

Aphids

Cotton aphid – *Aphis gossypii*
Green peach aphid – *Myzus persicae*
Cowpea aphid – *Aphis craccivora*

Cotton aphid is the most common aphid pest in cotton. Green peach aphid is occasionally a pest of young cotton but declines through the hotter part of the year. Cowpea aphid will colonise cotton but rarely becomes a problem.

Damage symptoms

Nymphs and wingless adults of cotton aphid cause early to late season damage to terminals, leaves, buds and stems. Cotton aphids have been shown to transmit the disease Cotton Bunchy Top (CBT). CBT is described on page 120. Once bolls begin to open, the sugary ‘honeydew’ excreted by aphids can contaminate the lint.

Sampling

Sample what?

Sampling should focus on non-winged adults together with their nymphs. Winged adults may be transitory, while the presence of non-winged adults together with their nymphs indicates a population has settled in the crop.

Sample for Species and Population

Species: Verify which aphid species is present before implementing any management strategies. Cotton aphid is more common and can be a vector of CBT, but green peach aphid can cause more severe damage than cotton aphid at lower densities.

Cotton aphid can be distinguished from green peach aphid by close examination with a hand lens. The distinguishing features are presence or absence of tubercles (on the head between the antenna), and the length of the siphunculi (between the back legs). As depicted in the diagrams above, green peach aphid has tubercles and long siphunculi. Cotton aphid doesn't have tubercles (the head is smooth between the antenna) and the siphunculi between the back legs are very short. If you are unable to make a determination, or suspect both could be present, contact Lewis Wilson, CSIRO Plant Industry at Narrabri, to arrange for a sample to be sent for identification. Contact details are provided at the end of this section.

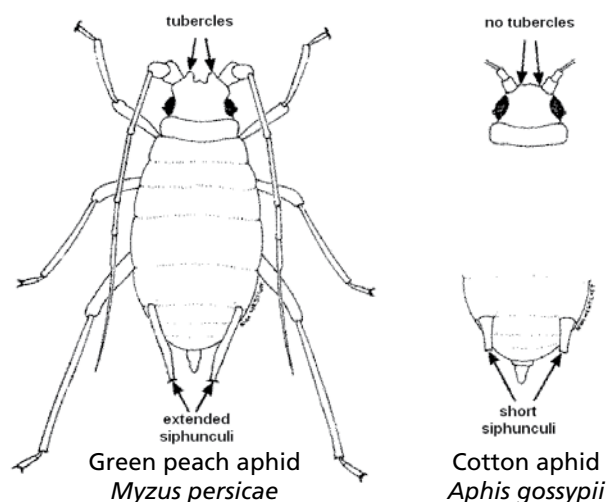
Population: Sample for non-adults and nymphs on the underside of mainstem leaves 3–4 nodes below the plant terminal. If a high proportion of plants have only the winged form, recheck within a few days to see if they have settled and young are being produced.

Frequency

Check the **population** at least weekly. Begin aphid sampling at seedling emergence and continue until defoliation. The **species** composition may change during the season. Particularly when aphid infestation occurs early in the season, the species should be verified on more than one occasion during the season.

Methods

Seedling to first open boll: Use a 0–5 scoring system based on the number of aphids /leaf. The protocols for scoring aphids are presented in full on page 14–15. The presence/absence sampling method is no longer recommended during this part of the season as recent research has found that this technique has poor precision in the range from 80–100% plants infested.



If hot spots of cotton aphid are found early season, monitor cotton for symptoms of CBT.

First open boll to harvest: Use a presence/absence scoring system. Check one leaf /plant. Choose a recently expanded leaf, close to the plant terminal. Only score a plant as infested if there are 4 or more non-winged aphids within 2 cm². Aphids are most abundant on the edges of fields so ensure perimeter sampling occurs. Assess plants for the presence of honeydew.

Thresholds

From the seedling stage through until first open boll, thresholds are based on the potential for the aphid population to reduce yield. These thresholds are dynamic, allowing the grower/consultant to consider the value of the crop and the cost of control as part of the decision. After first open boll the thresholds aim to protect the quality of the lint by avoiding contamination from honeydew. As penalties for honeydew contamination are severe, thresholds aim to limit honeydew contamination to trace amounts.

