

# HERBICIDE DAMAGE IDENTIFICATION AND INFORMATION GUIDE

## Introduction

Finding herbicide damage in a cotton crop has been an unfortunate experience for far too many cotton growers over the years. Damage may be from residues in the soil from a herbicide applied to a previous crop, from residues in contaminated spraying equipment, from accidental application of an inappropriate herbicide, or from aerial drift from herbicide applied to a different crop. The source of the damage is not a consideration in this guide, as in most cases the damage is the same, regardless of the source.

Damage will always have some impact on the crop, but the nature of the impact is influenced by crop growth stage at the time of exposure, the type of herbicide (damage can be from a wide range of different herbicides), the intensity of exposure (amount of herbicide impacting the crop), the crop potential, and the seasonal conditions at, and following, exposure.

At best, crop damage may delay crop maturity and in favourable conditions may result in no crop yield loss, or even an increase in crop yield. At worst, the crop may never recover from the damage.

The intent of this guide is to give cotton growers information relating the impact of known concentrations of a herbicide on crop growth, exposed at a given crop growth stage, on crop growth and development and final yield. While every crop and every season is different, this information should provide some guidance as to the likely impact of herbicide exposure to a cotton crop.

The Herbicide Damage Guide is a work in progress and covers only a limited range of herbicides and exposure rates. This data base will be expanded over time.

Information can be sourced directly where the nature of the herbicide exposure is known via the Herbicide Damage Information, or indirectly, using the Herbicide Damage Identification Guide to identify the likely herbicide or herbicides that may have caused the damage.

## Brief contents:

### J2. Herbicide Symptoms Guide

#### J2.1. Contents Summary

#### J2.2. Detailed Contents

### J3. Herbicide Damage Information

#### J3.1. Chlorsulfuron

**Group B**

#### J3.2. Iodosulfuron plus mefenpyr diethyl

**Group B**

#### J3.3. Imazamox

**Group B**

#### J3.4. Imazapic

**Group B**

#### J3.5. Imazapyr

**Group B**

#### J3.6. Imazamox plus imazapyr

**Group B**

#### J3.7. Imazapic plus imazapyr

**Group B**

J3.8. Imazethapyr	Group B
J3.9. Metsulfuron	Group B
J3.10. Tribenuron-methyl	Group B
J3.11. Atrazine	Group C
J3.12. Bromoxynil	Group C
J3.13. Simazine	Group C
J3.14. Isoxaflutole	Group F
J3.15. Flumioxazin	Group G
J3.16. 2,4-D	Group I
J3.17. Clopyralid	Group I
J3.18. Dicamba	Group I
J3.19. Fluroxypyr	Group I
J3.20. MCPA	Group I
J3.21. Triclopyr	Group I
J3.22. 2,4-D plus picloram	Group I
J3.23. Aminopyralid plus fluroxypyr	Group I
J3.24. MCPA plus picloram	Group I
J3.25. Picloram	Group I
J3.26. Triclopyr plus picloram	Group I
J3.27. 2,4-D plus glyphosate	Groups I & M
J3.28. Proxasulfone	Group K
J3.29. Paraquat plus diquat	Group L
J3.30. Amitrole plus paraquat	Groups L & Q
J3.31. Glyphosate	Group M
J3.32. Glufosinate	Group N
J3.33. Amitrole plus ammonium thiocyanate	Group Q

## Full Contents:

### J2. Herbicide Symptoms Guide

#### J2.1. Contents Summary

#### J2.2. Detailed Contents

### J3. Herbicide Damage Information

#### J3.1. Chlorsulfuron (Glean®)

#### Group B

Cotton plants were exposed to chlorsulfuron at 50% and 10% of the recommended dose rate. The chlorsulfuron formulation used was Dupont™ Glean® cereal herbicide (chlorsulfuron 750 g a.i./kg), at 10 g/ha and 2 g/ha. Glean was applied preplanting and at 4, 9, 12 and 16 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

