Project Title	Blackcurrant: Evaluation of Herbicides
Project number:	SF 012 (GSK210)
Project leader:	John Atwood, ADAS UK Ltd
Report:	Final report, September 2007
Previous report	None
Key staff:	John Atwood, Project leader Jon Carpinini, Field experiments
Location of project:	Charles Wharton Ltd Winsford Hall Stokesby Gt Yarmouth Norfolk NR29 3DG
Date project commenced:	1 March 2007
Date completion due:	31 September 2007
Key words:	Annual meadow grass, Artist, BUK9900H, blackcurrant, chickweed, cleavers, *Coronopus squamatus* L., dimethenamid-P, diuron, dove's foot cranesbill, flazasulfuron, flufenacet, *Gallium aparine* L., *Geranium molle* L., groundsel, herbicide, *Matricaria recutita* L., mayweed, metazachlor, metribuzin, pendimethalin, *Plantego major* L., plantain, *Poa annua* L., *Ribes nigra* L., *Senecio vulgaris* L., *Sonchus oleraceus* L., sowthistle, Springbok, *Stellaria media* L.Vill., Stomp 400SC, swinecress, weed control

The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

John Atwood
Senior Horticultural Consultant
ADAS UK Ltd

Signature ..... Date .....

Report authorised by:

Dr W E Parker
Horticulture Research & Consultancy Manager
ADAS UK Ltd

Signature ..... Date .....

CONTENTS

GROWER SUMMARY

Headline

- Two promising new herbicide combinations have been identified for use in blackcurrants which offer viable alternatives to the standard programme using diuron + Stomp (pendimethalin).

Background and expected deliverables

Efficient and cost effective weed control is important in blackcurrants, both to prevent yield loss from competition for water and nutrients and to enable efficient harvesting without impedance by weed growth. The most recent Pesticide Usage Survey for soft fruit (2001) showed that the vast majority (92%) of blackcurrants destined for processing were treated with herbicides and that simazine was the most widely used herbicide at that time. Under the on-going European Commission (EC) review of pesticides (Directive 91/414/EEC), simazine has been reviewed and, having been omitted from Annex 1 of Directive 91/414/EEC, has since been withdrawn for use on most fruit crops. Application for emergency extension for minor use has only been made for strawberries, nursery stock and forestry.

The other low cost alternative to simazine is diuron, which is also being withdrawn and must be used up by 13 December 2008.

With the loss of both simazine and diuron for blackcurrants it is important to identify alternative herbicides for blackcurrants for economical weed control, particularly as the remaining approved products have incomplete weed control spectra, or are not cost effective for overall use.

This work is intended to benefit the industry by:

- Providing information on the effectiveness and safety of a range of herbicides and tank mixtures.
- Providing the initial screening of chemicals to enable subsequent GLP residue studies to focus on the most promising materials for specific off-label approval (SOLA) applications.

All of the proposed new herbicides will require SOLA applications, or approval through mutual recognition, to secure their use on blackcurrant crops in the UK.

Summary of the project and main conclusions

The work was conducted in a four year-old blackcurrant plantation grown for processing in East Norfolk. The experiment was done in one year only, with a range of 11 herbicide treatments (Table 1) being applied to weed-free soil at the bush base in late March at growth stage B2 (bud burst). Treatment efficacy was compared with an untreated control.

Phytotoxicity symptoms, weed control and harvested yield were recorded from April – July 2007. Samples were collected for later pesticide residue analysis.

