

SAMPLING METHODS FOR THE CRITICAL PERIOD FOR WEED CONTROL

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What is the critical period for weed control

The critical period for weed control is a concept that relates the yield losses caused by weed competition to an economic threshold. It establishes an initial period when weeds are small and do not need to be controlled as they cause no economic loss, and a period later in the season when the cotton plants are relatively large and small weeds again cause no economic loss. These periods define the middle, critical period for weed control, in which weeds must be controlled while still small to avoid significant yield losses. Weeds which emerge after the critical period may still need to be controlled to avoid harvesting difficulties and lint contamination and should not be allowed to set seed, as this will lead to increased weed problems in later seasons. These weeds can also harbour pests and diseases. However, the timing of this control is flexible, provided seed set is prevented, and can be delayed to minimise the number of spray applications required over the season.

In practice, the critical period is defined by the type and density of weeds, potential crop yield, the cost of weed control and the economic threshold the cotton grower chooses. The critical period is defined in Table 1 for large and medium sized broadleaf and grass weeds in high yielding irrigated cotton, and lower yielding or rain-fed crops. Earlier articles defined a critical period

based on lower thresholds. The increased thresholds reflect the jump in glyphosate prices late last year.

The discussion focuses on the management of Roundup Ready Flex cotton crops because the critical period is readily adapted to the Roundup system and this is the most common cropping option used. The concept can be equally applied to conventional and Liberty Link crops.

Applying the critical period

Determining the critical period for weed control in a field requires a knowledge of the degree days since crop planting and the type and density of weeds present in the field. Degree days are calculated from the daily maximum and minimum temperatures since planting.

The type and density of weeds is determined from an in-field assessment. This assessment may take 30 - 40 minutes for each field, but is only required in the early part of the season and only after rainfall or irrigation events trigger new flushes of weeds.

The ability to identify weeds to species level is not necessary for the weed assessment, as weeds are grouped into 3 categories. Commonly occurring weeds in each category are:

- Large broadleaf weeds:
 - the noogoora burr group (Noogoora burr, Californian burr and Italian cocklebur),
 - thornapples (fierce thornapple, downy thornapple and common thornapple),
 - sesbania and budda pea

Seedling photos of these weeds can be found in WEEDpak on the COTTONpaks cd or at <http://www.cottoncrc.org.au>

Table 1. The start and end of the critical period for weed control for a range of weed types and densities. The minimum weed densities needed to trigger the critical period are also shown.

The Critical Period for Weed Control in cotton (day degrees since planting)												
Weed density (no./m ²)	High yielding cotton crops						Low yielding cotton crops					
	Broad-leaf weeds				Grasses		Broad-leaf weeds				Grasses	
	Large		Medium		Start	End	Large		Medium		Start	End
Start	End	Start	End	Start			End	Start	End			
0.1	145	189	145	172	-	-	-	-	-	-	-	-
0.2	144	275	144	244	-	-	254	229	-	-	-	-
0.5	143	447	143	387	-	-	251	368	-	-	-	-
1	141	600	141	514	-	-	246	498	246	319	-	-
2	139	738	139	627	-	-	238	620	238	421	-	-
5	131	862	131	729	129	174	215	735	215	537	-	-
10	121	915	121	771	127	248	184	785	184	595	152	206
20	106	944	106	795	125	357	142	812	142	631	147	290
50	87	962	87	810	119	531	93	830	93	654	134	431
Min. density	0.06		0.07		2.5		0.24		0.59		5.4	

- Medium broadleaf weeds:
 - All other weeds can be included in this group. If in doubt, put them here.
- Grasses:
 - includes the grasses and other grass-like species, such as the nutgrasses

The field sampling technique

The sampling technique to estimate the density of each weed type is similar to the technique used in the weed survey required by the Roundup Ready and Liberty Link Crop Management Plans.

Firstly, weed patchiness is assessed by a “drive-by” survey around the perimeter of the field, noting the location of the more weedy areas in the field. The density of each weed type is then assessed in 3 to 5 different areas of the field, with more sampling required on larger fields. The location of these assessments is determined from the drive-by survey, ensuring that the more weedy areas of the field are included in the assessments. Ensure that both head ditch and tail ditch ends of the field are checked, and that the observations are not concentrated on the edge of the field. On deep fields with runs of 1000 m or more, it may be necessary to go further into the field than the 250 m suggested below.

Once the areas for assessment are located, the assessment is undertaken by walking approximately 250 m into the field in each area and estimating weed density and type. The 500m walk (250 m each way) is broken into 50m strips, moving across 10 rows after each 50 m strip and estimating the density of each weed type in each 50 m strip (each strip is 1 m wide, from cotton row to cotton row). Ensure that the survey covers both beds and furrows in 2 m beds or other configurations).

The weed assessment method is simple. In each strip, the density of large and medium broadleaf weeds and grasses is assessed. This is done by estimating the density of each weed type as <5/50 m row, 5-50/50 m row, 50-500/50 m, or > 500/50 m. At first it may be necessary to count a few weeds to get an idea of what these densities look like, but the densities can be easily estimated by eye with experience. Density can be easily calculated in cotton on a 1 m planting configuration by visualizing a 1 m square area and counting the number of weeds in this area. One weed per square m equates to 50 weeds per 50 m². The exact length of each transect (50 m) is not critical, but is a guide to the amount of area which should be covered. It is essential that the survey goes towards the middle of the field, as the edge area may not be representative of the whole field.

A table for the weed assessments is given at the end of this document. To use this table:

1. For each 50 m strip, write a score of 1, 2, 3 or 4 corresponding to the estimated density of each weed type.
2. Add the scores in each column and add the columns to give a total for the assessment, as in the example below.