##### J3.1.1 2 g/ha chlorsulfuron pre-planting

##### J3.1.2 10 g/ha chlorsulfuron pre-planting

##### J3.1.3 2 g/ha chlorsulfuron at 4 nodes

##### J3.1.4 10 g/ha chlorsulfuron at 4 nodes

##### J3.1.5 2 g/ha chlorsulfuron at 9 nodes

##### J3.1.6 10 g/ha chlorsulfuron at 9 nodes

##### J3.1.7 2 g/ha chlorsulfuron at 12 nodes

##### J3.1.8 10 g/ha chlorsulfuron at 12 nodes

##### J3.1.9 2 g/ha chlorsulfuron at 16 nodes

##### J3.1.10 10 g/ha chlorsulfuron at 16 nodes

### **J3.2. Iodosulfuron-methyl sodium plus mefenpyr diethyl (Hussar®)**

**Group B**

Cotton plants were exposed to iodosulfuron-methyl sodium plus mefenpyr diethyl at 50% and 10% of the recommended dose rate. The formulation of iodosulfuron-methyl sodium plus mefenpyr diethyl used was Bayer CropScience Hussar® selective herbicide (iodosulfuron-methyl sodium 50 g a.i./kg plus mefenpyr diethyl 150 g a.i./kg), at 100 g/ha and 20 g/ha. Hussar was applied preplanting and at 5, 12, 15 and 18 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

**J3.2.1 20 g/ha Iodosulfuron-methyl sodium plus mefenpyr diethyl pre-planting**

**J3.2.2 100 g/ha Iodosulfuron-methyl sodium plus mefenpyr diethyl pre-planting**

**J3.2.3 20 g/ha Iodosulfuron-methyl sodium plus mefenpyr diethyl at 5 nodes**

**J3.2.4 100 g/ha Iodosulfuron-methyl sodium plus mefenpyr diethyl at 5 nodes**

**J3.2.5 20 g/ha Iodosulfuron-methyl sodium plus mefenpyr diethyl at 12 nodes**

**J3.2.6 100 g/ha Iodosulfuron-methyl sodium plus mefenpyr diethyl at 12 nodes**

**J3.2.7 20 g/ha Iodosulfuron-methyl sodium plus mefenpyr diethyl at 15 nodes**

**J3.2.8 100 g/ha Iodosulfuron-methyl sodium plus mefenpyr diethyl at 15 nodes**

**J3.2.9 20 g/ha Iodosulfuron-methyl sodium plus mefenpyr diethyl at 18 nodes**

**J3.2.10 100 g/ha Iodosulfuron-methyl sodium plus mefenpyr diethyl at 18 nodes**

### **J3.3. Imazamox (Raptor®)**

**Group B**

## J3.4. Imazapic (Flame®)

### Group B

Cotton plants were exposed to imazapic at 50% and 10% of the recommended dose rate. The imazapic formulation used was Crop Care Flame® Herbicide (imazapic 240 g a.i./L), at 100 ml/ha and 20 ml/ha. Flame was applied preplanting and at 4, 9, 12 and 16 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

### J3.4.1 20 ml/ha imazapic pre-planting

### J3.4.2 100 ml/ha imazapic pre-planting

### J3.4.3 20 ml/ha imazapic at 4 nodes

### J3.4.4 100 ml/ha imazapic at 4 nodes

### J3.4.5 20 ml/ha imazapic at 9 nodes

### J3.4.6 100 ml/ha imazapic at 9 nodes

### J3.4.7 20 ml/ha imazapic at 12 nodes

### J3.4.8 100 ml/ha imazapic at 12 nodes

### J3.4.9 20 ml/ha imazapic at 16 nodes

### J3.4.10 100 ml/ha imazapic at 16 nodes

## J3.5. Imazapyr (Arsenal®)

### Group B

## J3.6. Imazamox plus imazapyr (Intervix®)

### Group B

Cotton plants were exposed to imazamox plus imazapyr at 50% and 10% of the recommended dose rate. The imazamox plus imazapyr formulation used was Crop Care Intervix® Herbicide for CLEARFIELD® crops (imazamox 33 g a.i./L plus imazapyr 15 g a.i./L both present as ammonium salts), at 375 ml/ha and 75 ml/ha. Intervix was applied preplanting and at 5, 12, 15 and 18 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