Table 1. List of experimental herbicide treatments

Treatment	Product	Active ingredient	Product rate	Approval status
1.	Untreated control			
2.	Stomp 400SC + Unicrop Flowable Diuron	pendimethalin 400 g/L + diuron 500 g/L	5.0 L/ha + 2.0 L/ha	Label, SOLA
3.	Stomp 400SC + Artist	pendimethalin 400 g/L + flufenacet + metribuzin (24 : 17.5 % w/w)	5.0 L/ha + 2.5 kg/ha	Label, Approved on potatoes
4.	Stomp 400SC + Springbok	pendimethalin 400 g/L + metazachlor + dimethenamid-P (200 : 200 g/L)	5.0 L/ha + 2.5 L/ha	Label, Approved on oil seed rape
5.	Artist	flufenacet + metribuzin (24 : 17.5 % w/w)	2.5 kg/ha	Approved on potatoes
6.	Artist	flufenacet + metribuzin (24 : 17.5 % w/w)	5.0 kg/ha*	Approved on potatoes
7.	Springbok	metazachlor + dimethenamid-P (200 : 200 g/L)	2.5 L/ha	Approved on oilseed rape
8.	Springbok	metazachlor + dimethenamid-P (200 : 200 g/L)	5.0 L/ha*	Approved on oilseed rape
9.	Unnamed	flazasulfuron 25 % w/w	200 g/ha	Not approved
10.	Unnamed	flazasulfuron 25 % w/w	400 g/ha	Not approved
11.	BUK 9900H	Not disclosed	3.2 L/ha	Experimental
12.	BUK 9900H	Not disclosed	6.4 L/ha	Experimental

*2 x label rate

All treatments were applied on 27 March 2007 in 200 L/ha water at 2 bar pressure using a CO_2-pressurised Oxford Precision Sprayer with a 1.5 m boom and F03-110 spray nozzles.

The predominant weed species were annual meadow grass, blackcurrant seedlings, groundsel and mayweed. Cleavers, doves foot cranesbill, hairy bittercress, plantain and sowthistle were also present. Weed cover was slow to build up initially due to the dry April. However by harvest, following wetter weather in May and June, the weed cover on some untreated plots had reached 95%.

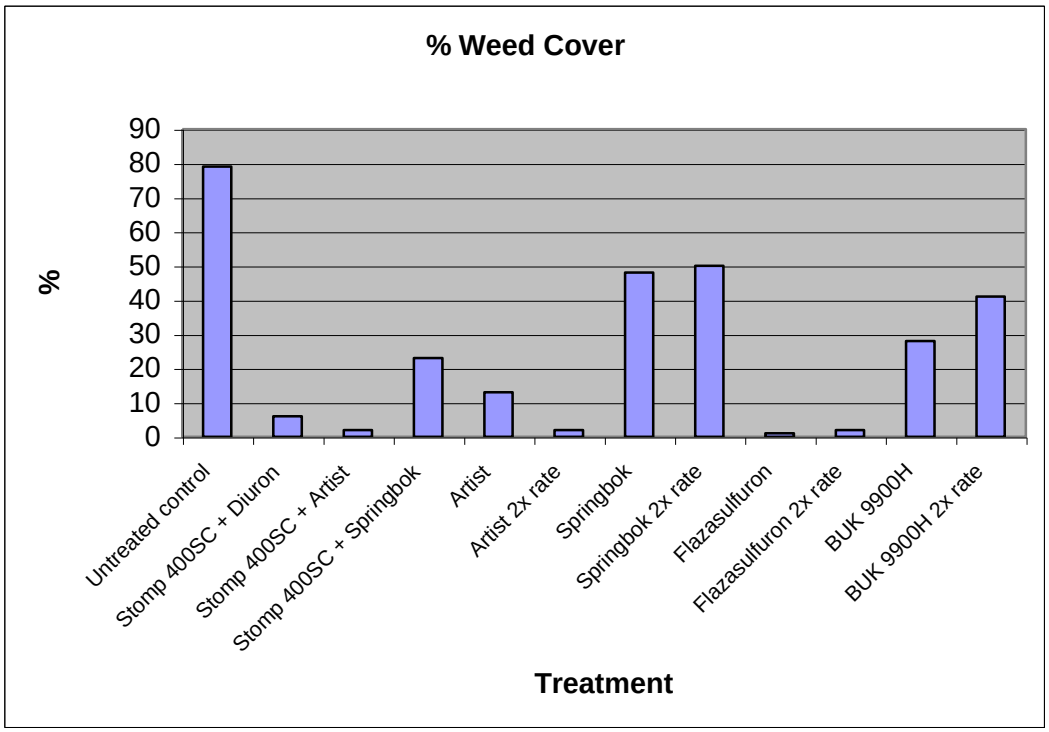
- The most effective treatments were the unnamed product (flazasulfuron), Stomp + Artist and the standard Stomp + Diuron (Figure 1).

- Flazasulfuron maintained almost complete weed control through to harvest. The few weeds that were present in these plots were mainly annual meadow grass and groundsel.

