

# The Effects of Simulated Herbicide Drift on Cotton Growth

Mark Hickman<sup>1</sup>, Andrew Storrie<sup>2</sup>, Tony Cook<sup>2</sup>

<sup>1</sup>NSW Agriculture, Gunnedah, Australian Cotton CRC.

<sup>2</sup>Tamworth Centre For Crop Improvement, NSW Agriculture, Tamworth.

Historically research has shown cotton to be highly susceptible to the phenoxy herbicides. However, there is limited information on the impacts of other herbicides that may be used within current farming systems. Every season there are reported cases of suspected herbicide damage over the summer period. Damage is primarily caused by physical drift of herbicides used for roadside weed control, or summer fallow weed management. The drift associated with fallow management can be from within or outside the farm boundary. Irrespective of where the damage originates, there are always two questions that the grower asks. "What has caused this damage" and "will the crop recover"? It was this scenario that promoted the establishment of this research. This paper examines the impacts of herbicides commonly used for fallow weed control on cotton growth and yield.

## Background to experiments

Small plot experiments were established in 3 separate seasons: 1995-96, 1996-97 and 2001-02. At each site, a known quantity of herbicide active ingredient was applied to a cotton crop using a hand-held 3 m boom. Cotton plants were then assessed for visual symptoms, and yield recovery. The aim of the treatments was to simulate a herbicide drift pattern as a result of fine droplets physically drifting onto the crop. Treatment rates that were used were zero, 0.001, 0.01, 0.1, 1, 3, 10 and 30% of the commonly recommended rate for that herbicide. In 2001-02, the number of rates was reduced to zero, 0.1, 1, 3, and 10% of the recommended field rate. Given the complexity of herbicide options that may be used within a mixed farming enterprise, it was decided that the herbicides and associated rates listed in Table 2 where the most likely options.

**Table 1: Experiment Details**

Year(s)	Site location	Variety	Days after sowing when treatments were applied
1995-96	Narrabri	Sicala V2	125
1996-97	Gunnedah	Siokra V15	95
2001-02	Boggabri	Nucotn 37	85

Treatments were visually scored and photographed for symptoms at 23 days after the herbicide application. A scoring system of 1 to 5 was used to score the visual damage of the herbicides. A

score of 5 represent a highest level of damage. Table 1 outlines the varieties and timing of treatment application. Harvesting with a small plot, single row cotton picker completed yield assessments of the experimental plots. Yield results from the 2001-02 season were not available at the time of this publication. The experimental plots were located at all sites within a commercial field and therefore general agronomic management (insecticides, irrigations etc) were applied to the experiment in accordance to the rest of the field.

**Table 2: Herbicide Products and Rates Assessed**

<b>Herbicide Active / Trade Name</b>	<b>Field Rate per Ha</b>	<b>Cotton Season that contained this product in the experiment.</b>
2,4-D Amine (800g/Kg) Baton <sup>®</sup>	1Kg	1995-96, 1996-97 & 2001-02
MCPA amine (500g/L)	1 L	Only 1996-97
Fluoroxypyr (200g/L) Starane <sup>®</sup> 200	750 mL	1995-96, 1996-97 & 2001-02
Triclopyr (600g/L) Garlon <sup>®</sup> 600	100 mL	1995-96, 1996-97
Glyphosate (450g/L) Glyphosate 450 (Plus non ionic wetter)	1 L	1995-96, 1996-97 & 2001-02
Metsulfuron (600g/Kg) Ally <sup>®</sup>	5g	1995-96, 1996-97
Dicamba (200g/L) Dicamba 200 <sup>®</sup>	700 mL	Only 2001-02
Dichlorprop (600g/L) DP 600 <sup>®</sup>	6 L	Only 2001-02
Glyphosate (450) + 2,4 D Amine (800) (Tank mixture)	1L + 1Kg	Only 2001-02

## Results

### Visual symptoms

The following descriptions of plant symptoms are based on the impact of applying 10 % of the respective herbicide. Growers can use these descriptions to help identify damage from different herbicides. Descriptions relate to damage at 23 days after treatment. Depending on the herbicide damage, symptoms may change over time or may persist throughout the growing period of the crop.