### J3.6.1 75 ml/ha imazamox plus imazapyr pre-planting

### J3.6.1 375 ml/ha imazamox plus imazapyr pre-planting

### J3.6.1 75 ml/ha imazamox plus imazapyr at 5 nodes

### J3.6.1 375 ml/ha imazamox plus imazapyr at 5 nodes

### J3.6.1 75 ml/ha imazamox plus imazapyr at 12 nodes

### J3.6.1 375 ml/ha imazamox plus imazapyr at 12 nodes

### J3.6.1 75 ml/ha imazamox plus imazapyr at 15 nodes

### J3.6.1 375 ml/ha imazamox plus imazapyr at 15 nodes

### J3.6.1 75 ml/ha imazamox plus imazapyr at 18 nodes

### J3.6.1 375 ml/ha imazamox plus imazapyr at 18 nodes

## J3.7. Imazapic plus imazapyr (Midas®)

### Group B

### J3.8. Imazethapyr (Spinnaker®)

#### Group B

Cotton plants were exposed to imazethapyr at 50% and 10% of the recommended dose rate. The formulation of imazethapyr used was Nufarm Spinnaker® 700 WDG Herbicide (imazethapyr 700 g a.i./Kg), at 70 g/ha and 14 g/ha. Spinnaker was applied preplanting and at 5, 12, 15 and 18 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

J3.8.1 14 g/ha imazethapyr pre-planting

J3.8.2 70 g/ha imazethapyr pre-planting

J3.8.3 14 g/ha imazethapyr at 5 nodes

J3.8.4 70 g/ha imazethapyr at 5 nodes

J3.8.5 14 g/ha imazethapyr at 12 nodes

J3.8.6 70 g/ha imazethapyr at 12 nodes

J3.8.7 14 g/ha imazethapyr at 15 nodes

J3.8.8 70 g/ha imazethapyr at 15 nodes

J3.8.9 14 g/ha imazethapyr at 18 nodes

J3.8.10 70 g/ha imazethapyr at 18 nodes

### J3.9. Metsulfuron (Ally®)

#### Group B

Cotton plants were exposed to metsulfuron-methyl at 50% and 10% of the recommended dose rate. The metsulfuron-methyl formulation used was Dupont™ Ally® herbicide (metsulfuron-methyl 600 g a.i./kg), at 3.5 g/ha and 0.7 g/ha. Ally was applied preplanting and at 4, 9, 12 and 16 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

J3.9.1 0.7 g/ha metsulfuron-methyl pre-planting

J3.9.2 3.5 g/ha metsulfuron-methyl pre-planting

J3.9.3 0.7 g/ha metsulfuron-methyl at 4 nodes

J3.9.4 3.5 g/ha metsulfuron-methyl at 4 nodes

J3.9.5 0.7 g/ha metsulfuron-methyl at 9 nodes

J3.9.6 3.5 g/ha metsulfuron-methyl at 9 nodes

J3.9.7 0.7 g/ha metsulfuron-methyl at 12 nodes

J3.9.8 3.5 g/ha metsulfuron-methyl at 12 nodes

J3.9.9 0.7 g/ha metsulfuron-methyl at 16 nodes

J3.9.10 3.5 g/ha metsulfuron-methyl at 16 nodes

### J3.10. Tribenuron-methyl (Express®)

#### Group B

## J3.11. Atrazine

## Group C

Cotton plants were exposed to atrazine at 50% and 10% of the recommended dose rate. The atrazine formulation used was Gesaprim<sup>®</sup> Granules 900 WG Herbicide (atrazine 900 g a.i./kg), a Syngenta product, at 1.1 kg/ha and 220 g/ha. Gesaprim 900 WG was applied preplanting and at 5, 10 and 17 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