- The alternative Stomp mixture, with Artist, performed as well as the standard Stomp + Diuron. However by harvest, there were signs that the Stomp + Artist mixture was losing efficacy with a few groundsel plants appearing.

The crops were carefully monitored after treatment but no phytotoxicity symptoms were observed.

Figure 1. Percentage weed cover on 5 July 2007



The Springbok and BUK 9900H treatments did not give adequate weed control. Springbok failed to give adequate control of annual meadow grass and groundsel, and the latter two species developed extensively on these plots. BUK 9900H also failed to control groundsel and doves foot cranesbill but did control annual meadow grass.

Yields in the untreated plots were low at 4.1 t/ha. Differences in yield between treatments were relatively small.

Flazasulfuron has shown good potential for use as a blackcurrant herbicide. It is available in continental Europe as a vineyard herbicide and this active substance is on Annex 1. It has performed well in both the 2006 and 2007 blackcurrant herbicide trials with no sign of crop damage, even when applied at double rate and to crops already at bud break. Performance in other horticultural crop trials has been good, although elsewhere it has shown weakness in black nightshade control.

The Stomp + Artist mixture also shows good potential as an alternative to the current Stomp + Diuron standard. The use of Stomp with Artist improved the control of polygonum weeds and nightshades. Artist is already approved for use in the UK on potatoes and its active substances are listed on Annex 1. However it is not currently cleared for use in fruit crops in the EU. Samples from the Artist and Springbok treatments were taken for residue analysis. No residues of the active ingredients from these products were found.

Financial benefits

The Stomp + Artist treatment is £24/ha more expensive than the standard treatment Stomp + Diuron. The costs of these programs are compared below:

- Stomp (5 L/ha) + Artist (2.5 L/ha) = £77/ha
- Stomp (5 L/ha) + Diuron (2 L/ha) = £53/ha

However the Stomp/Diuron treatment will not be available after December 2008.

Compared with the typical “horticultural” products Flexidor 125 (isoxaben) and Ronstar Liquid (oxadiazon) the cost savings from using Artist are significant:

- Stomp (5 L/ha) + Flexidor (2 L/ha) = £141/ha
- Somp (5 L/ha) + Ronstar Liquid (4 L/ha) = £194/ha

The cost of a Casoron G (dichlobenil) treatment would be greater than above at £650/ha for an overall application at 125 kg/ha, but could offer a wider range of perennial weed control.

Because flazasulfuron is not yet available on the UK market it is not possible to compare its costs with other treatments.

Action points for growers

- When a SOLA is available for the use of Artist, this product should be considered the primary choice for row or alleyway weed control as a mixture with Stomp.
- If flazasulfuron becomes available in the UK either through SOLA or mutual recognition, this product could be considered as an alternative.

SCIENCE SECTION

Introduction

Efficient and cost effective weed control is important in blackcurrants, to prevent yield loss from competition for water and nutrients and to enable efficient harvesting without impedance by weed growth. The most recent official Pesticide Usage Survey for soft fruit (Garthwaite & Thomas, 2001) showed that the vast majority (92%) of blackcurrants for processing was treated with herbicides and that simazine was the most widely used herbicide at that time. Under the on-going European Commission (EC) review of pesticides (Directive 91/414/EEC), simazine has been reviewed and having failed to be placed on Annex 1 of Directive 91/414/EEC has since been withdrawn for use on most fruit crops. Application for emergency extension for minor use has been made only for strawberries, nursery stock and forestry.

The other low cost alternative to simazine is diuron, which is also being withdrawn and must be used up by 13 December 2008.

With the loss of simazine and diuron for blackcurrants it is important to develop alternative herbicides for blackcurrants for economical weed control, as the remaining approved products have incomplete weed control spectra, or are not cost effective for overall use.

This work is intended to benefit the industry by:

- Providing information on the effectiveness and safety of a range of herbicides and tank mixtures.
- Providing the initial screening of chemicals to enable subsequent GLP residue studies to be focused on the most promising materials for SOLA applications.