#### a) 2,4-D amine

Leaf strapping with tightly crinkled and blistering margins. Flowering is reduced with squares aborting following the application. Disfiguration of the plant is not confined to the leaf, flowers, squares and petioles are also affected. New terminal growth is clawed in appearance and pale green/yellow. Slight plant stunting.

b) Fluroxypyr, (common name- Starane 200®)

Severe abortion of squares, with new growth tips either burnt / dead and severely cupped. The dominant feature is the downward bending of the petioles parallel to the stem, with latter growth then twisting upwards. The plants suffered a significant height reduction. Reddening of stems and petioles is very prominent with some stems/petioles blistered or slightly cracked.

c) Dicamba

Leaf damage is confined to the leaf margining with cupping downwards. Colour of the leaf damage is red to bronze and some yellow patches. Leaf blades appear wavy. New terminal and young leaf growth appears 'claw-like' but with no blistering. The same growth in 2,4-D amine treatments is more severely 'clawed'.

d) Dichlorprop (common name – DP 600®)

Severe leaf blotching on the older leaves. Colour of blotches range from red to bronze to almost purple. The new growth exhibits yellowing with some necrosis and square abortion. Plants appear noticeably stunted, with a compacted growth habit.

e) MCPA amine

New leaves are “strappy” in appearance with wavy leaf margins. Both flowering and plant height are significantly reduced.

Definition :

*“Strappy” leaves result from the inter-veinal areas of the leaf contracting, so those veins are almost parallel. This abnormal elongation of the leaf blade results in a highly wrinkled, and “claw-like” leaf blade.*

Figure 1, represents the typical visual damage scores that resulted from the treatments. These scores are subjective and assess the overall appearance of the plants treated. It accounts for biomass and/or height reductions, plant symptoms, fruit loss and the general appearance of the plant. As seen in figure 1, Starane® 200 has been rated as causing the highest damage, with glyphosate not recording any visual damage score. The addition of glyphosate to 2,4-D amine made no additional visual impacts compared to 2,4-D amine alone.

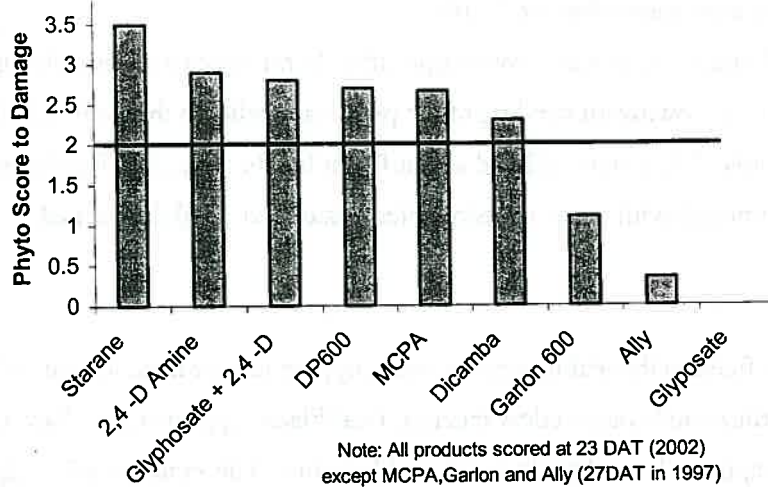


Figure 1: Visual damage ratings (1996-97 and 2001-02 season) incurred from 10% of the herbicide application rates.

Ranking Score	Apparent damage indicated by the score
0	No visual impact
0.1 to 1.0	Slight trace of herbicide activity.
1.1 to 2.0	Low herbicide effects evident.
2.1 to 3.0	Moderate herbicide effects evident.
3.1 to 4.0	Severe herbicide damage. Occasional plant death
4.1 to 5.0	Extreme herbicide damage. Causing death of all plants

