tex)	FINENESS (ug/in)	
<i>G. hirsutum</i>						
UPL-C ₂ *	2.10	38.9	29.8 (long)	19.44 (average)	5.10 (coarse)	MR to leafhopper; SR to thrips and R to bacterial blight caused by <i>X. malvacearum</i>
CRDI-1*	2.12	40.8	28.9 (long)	19.43 (average)	4.31 (average)	HR to leafhopper, MR to damping off caused by <i>R. solani</i> and <i>S. rolfsii</i>
CRDI- 2*	2.13	41.0	27.61 (med-long)	19.61 (average)	4.35 (average)	R to damping off caused by <i>S. rolfsii</i> and <i>R. solani</i> and to boll rot caused by <i>D. gossypina</i>
PSB-Ct ₈ *	2.23	39.76	30.39 (long)	19.45 (average)	4.58 (average)	R to damping off caused by <i>S. rolfsii</i> ; R to Fusarium wilt; MR to leafhopper
NSIC-Ct ₁₁ *	2.44	40.76	28.72 (long)	18.63 (average)	4.74 (average)	R to leafhopper; R to damping off caused by <i>S. rolfsii</i>
NSIC- Ct ₁₂ ** (Navkar 5)	2.52 – 3.36	36.09	30.07 (long)	20.15 (strong)	3.82 (fine)	R to leafhopper
NSIC- Ct ₁₃ ** (Bioseed 6527)	2.43	37.17	27.91 (med-long)	20.41 (strong)	4.12 (average)	HR to leafhopper; R to damping off caused by <i>S. rolfsii</i> and <i>R. solani</i>
<i>G. barbadense</i>						
PSB-Ct ₉ *	1.43	26.91	39.19 (extra long)	28.49 (very strong)	2.5 (fine)	MR to leafhopper; HR to damping off caused by <i>S. rolfsii</i> ; R to damping off caused by <i>R. solani</i>
PSB –Ct ₁₀ *	1.30	28.68	37.04 (extra long))	27.99 (very strong)	<2.5 (very fine)	HR to damping off caused by <i>S. rolfsii</i> ; R to damping off caused by <i>R. solani</i> ; HR to leafhopper

*Purelines

**Hybrid

¹ Lint Recovery

k.1.d. Other general recommendations for pesticide use

- Remember to mix thoroughly the insecticide with the water inside the sprayer.
- To minimize occupational hazard as well as improve spray distribution, utilize wind direction as much as possible. The spray mist must be blown away from the operator and towards the plants of the nearest downwind rows.
- No pesticide group should be used for more than four weeks to prevent the development of resistant insect pest population. Unfortunately, synthetic pyrethroids, though they are the most effective chemicals are the fastest to cause resistance development among insect pests. Hence, these should be used judiciously and for only one bollworm generation per cropping season, which is about one month. These should not be used during early crop stage to prevent too much exposure of insect pests to selection pressure. These insecticides may also cause resurgence of spider mites and aphids. Organophosphates like Selecron 500 EC can be used alternately with Carbamate.
- Avoid using kitchen tablespoon in measuring pesticide dosage as this poses a serious health hazard. Moreover, the assumption that one tablespoon is equivalent to 10 ml is incorrect. Tablespoons come in various sizes and usually contain less than 10 ml. Instead, use calibrated measuring cups.
- The most effective pesticide can work only if it is applied properly. Dirty, faulty or damaged spray equipment, as well as careless or untrained operators, render many spray applications futile.

k.1.c. Spray Application. For an effective and efficient chemical pest control, calibrate the sprayer. The following should be considered:

- **Appropriate Nozzle**

Select the appropriate nozzle to reduce the volume of spray solution per hectare. A nozzle with fine droplet size is desired. If a *double nozzle* is used, close one nozzle to reduce the discharge rate by half.

- **Horizontal Nozzle Direction**

For better distribution of spray droplets in the canopy, the nozzle must point forward or sideways (horizontal position) rather than downwards (vertical position).

- **Constant Pumping Pressure**

Pump the sprayer slowly and constantly to ensure uniform spray droplets. Uniform distribution of droplets means higher contact with the target insect pests.

- **Correct Amount of Insecticide Per Tank Load**

The list of recommended insecticide in Table 7 presents the appropriate sequence of insecticides as well as the correct amount to be mixed per tank load.