While thresholds do not take into account the risk of CBT, recent research has shown that risks are low unless significant populations of ratoon cotton or alternative weed hosts are neighbouring or within the field. Only when CBT symptoms are found in crops early in the season do thresholds need to be reduced.

Cotton aphid

SEEDLING TO FIRST OPEN BOLL	FIRST OPEN BOLL TO HARVEST
Calculate the Cumulative Season Aphid Score (page 15)	50% plants infested or 10% if trace amounts of honeydew present

Green peach aphid

SEEDLING TO FLOWERING	FLOWERING TO HARVEST
25% plants infested	Populations decline in hot weather. Highly unlikely to be present post-flowering.

Key beneficial insects

Predators – lady beetle larvae and adults, red and blue beetles, damsel bugs, big-eyed bugs, lacewing larvae, hoverfly larvae.
Parasitoids – *Aphidius colemani*, *Lysiphlebus testaceipes* (these cause mummification).

Selecting an insecticide

The insecticide products registered for the control of cotton aphid and green peach aphid in cotton in Australia are presented in Table 2 on page 13.

Survival strategies

Resistance profile – Cotton aphid

WIDESPREAD, HIGH LEVELS OF RESISTANCE	WIDESPREAD, LOW/MOD LEVELS OF RESISTANCE
acetamiprid, clothianidin thiamethoxam, and imidacloprid (chloronicotinyl)	
OCCASIONAL DETECTION OF HIGH LEVELS OF RESISTANCE	OCCASIONAL DETECTION OF LOW LEVELS OF RESISTANCE
pyrethroids (SP) dimethoate (OP) omethoate (OP) profenofos (OP) pirimicarb (carbamate)	endosulfan (OC) chlorpyrifos-methyl (OP)
CROSS RESISTANCE	
Strong cross-resistance between omethoate or dimethoate and pirimicarb Strong cross-resistance between all the chloronicotinyls (neonicotinoids)	

Neonicotinoid resistance in cotton aphid is of great concern. This group is important because it will control OP/carbamate resistant cotton aphids. The neonicotinoid group includes the active ingredients acetamiprid, thiamethoxam, clothianidin and imidacloprid. Neonicotinoid resistance was first detected in 2007/08 and in 2008/09 field control failures were reported against acetamiprid and clothianidin in two of twenty four strains tested. Subsequent testing of those strains has shown neonicotinoid resistance to be common with some strains acetamiprid, thiamethoxam, imidacloprid and clothianidin resistant. A significant reduction in selection pressure will be needed before neonicotinoid resistance declines. This will likely require the judicious use of neonicotinoid foliar sprays. It remains critical



Aphids and mummies. (Lewis Wilson, CSIRO)

to follow the recommendations of the industry’s IRMS and rotate insecticide chemistries taking into account the insecticide group of any seed treatment or at-planting insecticide. Additionally, a critical part of the IRMS for aphids is the 30+ day gap between the end of pirimicarb window and the start of the dimethoate/omethoate window because of cross resistance. Neonicotinoid resistance will place additional pressure on pirimicarb and dimethoate/omethoate and attention should be paid to their effective management.

Resistance profile –Green peach aphid

HIGH LEVELS OF RESISTANCE	LOW / MOD LEVELS OF RESISTANCE
dimethoate (OP) omethoate (OP) chlorpyrifos (OP) monocrotophos (OP)	pirimicarb (carbamate) profenofos (OP)
CROSS RESISTANCE (DIFFERENT TO COTTON APHID)	
No cross-resistance between omethoate or dimethoate and pirimicarb	

Over-wintering habit

Aphids don’t have an overwintering form, but cool temperatures slow the growth rate of aphids dramatically. In cotton growing areas aphids persist through winter on whatever suitable host plants are available.