Materials and Methods

Site Location

Charles Wharton Ltd
Winsford Hall
Stokesby
Gt Yarmouth
Norfolk
NR29 3DG

The work was done in Gravel Hole Field, Winsford Hall. The soil type was fine sandy loam. The crop was Blackcurrant 'Ben Gairn', planted in autumn 2003 at a spacing of 3 m x 0.3 m

Crop husbandry

Prior to the start of the experiment all existing weed cover was removed by an application of PDQ (paraquat + diquat) at 5 L/ha using a shielded knapsack sprayer avoiding all contact with the bush. This application was made on 15 March 2007. Apart from the experimental treatments, no other herbicides were applied to the plots and no hand-weeding was done. The guard rows and adjacent plantation rows were treated with Casoron G granules at an application rate of 125 kg/ha.

The crop received fertiliser (13:7:23 N:P:K + 10 Mg, 500 kg/ha) on 21 March 2007 and the normal fungicide and insecticide programme as applied to the rest of the plantation, including applications of Sulphur, Karamate Dry Flo Newtec (mancozeb), Bravo 500 (chlorothalonil), Scala (pyrimethanil), Signum (boscalid + pyraclostrobin), Stroby WG (kresoxim-methyl), Systhane 20EW (myclobutanil), Aphox (pirimicarb) and Teldor (fenhaxamid).

Table 2. List of experimental treatments

Treatment	Product	Active ingredient	Product rate	Approval status
1.	Untreated control			
2.	Stomp 400SC + Unicrop Flowable Diuron	pendimethalin 400 g/L + diuron 500 g/L	5.0 L/ha + 2.0 L/ha	Label, SOLA
3.	Stomp 400SC + Artist	pendimethalin 400 g/L + flufenacet + metribuzin (24 : 17.5 % w/w)	5.0 L/ha + 2.5 kg/ha	Label, Approved on potatoes
4.	Stomp 400SC + Springbok	pendimethalin 400 g/L + metazachlor + dimethenamid-P (200 :200 g/L)	5.0 L/ha + 2.5 L/ha	Label, Approved on oil seed rape
5.	Artist	flufenacet + metribuzin (24 : 17.5 % w/w)	2.5 kg/ha	Approved on potatoes
6.	Artist	flufenacet + metribuzin (24 : 17.5 % w/w)	5.0 kg/ha*	Approved on potatoes
7.	Springbok	metazachlor + dimethenamid-P (200 : 200 g/L)	2.5 L/ha	Approved on oilseed rape
8.	Springbok	metazachlor + dimethenamid-P (200 :200 g/L)	5.0 L/ha*	Approved on oilseed rape
9.	Flazasulfuron	flazasulfuron 25 % w/w	200 g/ha	Not approved
10.	Flazasulfuron	flazasulfuron 25 % w/w	400 g/ha*	Not approved
11.	BUK 9900H	Not disclosed	3.2 L/ha	Experimental
12.	BUK 9900H	Not disclosed	6.4 L/ha	Experimental

* 2 x label rate

Experiment Design

The experiment was a randomised complete block design with 12 treatments replicated four times. Plots were 3 m wide and 5 m long. Treatments (Table 2) were applied as two 1.5 m bands sprayed up to the base of the bush either side of 5 m of a row of blackcurrant bushes. There was one internal guard row between each treated row of blackcurrant bushes.

All treatments were applied on 27 March 2007 in 200 L/ha water at 2 bar pressure using a CO_2-pressurised Oxford Precision Sprayer with a 1.5 m boom and F03-110 spray nozzles. At the time of application the blackcurrants were at growth stage B2 (bud burst).

Assessments

Weed assessments were done within the central 2 m x 4 m of each plot. The first assessment (4 June 2007) for weed seedling numbers was done using four 0.16 m^2. quadrats. The second assessment was done on 5 July 2007 to estimate whole-plot percentage weed cover, assessed visually with the aid of quadrats. The crop was mechanically harvested on 12 July 2007 with a Joonas harvester. Fruit from each plot (15 m^2) was weighed in trays and yield (t/ha) was calculated.

Data analysis

Data were analysed using analysis of variance (ANOVA) with appropriate transformations ($\log_{10}$ (n+1) for numeric data, angular transformation for percentage data).

Results and Discussion

Weed Control

The predominant weed was annual meadow grass (*Poa annua* L.), blackcurrant seedlings (*Ribes nigrum* L.), groundsel (*Senecio vulgaris* L.) and mayweed (*Matricaria recutita* L.). Cleavers (*Gallium aparine* L.), Doves foot cranesbill (*Geranium molle* L.), hairy bittercress (*Cardamine hirsuta* L.), plantain (*Plantego major* L.) and sowthistle (*Sonchus oleraceus* L.) were also present. Weed cover was slow to build up initially due to the dry April, however by harvest, following wetter weather in May and June the weed cover on some untreated plots had reached 95%.