To determine the correct dosage per tank load, use the following procedure:

- Multiply the recommended amount per hectare with the actual field size (in hectare) to obtain the total amount of pesticide needed to treat the entire field.
- Divide this amount by the number of tank loads needed to treat the field. This gives the correct amount of pesticide per tank load.

Table 3. Recommended herbicides, dosage, time and method of application for weeds associated with cotton.

Common Name	Application Rate /16 li tankload ^{1/}	kg a.i. per ha	Time & Method of Application
Pendimethalin (Herbadox 330 EC)	160 ml	1.0	Pre-emergence to annual grass & broadleaf weeds; blanket application just after planting & irrigation
Pendimethalin (Prekill 330)	160 ml	1.0	Pre-emergence to annual grass & broadleaf weeds; blanket application just after planting & irrigation
Fluazifop-butyl (Onecide 15 EC)	40 ml	0.112	Early post-emergence to annual grass weeds; blanket application at 3 to 6 leaf stages of the weeds; applicable for minimum tillage
Glyphosate (Round-up)	107-214 ml	0.96 -1.92	Post-emergence to all kinds of weeds; blanket application at least one week before planting; applicable in minimum tillage
Isopropylamine Salt of Glyphosate (Power)	214-320 ml	0.67 - 1.0	Post-emergence to all kinds of weeds; blanket application at least one week before rotavation or before planting; applicable in minimum tillage

^{1/}Number of tank loads/ha: 18.5 tank loads, computed at 300 L of spray solution per hectare, using fan type nozzle.

F. Basal Fertilization

Apply basal fertilizer in band (along the furrows) before planting, then cover thinly with soil or dibble the fertilizer 5-8 cm away from the seeds just after planting or within one week after emergence. Make sure the fertilizer does not come in contact directly with the seeds.

G. Planting

g.1. Certified seeds. Plant certified seeds to ensure high germination, vigor, varietal purity and uniform field stand.

g.2. Seed Treatment.

g.2.a. Disease management. Before planting, soak the seeds in fungicide solution for 6 to 10 hours using any of the recommended fungicides (Table 4), then drain and incubate the seeds in a warm, moist place for not more than 12 hours. Plant soaked seeds immediately after incubation. This practice is recommended in fields with adequate soil moisture for continuous seedling growth.

In conditions of uncertain rain and relatively dry field, use unsoaked seeds. In which case, mix the dry fungicide thoroughly with the dry seeds.

Use of fungicide is optional, that is, depending on cost and on history of disease prevalent in the area.

g.2.b. Sucking insects. Treat seeds before planting using Gaucho 70 WS at 5 ml/kg seed/li water (seed treatment is in coordination with the manufacturer of the product).

Table 4. Recommended fungicides for seed treatment.

Common Name	Brand Name	Rate ^{1/}
Captan	Orthocide 50 WP	30
	Captan 50 WP	30
Benomyl	Benlate 50 WP	20
Thiophanate methyl	Fungitox 70 WP	30
Chlorothalonil	Daconil	30
Mancozeb	Dithane M-45	30

^{1/} In grams of the commercial product per liter of water per kilogram of seeds.

g.3. Method of planting. For conventionally prepared field, drop three seeds per hill for purelines and one or two seeds per hill for hybrid in the furrows then cover the seeds thinly with soil. Follow the recommended distances.

ash using a perforated small tin can.

- *Release earwigs.* If available, release 9,000-11,000 earwigs, *E. annulata*, per hectare at 68, 82 and 89 days after planting (DAP) or on the first occurrence of flower weevil.

d. Pink Bollworm

- *Sundry the seedcotton after harvest.* Aside from maintaining high quality fiber, sun drying kills pink bollworm larvae present in the seedcotton.

- *Fumigate the seeds.* If high incidence of pink bollworm larvae is detected in the ginnery, fumigate the agricultural or industrial seeds to reduce the number of insect pests that may be carried over to the next cropping season.

e. Spiny Bollworm

- The Trichogramma that is released for cotton bollworm can also control the spiny bollworm.

- Destroy wilted plant terminals which contain the spiny bollworm.

f. Aphids

- Early aphid infestation can be regulated by natural enemies such as predators and parasitoids (coccinellids, syrphids, spiders, lacewing, braconids)

- *Spray insecticides* – At harvest time, high aphid populations can reduce the quality of cotton fiber. The honeydew makes fiber sticky and causes discoloration due to sooty mold. Spraying systemic insecticide reduces aphid population. A tentative treatment threshold is “treat if equal or greater than 15% of the highest open bolls are with honeydew”.

c. Flower weevil

- *Practice close-season planting* - Plant all fields within the shortest range of time is the best way to minimize flower weevil infestation. A cotton cluster planted within four weeks allows flowers to escape the damaging population of flower weevil.