Alternative hosts

Cotton aphid has a broad host range, including many common weeds. Winter weed hosts include; marshmallow, capeweed and thistles. Ratoon or volunteer cotton is a host and may also carryover the CBT disease. Some legume crops such as faba beans are also potential winter hosts. Spring and summer weed hosts include; thornapples, nightshades, paddymelon, bladder ketmia and Bathurst burr. Sunflower crops and volunteers also accommodate the cotton aphid.

Winter weeds that support green peach aphids include; turnip weed and marshmallow. Spring germinations of peach vine and thornapples also host green peach aphid. Canola is an attractive host crop through late winter and early spring.

Further Information

CSIRO Plant Industries, Narrabri
Lewis Wilson: (02) 6799 1550 or 0427 991 550
I&I NSW, Camden
Grant Herron: (02) 4640 6471



Aphids on cotton. (Lewis Wilson, CSIRO)

TABLE 2: Control of aphids

Active ingredient	Concentration and formulation	Application rate of product	<i>A. gossypii</i> resistance detected	Comments
Cotton aphid <i>Aphis gossypii</i> and Green peach aphid <i>Myzus persicae</i>				
Acetamiprid	225 g/L SL	0.05–0.1 L/ha	Yes	Ensure good coverage. Use high rate under sustained heavy pressure.
Aldicarb	150 g/kg G	3.0–7.0 kg/ha	No	Apply into the seed furrow at sowing. Refer to the label for the method of distribution.
Amitraz	200 g/L EC	2.0 L/ha	No	Suppression when used for controlling Helicoverpa.
Chlorpyrifos	300 g/L EC, EC/ULV 500 g/L EC	0.5–0.7 L/ha 0.3–0.4 L/ha	No	Use higher rates on heavy infestations.
Clothianidin	200g/L SC	0.125-0.25L/ha	Yes	Apply when aphid numbers are low and beginning to build.
Diafenthiuron	500 g/L SC	0.6 or 0.8 L/ha	Yes low level	Apply before damage occurs. Only use lower rate when spraying by ground rig.
Dimethoate	400 g/L EC	0.5 L/ha	No	Do not use where resistant strains are present.
Disulfoton	50 g/kg G	14.0 kg/ha	No	Apply in band near seed at planting.
Endosulfan	350 g/L EC	2.1 L/ha	No	Apply at first sign of infestation. Ensure pesticide application management plan (PAMP) is completed.
Imidacloprid	200 g/L SC	0.25 L/ha	Yes	Add Pulse penetrant at 0.2% v/v (2 mL/L water)
Omethoate	800 g/L SL	0.25 L/ha	No	Apply by ground or air.
Paraffinic oil	792 g/L	2% or 2L/100 L of water	No	Apply by ground rig using a minimum of 80L/ha of water. If populations exceed 20 per terminal use in a mixture with another aphicide.
Parathion-methyl	500 g/L EC	0.7–1.4 L/ha	No	Use low rate on light infestations and open crops. Ground application only. Higher rate in NSW only.
Phorate	100 g/kg G	6.0 kg/ha	No	For short residual control.
		11.0–17.0 kg/ha	No	For extended period of control. Only use the highest rate on heavy soils when conditions favour good emergence.
	200 g/kg G	3.0 kg/ha	No	For short residual control.
		5.5–8.5 kg/ha	No	NSW registration only.
Pirimicarb	500 g/kg WDG, WP	0.5 or 0.75 kg/ha	No	Thorough spray coverage essential for best results.
Profenofos	250 g/L EC 500 g/L EC	2.0 L/ha 1.0 L/ha	No	Spray timing is important. For best results apply when pest levels have reached commercial thresholds.
Pymetrozine	500 g/kg WDG	0.4 kg/ha	No	Apply to an actively growing crop prior to cut out. Add 0.2% v/v organo-silicone surfactant.
Spirotetramat	240g/L SC	0.3-0.4L/ha	No	Add Hasten Spray Adjuvant 1.0L/ha.
				Use the higher rate when periods of high pest pressure or rapid crop growth are evident, when longer residual control is desired or when crops are well advanced.
				Do not re-apply within 14 days of a previous Movento spray. Do not apply more than 2 applications per crop.
Thiamethoxam	250 g/kg WDG	0.2 kg/ha	Yes	Add 0.2% w/v organo-silicone surfactant. Apply to aphid population in early stages of development. DO NOT apply more than twice per season or as consecutive sprays.