The most effective treatments were flazasulfuron, Stomp + Artist, the higher rate of Artist alone, and the standard treatment Stomp + Diuron (Table 3). Flazasulfuron in particular maintained almost complete weed control through to harvest (Table 4). The few weeds that were present in these plots were mainly annual meadow grass and very few groundsel. The alternative Stomp mixtures, with Artist, performed as well or better than the standard Stomp + Diuron. However by harvest, there were signs that the Stomp + Artist mixture was losing efficacy with a few groundsel germinating. The Springbok and BUK 9900H treatments did not give adequate weed control. Springbok failed to give adequate control of annual meadow grass or groundsel, and the latter two species developed extensively on these plots. BUK 9900H also failed to control groundsel and doves foot cranesbill but did control meadow grass.

Table 3. Effect of treatment on weeds/m^2 assessed on 4 June 2007

Treatment	Product	Annual meadow grass	Blackcurrant	Cleavers	Doves foot cranesbill	Groundsel	Hairy bittercress	Mayweed	Plantain	Sowthistle	Weed seedlings (No./m^2)	Weed seedlings (No./m^2) Log transform
1.	Untreated control	277	0	0	6	14	9	81	0	1	387	2.49
2.	Stomp 400SC 5.0 L/ha+ Diuron 2.0 L/ha	0	0	0	0	9	0	0	0	0	9	0.96
3.	Stomp 400SC 5.0 L/ha + Artist 2.5 kg/ha	0	0	0	0	1	0	0	0	0	1	0.15
4.	Stomp 400SC 5 L/ha+ Springbok 2.5 L/ha	0	1	0	0	10	0	0	2	0	13	0.72
5.	Artist 2.5 kg/ha	0	23	0	0	3	0	0	0	0	26	0.75
6.	Artist 5.0 kg/ha	0	0	0	0	2	0	0	0	0	2	0.37
7.	Springbok 2.5 L/ha	14	8	1	4	22	0	16	3	0	68	1.70

Treatment	Product	Annual meadow grass	Blackcurrant	Cleavers	Doves foot cranesbill	Groundsel	Hairy bittercress	Mayweed	Plantain	Sowthistle	Weed seedlings (No./m^2)	Weed seedlings (No./m^2) Log transform
8	Springbok 5.0 L/ha	11	4	0	0	17	0	0	4	1	36	1.54
9.	Flazasulfuron 200 g/ha	0	0	0	0	0	0	0	0	0	0	0
10.	Flazasulfuron 400 g/ha	0	0	0	0	0	0	0	0	0	0	0
11.	BUK 9900H 3.2 L/ha	2	2	0	14	7	0	0	0	0	27	1.02
12.	BUK 9900H 6.4 L/ha	0	2	0	9	11	0	0	2	0	23	0.80
F pr		<0.001				<0.001		0.42				<0.001
d.f.		33				33		33				33
SED		47.0				4.2		32.3				0.397

Table 4. Effect of treatment on percentage weed cover assessed on 5 July 2007 (x denotes presence of the weed).

Treatment	Product	% Weed cover 5/07/07	% Weed cover 5/07/07 Angular transform	Annual meadow grass	Blackcurrant	Chickweed	Cleavers	Doves foot cranesbill	Groundsel	Mayweed	Plantain	Sowthistle	Swinecress
1.	Untreated control	79	65	x	x	x	x	x	x	x	x	x	x
2.	Stomp 400SC 5.0 L/ha+ Diuron 2.0 L/ha	6	14	x	x				x		x	x	
3.	Stomp 400SC 5.0 L/ha + Artist 2.5 kg/ha	2	5	x	x			x	x				
4.	Stomp 400SC 5 L/ha+ Springbok 2.5 L/ha	23	27	x	x				x		x	x	
5.	Artist 2.5 kg/ha	13	20	x	x	x		x	x				
6.	Artist 5.0 kg/ha	2	6		x				x		x		
7.	Springbok 2.5 L/ha	48	43	x	x	x		x	x	x	x		
8	Springbok 5.0 L/ha	50	45	x	x	x		x	x		x		
9.	Flazasulfuron 200 g/ha	1	5	x					x		x		
10.	Flazasulfuron 400 g/ha	2	7	x					x		x		
11.	BUK 9900H 3.2 L/ha	28	31	x		x		x	x		x	x	x
12.	BUK 9900H 6.4 L/ha	41	39	x		x		x	x		x	x	
F pr.			<0.001										
df			33										
SED			8.1										

Phytotoxicity

The bushes were monitored monthly following treatment for signs of phytotoxicty. No symptoms of phytotoxicity were noted.