- *Observe field sanitation* - Cut/plow under plant residues after harvest to kill remaining insect pests and deprive the few survivors of food source during the cotton off-season.

- *Use trap Crop* - Okra planted along borders of cotton field serves as trap crop for flower weevil. Okra flowers trap initial infestation of flowerweevil, hence directed control using insecticides can be done on the trap crop.

- Red ants are the most important natural enemies of flower weevil. To avoid killing red ants, insecticide should be applied only when absolutely necessary.

- *Destroy damaged flowers* - Flowers detected to contain a weevil or show typical damage symptoms should be collected and destroyed by squeezing or burning. Removing petals of infested flowers one day after infestation could also help reduce flower weevil population. Flower weevil adult lays eggs on the base of the petals. Since more than 70 percent of infested flowers during the early infestation already contain eggs, petal removal should be done continuously for about two weeks from the start of flowering.

- *Employ flower-to-flower either dusting with ash or sand or insecticide spraying*. Start dusting or spraying on the first occurrence or upon observation of flower weevil. Do it once a week preferably at 9 AM to 12 noon. However, as soon as more flowers are formed spray 2-3 times a week for one month but not beyond 97 DAP. However, if the population is controlled on the first week, application may be suspended and resume when population of the insect is again observed. Spray cotton flowers with any insecticide using the manufacturers' rate. Dust flowers with

For minimum tillage (direct dibbling or furrow slicing method), dibble three seeds per hill for purelines and one or two seeds per hill for hybrid at 6 to 8 cm deep using a dibbler (any sharpened stick with about 4 cm in diameter) and cover thinly with soil.

g.4. Spacing/Plant Population. The desired plant spacing/density of pureline varieties for the various agro-climatic growing conditions in the country is shown in Appendix Table 1.

For NSIC- Ct₁₂ varieties, maintain one or two plants per hill at 100 cm between rows and 40-60 cm between hills while NSIC- Ct₁₃ maintain one or two plants per hill at 90-100 cm between rows and 30-60 cm between hills.

g.5. Seeding Rate. Seeding rate depends on the recommended plant density and percent seed germination. Late planting usually requires higher seeding rate. Generally, the recommended seeding rates with 85% germination are as follows (Table 5).

Table 5. Seeding rate per location.

Location	<i>G. hirsutum</i>	<i>G. barbadense</i>	Hybrid
Luzon	15 kg/ha	15 kg/ha	2-3 kg/ha
Visayas	15 kg/ha		
Mindanao	10 kg/ha		

If percent germination is below 85%, adjust the recommended seeding rate by an additional 3.0-5.0 kg seed per hectare for pureline varieties and 0.6 to 1 kg for hybrid variety.

Irrigate the field after planting, if necessary.

H. Replanting and Thinning

h.1. Replanting. Replant missing hills within 10 to 22 days after planting (DAP).

Raise seedlings in soil blocks for replanting purposes.

h.2. Thinning. Thin the plants within 14 to 27 DAP leaving two vigorous plants per hill for pureline varieties and one or two for hybrid variety. Delayed thinning results in weak and lanky plants.

I. Off-barring, Side-dressing and Hilling-up

i.1. Off-barring. Off bar the field at 22-27 DAP. Inter-tillage cultivation during the growing season controls weeds, provides good aeration, and hastens water infiltration. Off-barring and hilling-up may be done if minimum tillage without mulch is employed, especially in areas where weeds are prevalent and furrow irrigation is practiced.

i.2. Side-dressing and hilling-up. At 42-47 DAP, drop or dibble the fertilizer 3-5 cm away from the plant base. Hill-up thereafter to cover the fertilizer then irrigate immediately. Do not fertilize at noontime because this favors loss of N through volatilization. In case plants have very luxuriant growth, the application of sidedress N may be optional. The sidedress N can also be splitted at 35-42 DAP and at 55-60 DAP especially if the soil is sandy.

For rainfed areas, drop the fertilizer 3-5 cm away from the base of the plant and hill-up immediately. Apply the fertilizer when the soil moisture is enough to dissolve the fertilizer.

J. Irrigation

j.1. Irrigation can be done through the furrow or hose method, depending on water source and economics of application. The hose method is recommended when water for irrigation is scarce. This is done by carrying the hose (usually 1" – 1 1/4" plastic hose) and directing water discharge to the rows or hills.