### J3.11.1 200 g/ha atrazine pre-planting

### J3.11.2 1 kg/ha atrazine pre-planting

### J3.11.3 200 g/ha atrazine at 5 nodes

### J3.11.4 1 kg/ha atrazine at 5 nodes

### J3.11.5 200 g/ha atrazine at 10 nodes

### J3.11.6 1 kg/ha atrazine at 10 nodes

### J3.11.7 200 g/ha atrazine at 17 nodes

### J3.11.8 1 kg/ha atrazine at 17 nodes

## J3.12. Bromoxynil

## Group C

Cotton plants were exposed to Bromoxynil at 50% and 10% of a typical field dose rate. The bromoxynil formulation used was Bromicide<sup>®</sup> 200 (bromoxynil 200 g a.i./L, present as the n-octanoyl ester), a Nufarm product, at 750 ml/ha and 150 ml/ha. Bromicide 200 was applied at 6, 11 and 15 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

### J3.12.1 150 ml/ha dicamba at 6 nodes

### J3.12.2 750 ml/ha dicamba at 6 nodes

### J3.12.3 150 ml/ha dicamba at 11 nodes

### J3.12.4 750 ml/ha dicamba at 11 nodes

### J3.12.5 150 ml/ha dicamba at 15 nodes

### J3.12.6 750 ml/ha dicamba at 15 nodes

### **J3.13. Simazine**

### **Group C**

Cotton plants were exposed to simazine at 50% and 10% of the recommended dose rate. The simazine formulation used was Simazine 900DF herbicide (simazine 900 g a.i./kg), a Nufarm product, at 1.65 kg/ha and 330 g/ha. Simazine 900DF was applied preplanting and at 5, 10 and 17 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

**J3.13.1 330 g/ha simazine pre-planting**

**J3.13.2 1.65 kg/ha simazine pre-planting**

**J3.13.3 330 g/ha simazine at 5 nodes**

**J3.13.4 1.65 kg/ha simazine at 5 nodes**

**J3.13.5 330 g/ha simazine at 10 nodes**

**J3.13.6 1.65 kg/ha simazine at 10 nodes**

**J3.13.7 330 g/ha simazine at 17 nodes**

**J3.13.8 1.65 kg/ha simazine at 17 nodes**

### **J3.14. Isoxaflutole (Balance<sup>®</sup>)**

### **Group F**

Cotton plants were exposed to isoxaflutole at 50% and 10% of the recommended dose rate. The isoxaflutole formulation used was Balance<sup>®</sup> 750 WG Herbicide (isoxaflutole 750 g a.i./kg), a Bayer Crop Science product, at 50 g/ha and 10 g/ha. Balance was applied preplanting and at 4, 9, 12 and 16 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

**J3.14.1 10 g/ha isoxaflutole pre-planting**

**J3.14.2 50 g/ha isoxaflutole pre-planting**

**J3.14.3 10 g/ha isoxaflutole at 4 nodes**

**J3.14.4 50 g/ha isoxaflutole at 4 nodes**

**J3.14.5 10 g/ha isoxaflutole at 9 nodes**

**J3.14.6 50 g/ha isoxaflutole at 9 nodes**

**J3.14.7 10 g/ha isoxaflutole at 12 nodes**

**J3.14.8 50 g/ha isoxaflutole at 12 nodes**

**J3.14.9 10 g/ha isoxaflutole at 16 nodes**

**J3.14.10 50 g/ha isoxaflutole at 16 nodes**

### **J3.15. Flumioxazin (Valor<sup>®</sup>)**

### **Group G**



## J3.16. 2,4-D

## Group I

Cotton plants were exposed to 2,4-D amine at 10% and 1% of a typical field dose rate. The 2,4-D formulation used was Baton<sup>®</sup> (2,4-D amine 800 g a.i./kg, present as the dimethylamine salt), a Nufarm product, at 100 g/ha and 10 g/ha. Baton was applied at 6, 8, 12 and 16 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

J3.16.1 8 g/ha 2,4-D at 6 nodes

J3.16.2 80 g/ha 2,4-D at 6 nodes

J3.16.3 8 g/ha 2,4-D at 8 nodes

J3.16.4 80 g/ha 2,4-D at 8 nodes

J3.16.5 8 g/ha 2,4-D at 12 nodes

J3.16.6 80 g/ha 2,4-D at 12 nodes

J3.16.7 8 g/ha 2,4-D at 16 nodes

J3.16.8 80 g/ha 2,4-D at 16 nodes

## J3.17. Clopyralid (Lontrel<sup>®</sup>)

## Group I

Cotton plants were exposed to clopyralid at 50% and 10% of a typical field dose rate. The clopyralid formulation used was Lontrel<sup>®</sup> Herbicide (clopyralid 300 g a.i./L, present as the triisopropanolamine salt), a Dow AgroSciences product, at 60 ml/ha and 12 ml/ha. Lontrel was applied pre-planting and at 5, 12, 15 and 18 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