Yield

Yields were low in this plantation. The bushes were young and may have suffered drought stress in 2006. Differences in yield were relatively small and not significant (Table 5).

Residue analysis

Samples from the Artist and Springbok treatments were taken for residue analysis. No residues of the active ingredients from these products were found.

Table 5*. Effect of treatment on yield (t/ha) at harvest*

Treatment	Product	Yield (t/ha)
1	Untreated control	4.1
2	Stomp 400SC 5.0 L/ha+ Diuron 2.0 L/ha	4.1
3	Stomp 400SC 5.0 L/ha + Artist 2.5 kg/ha	3.8
4	Stomp 400SC 5 L/ha+ Springbok 2.5 L/ha	4.5
5	Artist 2.5 kg/ha	4.0
6	Artist 5.0 kg/ha	3.3
7	Springbok 2.5 L/ha	3.4
8	Springbok 5.0 L/ha	4.5
9	Flazasulfuron 200 g/ha	4.5
10	Flazasulfuron 400 g/ha	4.2
11	BUK 9900H 3.2 L/ha	4.6
12	BUK 9900H 6.4 L/ha	3.6
F pr.		0.759
d.f.		33
S.E.D		0.77

Conclusions

Flazasulfuron has shown good potential for use as a blackcurrant herbicide. It is available in continental Europe as a vineyard herbicide and is listed on Annex 1 of Directive 91/414/EEC. It has performed well in both the 2006 and 2007 blackcurrant herbicide trials with no sign of crop damage even when applied at double rate and to crops already at bud break. Performance in other horticultural crop trials has been good, although elsewhere it has shown weakness in black nightshade control.

The Stomp + Artist mixture also shows good potential as an alternative to the current Stomp + Diuron standard. The use of Stomp with Artist improves the control of polygonum weeds and nightshades. Artist is already approved for use in the UK on potatoes and the actives are on Annex 1. However it is not currently cleared for use in other fruit crops in the EU.

The other products tested, Springbok and BUK 9900H, did not prove sufficiently effective to be worth progressing for use in blackcurrants.

Technology transfer

No technology transfer activities were carried out during this project.