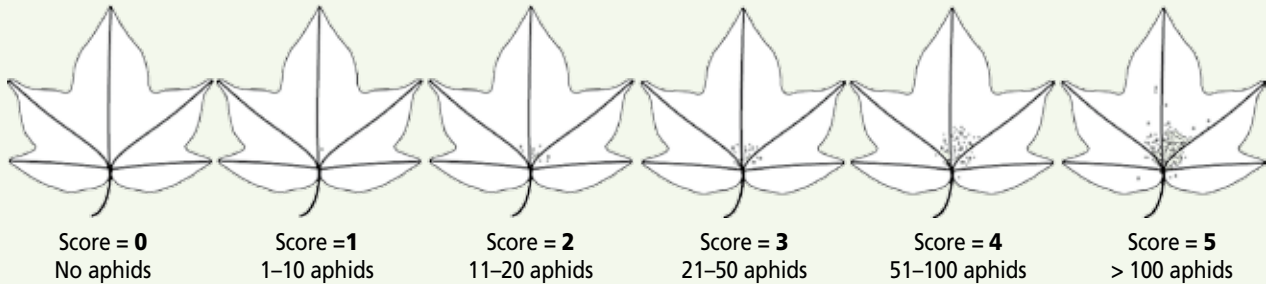
SAMPLING PROTOCOLS FOR COTTON APHID FOR USE UNTIL FIRST OPEN BOLL

STEP 1. COLLECT LEAVES.

Fields should be sampled in several locations as aphids tend to be patchy in distribution. At each location collect at least 20 leaves, taking only one leaf per plant. Choose mainstem leaves from 3–4 nodes below the terminal. The same leaves can also be used for mite and whitefly scoring. It is important to sample for aphids regularly, even if it is suspected that none are present. The estimate of yield loss will be most accurate when sampling detects the time aphids first arrive in the crop.

STEP 2. SCORE LEAVES.

Allocate each leaf a score of 0, 1, 2, 3, 4 or 5 based on the number of aphids on the leaf. After counting aphids a few times, you will quickly gain confidence in estimating abundance. As a guide, the diagrams below represent the minimum population for each score. Discount pale brown bloated aphids as these are parasitised. Sum the scores and divide by the number of leaves to calculate the Average Aphid Score.



STEP 3. USE THE APHID YIELD LOSS ESTIMATOR ON THE WEB.

In order to estimate yield loss, the Average Aphid Score must firstly be transformed into a Sample Aphid Score and then into a Cumulative Season Aphid Score. Record keeping and calculation of these Scores can be simplified by using the Aphid Yield Loss Estimator in CottASSIST on the web. The Tool allows users to keep records for multiple crops on multiple farms throughout the season. After initial set up, the user enters the Average Aphid Score from Step 2 and the date of each check. The Tool then calculates the Scores and tracks the estimate of yield loss. Find CottASSIST on the 'Industry' home page in the Cotton CRC website.

Alternatively, the Scores can be calculated manually by following Steps 4 and 5.

Example yield loss estimate from the Aphid Yield Loss Estimator web tool.

CottASSIST | Aphid Analysis - Microsoft Internet Explorer provided by NSW Primary Industries

Address: <http://www.cottassist.cottoncrc.org.au/Aphids/AphidAnalysis.aspx>

Welcome The Boll Baron! [Log Out](#)

Aphid Yield Loss Estimator

Select a Crop: 2003-04 FNC 168d
 Sow Date: 09/10/2008
 Farm Name: Gofastorgohome

Aphid Samples

Sample Date	AAS	CSAS	Trem	Yield Loss
22/12/08	0.012	0.030	106	0.00%
30/12/08	0.000	0.078	106	0.00%
05/01/09	0.000	0.000	92	0.00%
12/01/09	0.000	0.000	85	0.00%
19/01/09	0.525	1.838	85	0.00%
27/01/09	0.113	4.390	85	0.00%
02/02/09	0.450	6.079	85	0.00%
09/02/09	0.700	10.104	85	1.32%
16/02/09	0.950	15.879	85	3.31%
01/03/09	0.625	26.116	85	6.78%