J3.17.1 12 g/ha clopyralid pre-planting

J3.17.2 60 g/ha clopyralid pre-planting

J3.17.3 12 g/ha clopyralid at 5 nodes

J3.17.4 60 g/ha clopyralid at 5 nodes

J3.17.5 12 g/ha clopyralid at 12 nodes

J3.17.6 60 g/ha clopyralid at 12 nodes

J3.17.7 12 g/ha clopyralid at 15 nodes

J3.17.8 60 g/ha clopyralid at 15 nodes

J3.17.9 12 g/ha clopyralid at 18 nodes

J3.17.10 60 g/ha clopyralid at 18 nodes

### J3.18. Dicamba

### Group I

Cotton plants were exposed to dicamba at 50% and 10% of a typical field dose rate. The dicamba formulation used was Kamba<sup>®</sup> 500 (dicamba 500 g a.i./L, present as the dimethylamine salt), a Nufarm product, at 280 ml/ha and 56 ml/ha. Kamba 500 was applied at 6, 11 and 15 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

J3.18.1 28 g/ha dicamba at 6 nodes

J3.18.2 140 g/ha dicamba at 6 nodes

J3.18.3 28 g/ha dicamba at 11 nodes

J3.18.4 140 g/ha dicamba at 11 nodes

J3.18.5 28 g/ha dicamba at 15 nodes

J3.18.6 140 g/ha dicamba at 15 nodes

### J3.19. Fluroxypyr (Starane<sup>®</sup>)

### Group I

Cotton plants were exposed to fluroxypyr at 60% and 12% of a typical field dose rate. The fluroxypyr formulation used was Starane<sup>®</sup> 200 herbicide (fluroxypyr 200 g a.i./L, present as the methylheptyl ester), a Dow AgroSciences product, at 900 ml/ha and 180 ml/ha. Starane<sup>®</sup> 200 was applied at 6, 11 and 15 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

J3.19.1 36 g/ha fluroxypyr at 6 nodes

J3.19.2 180 g/ha fluroxypyr at 6 nodes

J3.19.3 36 g/ha fluroxypyr at 11 nodes

J3.19.4 180 g/ha fluroxypyr at 11 nodes

J3.19.5 36 g/ha fluroxypyr at 15 nodes

J3.19.6 180 g/ha fluroxypyr at 15 nodes

### J3.20. MCPA

### Group I

Cotton plants were exposed to MCPA at 50% and 10% of a typical field dose rate. The MCPA formulation used was MCPA 500 (MCPA 500 g a.i./L, present as the dimethylamine salt), a Nufarm product, at 1.05 L/ha and 210 ml/ha. MCPA 500 was applied at 6, 11 and 15 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

J3.20.1 105 g/ha MCPA at 6 nodes

J3.20.2 525 g/ha MCPA at 6 nodes

J3.20.3 105 g/ha MCPA at 11 nodes

J3.20.4 525 g/ha MCPA at 11 nodes

J3.20.5 105 g/ha MCPA at 15 nodes

J3.20.6 525 g/ha MCPA at 15 nodes

### J3.21. Triclopyr (Garlon<sup>®</sup>)

### Group I

## J3.22. 2,4-D plus picloram (Tordon® 75D)

**Group I**

Cotton plants were exposed to a combination of 2,4-D and picloram. The combination was applied at 50% and 10% of a typical field dose rate. The formulation used was Tordon® 75D Herbicide (2,4-D 300 g a.i./L, present as the triisopropanolamine salt plus picloram 75 g a.i./L present as the triisopropanolamine salt), a Dow AgroSciences product, at 500 ml/ha and 100 ml/ha. Tordon 75D was applied preplanting and at 5, 10 and 17 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