To help reduce the frequency and amount of water application, mulch the field with suitable materials (usually rice straw). This is recommended in areas where mulching

Table 7. List of recommended insecticides (Continuation)

DAYS AFTER PLANTING	TARGET INSECT	INSECTICIDE			RECOMMENDED RATE, (ml or g/ha)	AMOUNT/ 16 li H ₂ O, using local nozzle (ml or g)	
		GROUP NAME	COMMON NAME	TRADE NAME			
64 – 91	Bollworm and other Defoliators		Cyfluthrin	Baythroid 50 EC	750	68	
			Fenvalerate	Kilpes 3 EC	1793	163	
			Lambda	Karate 2.5 EC	500	45	
			Cyhalothrin	Bida 2.5 EC	880	80	
			Carbamate	Methomyl	Lannate 40 SP	330	30
			Organo-Phosphate + Synthetic pyrethroids	Chlorpyrifos + Beta cyfluthrin	Rador 262.5 EC	660	60
			Insect Growth Regulator	Chlorfluazuron	Atabron 5E	550	50
			Oxydiazines	Indoxacarb	Steward WDG	55	5
			Diamides	Flubendiamide	Fenos SC 480	66	6
			-	Chlorantraniliprole	Prevathon ¹	165	15
92 – 105	Leafhopper/ Thrips	Organo-Phosphate	Profenofos	Selecron 500 EC	780	70	
			Dimethoate	Perfekthion 40 EC	180	17	
		Carbamate	BPMC	Hopcin 50 EC	1000	90	
		Carbamate	Carbaryl	Sevin 85S	1750	160	
		Organo-Phosphate + Synthetic Pyrethroid	Profenofos + Cypermethrin	Lannate 40 SP Polytrin C 440 EC	330 1000	30 90	
106 – 126	Aphids/ Mealybugs/ Cotton Stainer	Organo-Phosphate	Dimethoate	Perfekthion 40 EC	180	17	
			Profenofos	EC	780	75	
		Carbamate	BPMC	Selecron 500 EC Hopcin 50 EC	1000	90	

*Number of tankload/ha = 11

**Recommended for grub-infested areas

***As seed treatment

¹ Based on insecticide evaluation, Damo et al 2016.

Table 7. List of recommended insecticides for cotton in relation to crop age and target insects.

DAYS AFTER PLANTING	TARGET INSECT	INSECTICIDE			RECOMMENDED RATE, (ml or g/ha)	AMOUNT/ 16 li H ₂ O, using local nozzle (ml or g)	
		GROUP NAME	COMMON NAME	TRADE NAME			
Pre-plant	Grubs/ Nematodes/	Carbamate	Carbofuran**	Furadan 3G	33 kg (may be mixed with basal fertilizer)		
	Sucking Pests	Neonicotinoids	Imidacloprid	Gaucho 70 WS	5 ml/kg seed***		
22 – 42	Leafhoppers/ Thrips/ Aphids	Neonicotinoids	Imidacloprid	Confidor 100 SL	33	3	
		Organo-Phosphate	Dimethoate	Perfekthion 40 EC	180	17	
		Phosphate	Profenofos	Selecron 500 EC	780	70	
		Carbamate	BPMC	Hopcin 50 EC	1000	90	
	Bollworm	Carbamate	Carbaryl	Sevin 85S	1750	160	
		Organo-Phosphate	Profenofos	Selecron 500 EC	780	70	
		Insect Growth Regulator	Chlorfluazuron	Atabron	550	50	
43 – 63	Bollworm and other Defoliators	Organo-Phosphate	Profenofos	Selecron 500 EC	780	70	
		Carbamate	Carbaryl	Sevin 85 S	1750	160	
		Insect Growth Regulator	Chlorfluazuron	Atabron 5E	550	50	
		Oxydiazines	Indoxacarb	Steward WDG	55	5	
		Diamide	Flubendiamide	Fenos SC 480	66	6	
	Leafhopper/ Thrips/ Aphids/ Mites	Insecticides	-	Chlorantraniliprole	Prevathon ¹	165	15
		Organo-Phosphate	Profenofos	Selecron 500 EC	780	70	
		Dimethoate	Perfekthion 40 EC		180	17	
		Carbamate	BPMC	Hopcin 50 EC	1000	90	
		Organo-Phosphate	Triazophos	Hostathion 40 EC	800	70	
64 – 91	Bollworm and other Defoliators	Synthetic Pyrethroid	Cypermethrin	Flash 5 EC	900	82	
			Bugbuster 50 EC		900	82	
			Sherpa 5 EC		1430	130	
			Cymbush 5 EC		1100	100	
			Magnum 5 EC		1320	120	
			Punis X.5.5 EC		891	81	
			Cypro 5 EC		1892	172	
			Attack 5 R		1320	120	

materials are abundant and cost-free.