Large broadleaf weeds		Number per 50 m of row				Total
		<5 1	5 - 50 2	50 - 500 3	>500 4	
0-50 m			2			
50-100 m			2			
100-150 m			2			
150-200 m	1					
200-250 m			2			
250-200 m	1					
200-150 m	1					
150-100 m	1					
100-50 m	1					
50 - 0 m				3		
Sum		<u>5</u>	<u>8</u>	<u>3</u>		16

3. The scores from this assessment, along with the scores from the other assessments done in the paddock are transferred to the Score Summary, as in the example below.

Score Summary	1	2	3	4	5
Large broadleaf	16	12	23	19	30
Medium broadleaf					
Grasses					

4. These numbers are converted to weed density using the table of Scores and Weed densities on the right hand side of the page, recorded in the Assessment Summary, and the average entered, as shown below.

Assessment summary	1	2	3	4	5	Average
Large broadleaf	0.2	0.079	1	0.4	5	<u>1.3</u>
Medium broadleaf						—
Grasses						—

5. This average is the field density of broadleaf weeds used to determine the critical period for weed control for this field. In this case, a density of 1.3 translates to a critical period from 139 to 738 day degrees duration, using the closest higher number from the Critical Period table (Table 1).

If the density of large broadleaf weeds (1.3/m²) occurred within the Critical period, then a spray should be applied as soon as practical.

Outside the Critical Period, this weed density could be tolerated, provided the weeds are controlled before they set seed. However, if another flush of weeds emerges soon after, the field may need to be reassessed, as the increased weed density may fall within the new Critical Period that is derived by the new, larger, weed population.

Summary

- Use a drive-by survey to identify patches of heavier weeds in the field
- Assess weeds in 3 - 5 of the more weedy areas (depending on field size)
- Estimate the weed type and density on a 250 m strip into the field at each assessment point
- Use these assessments to determine the Critical Period for Weed Control for this crop.
- Organise to control weeds as soon as practical if the weed flush is within the Critical Period
- If not, monitor the weeds and control them before they set seed.

Applying the critical period requires that weed control begins soon after emergence in high yielding crops, while weeds are still small. A lighter herbicide rate would be appropriate for these weeds. The threshold will be reached later in lower yielding crops. The duration of the critical period depends on the density of weeds present.

All weed flushes can be controlled with Roundup during the critical period within the constraints of the Roundup Ready Herbicide label, with an inter-row cultivation or early layby available as an additional management tool if required.

Ensuring weeds are controlled soon after emergence is a practical approach to weed control which will help maximize crop yields. The approach can be equally applied to irrigated and dryland crops using Roundup Ready Flex, Liberty Link[®] or conventional cotton varieties.

The Critical Period Weed Sampling Sheet

Date:
Property:

Recorder:
Field:

Assessment:

Large broadleaf
weeds

Number per 50 m of row

<5	5 - 50	50 - 500	>500
1	2	3	4

0-50 m				
50-100 m				
100-150 m				
150-200 m				
200-250 m				
250-200 m				
200-150 m				
150-100 m				
100-50 m				
50 - 0 m				
Total				

Large broadleaf – Noogoora burrs,
thornapples, sesbania & budda pea
Medium broadleaf – all other
broadleaf weeds
Grasses – grasses and all grass like
weeds

Sum

—	—	—	—
---	---	---	---

Medium broadleaf
weeds

<5	5 - 50	50 - 500	>500
1	2	3	4

0-50 m				
50-100 m				
100-150 m				
150-200 m				
200-250 m				
250-200 m				
200-150 m				
150-100 m				
100-50 m				
50 - 0 m				
Total				

Sum

—	—	—	—
---	---	---	---

Grasses

<5	5 - 50	50 - 500	>500
1	2	3	4

0-50 m				
50-100 m				
100-150 m				
150-200 m				
200-250 m				
250-200 m				
200-150 m				
150-100 m				
100-50 m				
50 - 0 m				
Total				

Sum

—	—	—	—
---	---	---	---

Assessment score

1	2	3	4	5
---	---	---	---	---

Large broadleaf

--	--	--	--	--

Medium broadleaf

--	--	--	--	--

Grasses

--	--	--	--	--

Assessment summary

1	2	3	4	5	Average
---	---	---	---	---	---------

Large broadleaf

					—
--	--	--	--	--	---

Medium broadleaf

					—
--	--	--	--	--	---

Grasses

					—
--	--	--	--	--	---

Assessment
score

Weed
density

1	0.006
2	0.008
3	0.010
4	0.013
5	0.016
6	0.020
7	0.025
8	0.032
9	0.040
10	0.05
11	0.063
12	0.079
13	0.10
14	0.13
15	0.16
16	0.20
17	0.25
18	0.32
19	0.40
20	0.5
21	0.63
22	0.79
23	1.00
24	1.26
25	1.58
26	1.99
27	2.51
28	3.15
29	3.97
30	5
31	6.29
32	7.92
33	10
34	12.6
35	15.8
36	19.9
37	25.1
38	31.5
39	39.7
40	50

Examples of Large Weeds



Noogoora burr complex:
Italian cockleburr, Californian burr
and Noogoora burr (L to R)



Thornapple complex:
common thornapple,
fierce thornapple, and
downy thornapple



Sesbania and budda pea



The Critical Period for Weed Control in cotton (day degrees since planting)														
Weed density (no./m ²)	High yielding cotton crops						Low yielding cotton crops							
	Broad-leaf weeds				Grasses		Broad-leaf weeds				Grasses			
	Large		Medium		Start	End	Large		Medium		Start	End	Start	End
	Start	End	Start	End			Start	End	Start	End				
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