**J3.22.1 30 g + 7.5 g/ha 2,4-D + picloram pre-planting**

**J3.22.2 150 g + 37.5 g/ha 2,4-D + picloram pre-planting**

**J3.22.3 30 g + 7.5 g/ha 2,4-D + picloram at 5 nodes**

**J3.22.4 150 g + 37.5 g/ha 2,4-D + picloram at 5 nodes**

**J3.22.5 30 g + 7.5 g/ha 2,4-D + picloram at 10 nodes**

**J3.22.6 150 g + 37.5 g/ha 2,4-D + picloram at 10 nodes**

**J3.22.7 30 g + 7.5 g/ha 2,4-D + picloram at 17 nodes**

**J3.22.8 150 g + 37.5 g/ha 2,4-D + picloram at 17 nodes**

## J3.23. Aminopyralid plus fluroxypyr (Hotshot®)

**Group I**

## J3.24. MCPA plus picloram (Tordon® 242)

**Group I**

Cotton plants were exposed to a combination of MCPA and picloram. The combination was applied at 50% and 10% of a typical field dose rate. The formulation used was Tordon® 242 Cereal Herbicide (MCPA 420 g a.i./L, present as the potassium salt plus picloram 26 g a.i./L present as the potassium salt), a Dow AgroSciences product, at 500 ml/ha and 100 ml/ha. Tordon 242 was applied preplanting and at 5, 10 and 17 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

**J3.24.1 42 g + 2.6 g/ha MCPA + picloram pre-planting**

**J3.24.2 210 g + 13 g/ha MCPA + picloram pre-planting**

**J3.24.3 42 g + 2.6 g/ha MCPA + picloram at 5 nodes**

**J3.24.4 210 g + 13 g/ha MCPA + picloram at 5 nodes**

**J3.24.5 42 g + 2.6 g/ha MCPA + picloram at 10 nodes**

**J3.24.6 210 g + 13 g/ha MCPA + picloram at 10 nodes**

**J3.24.7 42 g + 2.6 g/ha MCPA + picloram at 17 nodes**

**J3.24.8 210 g + 13 g/ha MCPA + picloram at 17 nodes**

## J3.25. Picloram

**Group I**

### **J3.26. Triclopyr plus picloram (Grazon® DS)**

**Group I**

Cotton plants were exposed to a combination of triclopyr and picloram. The combination was applied at 50% and 10% of a typical field dose rate. The formulation used was Grazon® DS Herbicide (triclopyr 300 g a.i./L plus picloram 100 g a.i./L), a Dow AgroSciences product, at 250 ml/ha and 50 ml/ha. Grazon DS was applied preplanting and at 5, 10 and 17 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

**J3.26.1 15 g + 5 g/ha triclopyr + picloram pre-planting**

**J3.26.2 75 g + 25 g/ha triclopyr + picloram pre-planting**

**J3.26.3 15 g + 5 g/ha triclopyr + picloram at 5 nodes**

**J3.26.4 75 g + 25 g/ha triclopyr + picloram at 5 nodes**

**J3.26.5 15 g + 5 g/ha triclopyr + picloram at 10 nodes**

**J3.26.6 75 g + 25 g/ha triclopyr + picloram at 10 nodes**

**J3.26.7 15 g + 5 g/ha triclopyr + picloram at 17 nodes**

**J3.26.8 75 g + 25 g/ha triclopyr + picloram at 17 nodes**

### **J3.27. 2,4-D plus glyphosate**

**Groups I & M**

Cotton plants were exposed to a combination of glyphosate and 2,4-D amine. The glyphosate was applied at 17% and 3% of the field dose rate commonly used in Roundup Ready Flex® cotton, and the 2,4-D was applied at 10% and 1% of a typical field dose rate. The glyphosate formulation used was Roundup Ready Herbicide® (glyphosate 690 g a.i./kg, present as the mono-ammonium salt), a Monsanto product, at 250 g/ha and 50 g/ha. The 2,4-D formulation used was Baton® (2,4-D amine 800 g a.i./L, present as the dimethylamine salt), a Nufarm product, at 100 ml/ha and 10 ml/ha. The combinations were applied at 6, 8, 12 and 16 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

