Recovering from 2,4-D damage - Induced water stress.

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The tips of a cotton crop showing typical symptoms of 2,4-D damage.

Over the years, growers have tried a range of strategies to try to help crops recover from herbicide damage, including:

- Additional irrigations,
- Additional fertilizer, and
- Slashing.

All of which appear to give little or no benefit.

However, an observation made over the last couple of seasons was that phenoxy damage (typically 2,4-D damage) was reduced where cotton plants were stressed at the time of exposure to the herbicide. This observation appears to have some merit, as the phenoxy herbicides act by causing uncontrolled cell division and growth (as well as a range of other effects), such that the plant literally grows itself to death. It stands to reason that a phenoxy herbicide will have little effect on a plant which is not growing. The theory is also supported by observations in the south, where 2,4-D applications to control saffron thistles in wheat in winter can be ineffective if the applications are followed by a series of cloudy days or heavy frosts, where the weeds are not actively growing.

TESTING THE THEORY

An experiment to test the stress theory was established at ACRI on the 9th October 2009, in what was a hot, dry spring. The crop was exposed to 1% of a typical field rate of 2,4-D amine (16 ml of Amicide 625 per ha) applied at 8 nodes of crop growth on the 27th November, 6 days before the 1st in-crop irrigation (on the 3rd of December), and 24 days before the 2nd irrigation (on the 21st of December). Water stress was imposed on some treatments following the herbicide damage by skipping either the 1st or both the 1st and 2nd irrigations.

The results of the first part of the experiment were quite disappointing (Table 1), with the crop showing no yield reduction due to the herbicide damage and no effect of the water stress – except a small increase in yield on the stressed plots! So, did something go wrong? Yes, it rained, with 47 ml recorded on the day of the 2nd irrigation and a further 186 ml in the following 11 days. The only yield effect of the treatments was a yield increase where the irrigations were missed, presumably due to a reduction in water logging on these treatments!

Table 1. Impact on lint yield of exposure to a 1% rate of 2,4-D at 8 nodes

	Irrigations in Nov & Dec		
	Full irrigation	**Missed 1st irrigation**	**Missed 1st & 2nd irrigations**
Untreated	12.7	13.0	13.7
1% 2,4-D	13.2	13.4	13.7

Nevertheless, the herbicide damage and the irrigation delay each caused a delay in crop maturity of 7 or more days, with no indication that delaying the irrigations improved crop recovery from the herbicide damage (Table 2). None of the treatments affected fiber quality.

Table 2. Days delay in crop maturity from a 1% rate of 2,4-D at 8 nodes

	Irrigations in Nov & Dec		
	Full irrigation	**Missed 1st irrigation**	**Missed 1st & 2nd irrigations**
Untreated	-	7	7
1% 2,4-D	22	15	21

A SECOND TRY

The treatments were repeated with the next two irrigations, with the 2,4-D applied at 18 nodes of crop growth, on the 11th of January. This spray, again at 1%, occurred 10 days before the 3rd irrigation (21 January), and 24 days before the 4th irrigation (4 February), with some treatments skipping these two irrigations.

Again rain occurred on the 3 days following the 4th irrigation (46 ml), but this time the rain had little impact on the results.

This time the data did support the theory that a stressed plant would be less affected by 2,4-D damage, with a reduction in the effect of 2,4-D damage due to imposing water stress after the herbicide exposure: from a 19%

reduction in yield from 2,4-D damage with full irrigation, down to a 9% reduction with 2 missed irrigations when compared with treatments with the same water regime but without the herbicide damage (Table 3). However, missing two irrigations in the middle of the season caused a 34% yield reduction (in the absence of 2,4-D), so any benefit by reducing the impact of the 2,4-D damage was more than lost by the damage caused by missing the irrigations!

Looking at it another way. The 2,4-D damage caused a 2.5 bale yield loss under full irrigation. Imposing water stress after the damage was first noticed resulted in a further 2.5 bale yield loss, with a 5 bale yield loss from the combination of 2,4-D and water stress!! Imposing water stress is a really bad way of dealing with 2,4-D damage!

Table 3. Impact on lint yield of exposure to a 1% rate of 2,4-D at 18 nodes

	Irrigations in Jan & Feb		
	Full irrigation	**Missed 3rd irrigation**	**Missed 3rd & 4th irrigations**
Untreated	12.7	13.0	8.4
1% 2,4-D	10.2	10.9	7.7
Yield reduction	19%	16%	9%

Again, the herbicide damage and the irrigation delay each caused a delay in crop maturity of 7 or more days, with no indication that delaying the irrigations improved crop recovery from the herbicide damage (Table 4). None of the treatments affected fiber quality.

Table 4. Days delay in crop maturity from a 1% rate of 2,4-D at 18 nodes

	Irrigations in Jan & Feb		
	Full irrigation	**Missed 3rd irrigation**	**Missed 3rd & 4th irrigations**
Untreated	-	7	7
1% 2,4-D	14	26	18

So, the theory of using moisture stress to ameliorate 2,4-D damage appears to be sound, but in practice it's like cutting off your arm to save your hand. It just doesn't work!

The option of not irrigating a 2,4-D damaged crop for a few weeks mid-season to see how bad the damage is, is a poor option. The decision to persist with or to terminate a crop should be made as soon as possible after damage is observed and the crop given every opportunity to compensate, if this is the decision.

For more information on herbicide damage and crop response, see the Cotton CRC website at:

www.cottoncrc.org.au/content/Industry/Tools/Herbicide_Damage_Identification.aspx

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