Irrigation should be done during the crop's critical stages, i.e., on the 6th, 8th, 11th, and 13th week after planting. If the above schedules are not applicable, irrigation may be based on mid-day wilting of the crop or soil-feel method as it relates to the available soil moisture. Based on feel and appearance of the soil 15 cm. from the surface, irrigate when the soil appears dry and will not form a ball with pressure on coarse and light soils, somewhat crumbly but will hold together with pressure on medium soils, or somewhat pliable but will form ball with pressure on heavy soils.

j.2. Drip fertigation is the application of irrigation water with dissolved fertilizer directly to the plant's root area through the use of drippers. (See brochure on drip fertigation.)

K. Pest Management

k.1. Insect Pest Management

k.1.a. Insect Pest Monitoring. Insect Pest Monitoring is vital for successful pest management. It gives timely information on the presence of pest, thus, allowing an intelligent decision whether insecticides are needed or not.

Survey weekly 10 randomly selected plants for the presence or absence of pests starting from 21 to 105 DAP. Natural enemies of cotton insect pests help in suppressing the pest population. Hence, they should be preserved by applying insecticides only when the critical pest level (CPL) for each pest is reached (Table 6).

Table 6. Critical pest levels for cotton insect pests in the Philippines

Pest	Days After Planting	Critical Pest Level (CPL) ^{1/} (Based on 10 sample plants)
Bollworm Larvae	22-63	2 plants ^{2/} with bollworm
	64-91	1 plant ^{2/} with bollworm
	93-105	1 plant ^{3/} with bollworm
Leafhopper	22-91	5 plants ^{4/} with leafhopper and with sucking damage ^{7/}
Aphids	22-91	6 plants ^{4/} with aphids
	92-126	2 highest open bolls ^{5/} with honey dew
Thrips	22-63	4 plant tips ^{6/} with thrips
	64-105	2 third leaves with thrips
Flower weevil/ Pink bollworm	Flowering period	1 adult
Mites	43-63	6 third leaves with mites
Defoliators	43-91	7 third leaves with feeding damage
	92-105	6 third leaves with feeding damage

^{1/} Spray when these levels are reached. ^{4/} Inspect 3 leaves from top, middle, bottom portion of the sample plant.

^{2/} Whole plant. ^{5/} The highest open boll on the sampling plant or the first open boll on the way to the next sampling plant.

^{3/} The second sympodial branch Below the plant terminal. ^{6/} Top 5 cm of the plant mainstem.

^{7/} Leaf edges hopper burn.

To check the effectiveness of the insecticide used against the target insect pests, conduct an insect survey three days after spraying.

k.1.b. Management options for each insect pest

a. Leafhopper

- *Use resistant varieties* - Plant resistant varieties such as CRDI-1, UPL-C₂, Navkar 5 and Bioseed 6527. Using these varieties can delay insecticide application that favors preservation and increase in population of natural enemies.

- Spray recommended insecticide when CPL is reached (see Table 6 for critical pest levels of cotton insect pests and Table 7 for recommended insecticides).

b. Cotton Bollworm

- *Release Trichogramma chilonis*- *Trichogramma chilonis* is recommended whenever available because it parasitizes eggs of *H. armigera*. Parasite density of 67,000 *Trichogramma* (34 strips) per hectare per release is recommended at two releases per week commencing at 27 DAP or when cotton bollworm eggs are observed. Parasite density can be increased in areas with abundant supply of *Trichogramma*.

- *Use Trap Crops* - Single rows of tomato, tobacco and corn planted at an interval of 15-20 rows of cotton can be employed to divert cotton bollworm moth away from cotton. The trap crop is regularly checked for the initial infestation of the cotton bollworms and are either handpicked or sprayed with appropriate insecticides. These trap crops are also good shelters for parasitoids and predators in addition to providing additional income.

- Spray the recommended insecticide when necessary (see Table 6 for the critical pest levels of cotton insect pests and Table 7 for the recommended insecticides).