**J3.27.1 35 g + 8 g 2,4-D/ha + glyphosate at 6 nodes**

**J3.27.2 173 g + 80 g/ha 2,4-D + glyphosate at 6 nodes**

**J3.27.3 35 g + 8 g/ha 2,4-D + glyphosate at 8 nodes**

**J3.27.4 173 g + 80 g/ha 2,4-D + glyphosate at 8 nodes**

**J3.27.5 35 g + 8 g/ha 2,4-D + glyphosate at 12 nodes**

**J3.27.6 173 g + 80 g/ha 2,4-D + glyphosate at 12 nodes**

**J3.27.7 35 g + 8 g/ha 2,4-D + glyphosate at 16 nodes**

**J3.27.8 173 g + 80 g/ha 2,4-D + glyphosate at 16 nodes**

### **J3.28. Pyroxasulfone (Sakura®)**

**Group K**

## J3.29. Paraquat plus diquat (Spray.Seed®)

## Group L

Cotton plants were exposed to the combination of paraquat plus diquat at 50% and 10% of a typical field dose rate. The paraquat plus diquat formulation used was Spray.Seed® 250 (paraquat 135 g a.i./L, present as paraquat dichloride, plus diquat 115 g a.i./L, present as diquat dibromide), a Syngenta product, at 1.6 L/ha and 320 ml/ha. Spray.Seed was applied at 6, 11 and 15 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

**J3.29.1 43 g + 37 g/ha paraquat + diquat at 6 nodes**

**J3.29.2 216 g + 184 g/ha paraquat + diquat at 6 nodes**

**J3.29.3 43 g + 37 g/ha paraquat + diquat at 11 nodes**

**J3.29.4 216 g + 184 g/ha paraquat + diquat at 11 nodes**

**J3.29.5 43 g + 37 g/ha paraquat + diquat at 15 nodes**

**J3.29.6 216 g + 184 g/ha paraquat + diquat at 15 nodes**

## J3.30. Amitrole plus paraquat (Alliance®)

## Groups L & Q

## J3.31. Glyphosate

## Group M

Cotton plants were exposed to glyphosate at 17% and 3% of the field dose commonly used in cotton. The glyphosate formulation used was Roundup Ready Herbicide® (glyphosate 690 g a.i./kg, present as the mono-ammonium salt), a Monsanto product, at 250 g/ha and 50 g/ha. Roundup Ready Herbicide was applied at 6, 8, 12 and 16 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

**J3.31.1 35 g/ha glyphosate at 6 nodes**

**J3.31.2 173 g/ha glyphosate at 6 nodes**

**J3.31.3 35 g/ha glyphosate at 8 nodes**

**J3.31.4 173 g/ha glyphosate at 8 nodes**

**J3.31.5 35 g/ha glyphosate at 12 nodes**

**J3.31.6 173 g/ha glyphosate at 12 nodes**

**J3.31.7 35 g/ha glyphosate at 16 nodes**

**J3.31.8 173 g/ha glyphosate at 16 nodes**

### **J3.32. Glufosinate (Liberty®)**

### **Group N**

Cotton plants were exposed to glufosinate at 50% and 10% of the recommended dose rate for use in Liberty Link® cotton. The glufosinate formulation used was Liberty® 200 (glufosinate-ammonium 200 g a.i./L), a Bayer CropScience product, at 1.875 L/ha and 375 ml/ha. Liberty 200 was applied at 6, 11 and 15 nodes of cotton growth, broadcast over the crop in 100 L water/ha. All data were compared to an untreated control.

**J3.32.1 75 g/ha glufosinate at 6 nodes**

**J3.32.2 375 g/ha glufosinate at 6 nodes**

**J3.32.3 75 g/ha glufosinate at 11 nodes**

**J3.32.4 375 g/ha glufosinate at 11 nodes**

**J3.32.5 75 g/ha glufosinate at 15 nodes**

**J3.32.6 375 g/ha glufosinate at 15 nodes**

### **J3.33. Amitrole plus ammonium thiocyanate (Amitrole T®) Group Q**