Predicted Yield Loss

% Yield Loss vs Sample Date

Legend: Sprayed (red), Natural Reset (blue)

STEP 4. MANUAL CALCULATION OF THE CUMULATIVE SEASON APHID SCORE.

Use the Look Up Table below to firstly convert the Average Aphid Score calculated in Step 2 to a Sample Aphid Score. This step accounts for the length of time the observed aphids have been present in the crop. If aphids are found in the first assessment of the season, assume the 'Score last check' was '0' and that it occurred 5 days ago.

Find the value in the table where 'this check' and the 'last check' intersect. Multiply this value by the number of days that have lapsed between checks. This value is the Sample Aphid Score.

As the season progresses, add this check's Sample Aphid Score to the previous value to give the Cumulative Season Aphid Score.

When aphids are sprayed, or, if during the season the Average Aphid Scores return to '0' in 2 consecutive checks, reset the Cumulative Season Aphid Score to '0'. Disappearance of aphids can occur for reasons such as predation by beneficials, changes in the weather and insecticide application.

Average score last check	Average score this check										
	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
0	0.0	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5
0.5	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.8
1.0	0.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.8	3.0
1.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.8	3.0	3.3
2.0	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.8	3.0	3.3	3.5
2.5	1.3	1.5	1.8	2.0	2.3	2.5	2.8	3.0	3.3	3.5	3.8
3.0	1.5	1.8	2.0	2.3	2.5	2.8	3.0	3.3	3.5	3.8	4.0
3.5	1.8	2.0	2.3	2.5	2.8	3.0	3.3	3.5	3.8	4.0	4.3
4.0	2.0	2.3	2.5	2.8	3.0	3.3	3.5	3.8	4.0	4.3	4.5
4.5	2.3	2.5	2.8	3.0	3.3	3.5	3.8	4.0	4.3	4.5	4.8
5.0	2.5	2.8	3.0	3.3	3.5	3.8	4.0	4.3	4.5	4.8	5.0

STEP 5. MANUAL CALCULATION OF THE YIELD LOSS ESTIMATE.

Use the table to estimate the yield loss that aphids have already caused. The 'Time Remaining' in the season needs to be determined the first time aphids are found in the crop. The data set is based on 165 days from planting to 60% open bolls. If for example aphids are first found 9 weeks after planting, the Time remaining would be ~100 days. As the Season Aphid Score accumulates with each consecutive check, continue to read down the '100' days remaining column to estimate yield loss. When aphids are sprayed, or, if aphids disappear from the crop then reappear at a later time, reassess the time remaining based on the number of days left in the season at the time of their reappearance.

Crop sensitivity to yield loss declines as the crop gets older. The estimate takes into account factors that affect the rate of aphid population development, such as beneficials, weather and variety. Yield reductions >4% are highlighted, however the value of the crop and cost of control should be used to determine how much yield loss can be tolerated before intervention is required.

Cumulative Season Aphid Score	Time Remaining (days until 60% open bolls at the time when aphids are first observed)									
	100	90	80	70	60	50	40	30	20	10
0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
10	2	2	1	1	1	0	0	0	0	0
15	5	4	3	3	2	1	1	0	0	0
20	7	6	5	4	3	2	1	1	0	0
25	9	8	7	6	5	3	2	1	0	0
30	11	10	8	7	6	5	3	2	1	0
40	15	13	12	10	8	7	5	3	1	0
50	19	17	15	13	11	9	7	5	2	0
60	23	21	18	16	13	11	8	6	3	1
80	31	28	25	22	18	15	12	8	5	1
100	38	34	31	27	23	19	15	11	7	2
120	45	41	37	32	28	23	18	13	9	3