**Preliminary Results: Boll counts /m for 10% Application Rate**

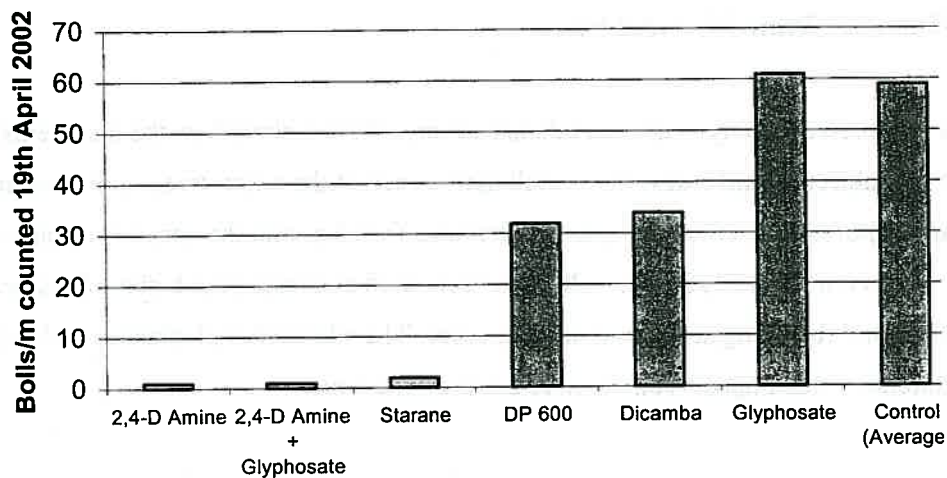


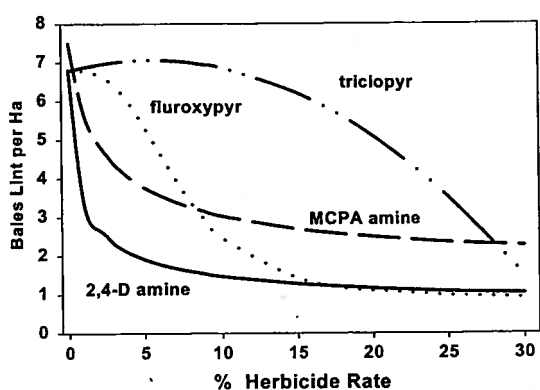
Figure 2: Boll counts per metre collected on the 19-4-02 from the drift simulation treatments of 10%.

### Yield Impacts:

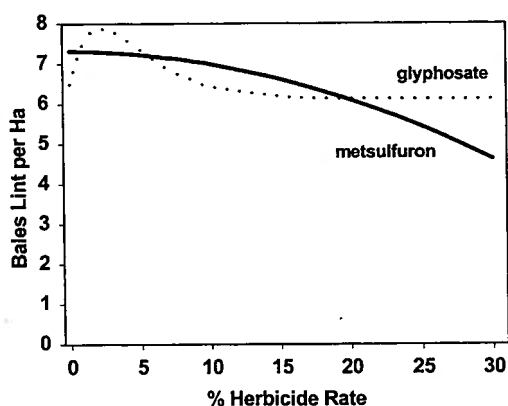
Boll counts per metre for the 2001-02 site (figure 2), confirms the visual assessment ranking. The treatments that had higher visual damage score also resulted in a lower estimate of bolls that may reach harvest.

Figure 3, indicates the yield results from the previous experiment conducted in 1996-97. These products were applied at the start of flowering (95 days after sowing, as indicated by Table 1). The results indicate Starane® 200 to be less damaging than 2,4-D amine at the lower rates. However, at higher rates, Starane® 200 was as damaging as 2,4-D amine. MCPA amine followed a similar trend to 2,4-D amine, but it was less damaging. While, Garlon® 600 also appeared to be damaging when applied at this growth stage. Metsulfuron applied at the start of cotton flowering resulted in a maximum yield decline of 33% for this site, figure 4. Finally, glyphosate yields appeared constant, except for one low rate application.

**Figure 3.** The effect of 2,4-D amine, Starane® 200 (fluroxypyr), MCPA amine and Garlon® 600 (triclopyr) on cotton applied at the start of flower. (1996-97)



**Figure 4.** The effect of metsulfuron and glyphosate on cotton yield when applied at the start of flowering. (1996-97)



### Conclusions:

Visual assessments indicate a significant difference in the type of damage symptoms recorded from the range of products tested under these simulated drift conditions. 2,4-D amine causes significant damage to cotton, while Starane® 200 is less damaging on cotton at the lower rates (less than 5%) and equally damaging as 2,4-D amine at the higher rates (10 to 30%). It appears glyphosate (450 g a.i./L) applied at these drift simulation rates has little impact on cotton growth and yield.

## Acknowledgments

We would like to thank Brian and Andrew Thibault, Gunnedah, and Rob Evans, South Pacific Agricultural Company, Boggabri for their time and resources as these people made available to allow these experiments to occur. The authors would also like to acknowledge the biometricians at NSW Agriculture, Tamworth, Clare Altson and Steve Harden for their assistance.