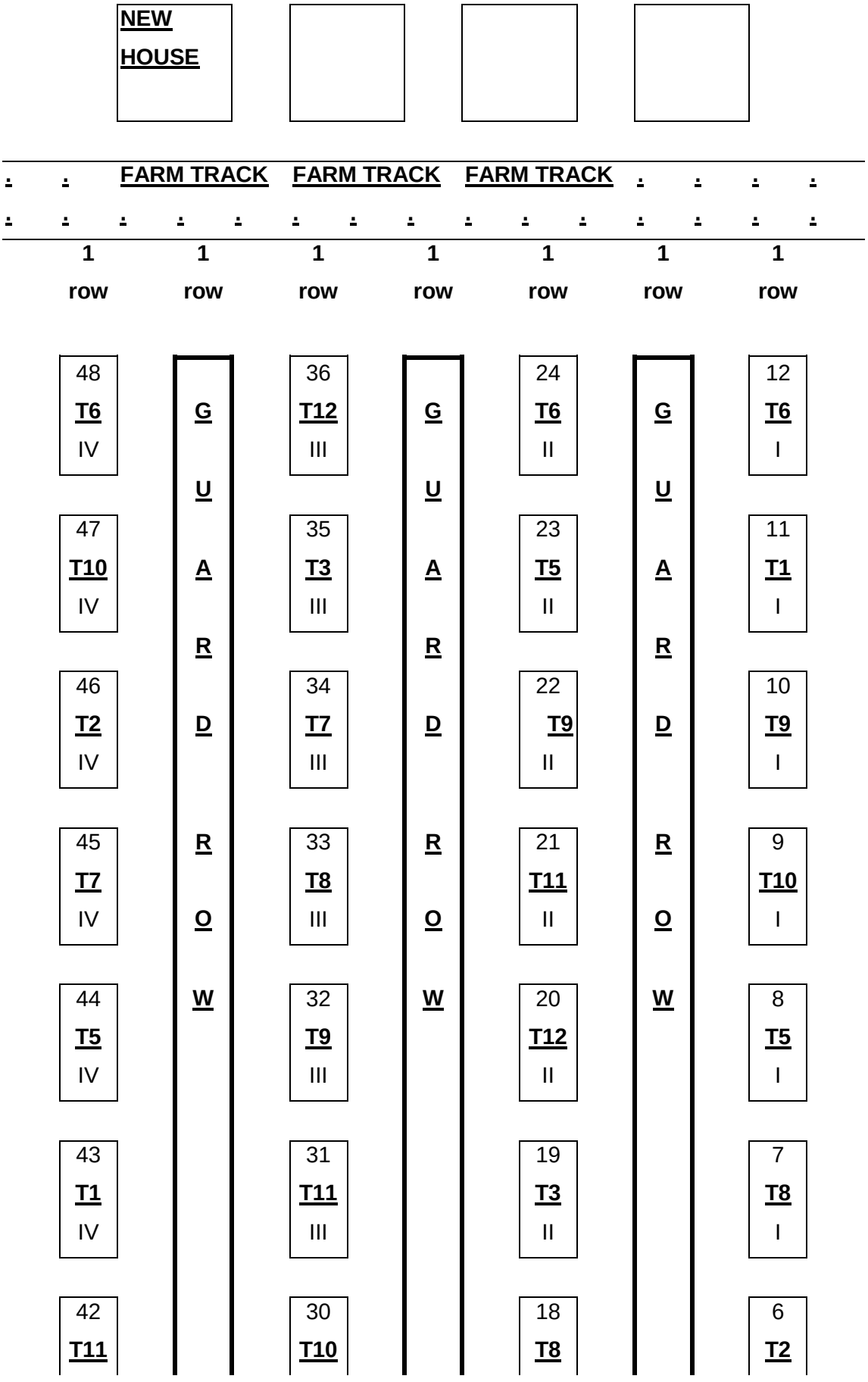
References

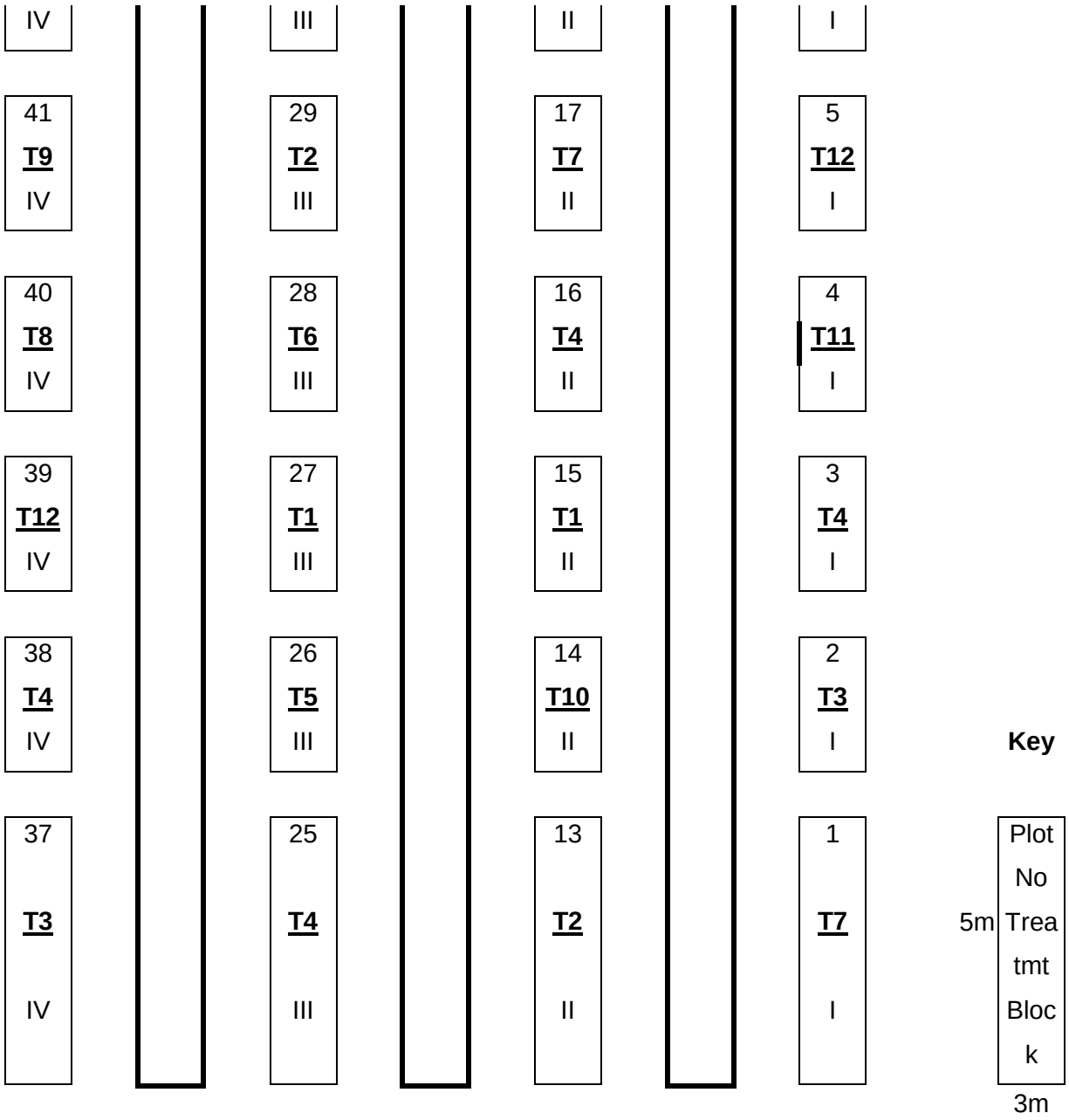
Garthwaite DG & Thomas MR, 2001. Pesticide Usage Survey Report 181, Soft Fruit in Great Britain 2001.

Appendices

Appendix 1: Experimental layout

Blackcurrant Herbicide Trial, Winsford, 2007.





Treatments

1. Untreated control	7. Springbok 2.5 L/ha
2. Stomp 400SC 5.0 L/ha+Diuron 2.0 L/ha	8. Springbok 5.0 L/ha
3. Stomp 400SC 5.0 L/ha + Artist 2.5 kg/ha	9. Flazasulfuron 200 g/ha
4. Stomp 400SC 5 L/ha+ Springbok 2.5 L/ha	10. Flazasulfuron 400 g/ha
5. Artist 2.5 kg/ha	11. BUK 9900H 3.2 L/ha
6. Artist 5.0 kg/ha	12. BUK 9900H 6.4 L/ha

Appendix 2: Pictures of weed control in selected treatments

	
1. Untreated control	2. Stomp 400SC 5.0 L/ha+Diuron 2.0 L/ha
	
3. Stomp 400SC 5.0 L/ha + Artist 2.5 kg/ha	4. Stomp 400SC 5 L/ha+ Springbok 2.5 L/ha
	
5. Artist 2.5 kg/ha	7. Springbok 2.5 L/ha

	
9. Flazasulfuron 200 g/ha	11. BUK 9900H 3.2 L/ha

Appendix 3: Residue analysis reports

QTS Analytical Ltd

Quality, Turnaround and Service

Analytical Report

Sample Number:	**QTS 121144** **Other**
Customer Name	GlaxcoSmithKline Services
Address	Building 11, Floor 2 Stockley Park West Uxbridge UB11 1BT
Contact Name	Rob Saunders
Commodity	Blackcurrant
Origin	UK
Sample Reference	Treatment - 5 Date Picked : 12/07/07
Date Received	13/07/2007
Testing Commenced	13/07/2007
Testing Completed	24/08/2007
Issue Date	24/08/2007

Test	Result	Reporting Limit	Units	Comment
FLUFENACET ANALYSIS				
Flufenacet	< 0.05	0.05	mg/kg	

Signed on behalf of QTS: **Position: Laboratory Manager**

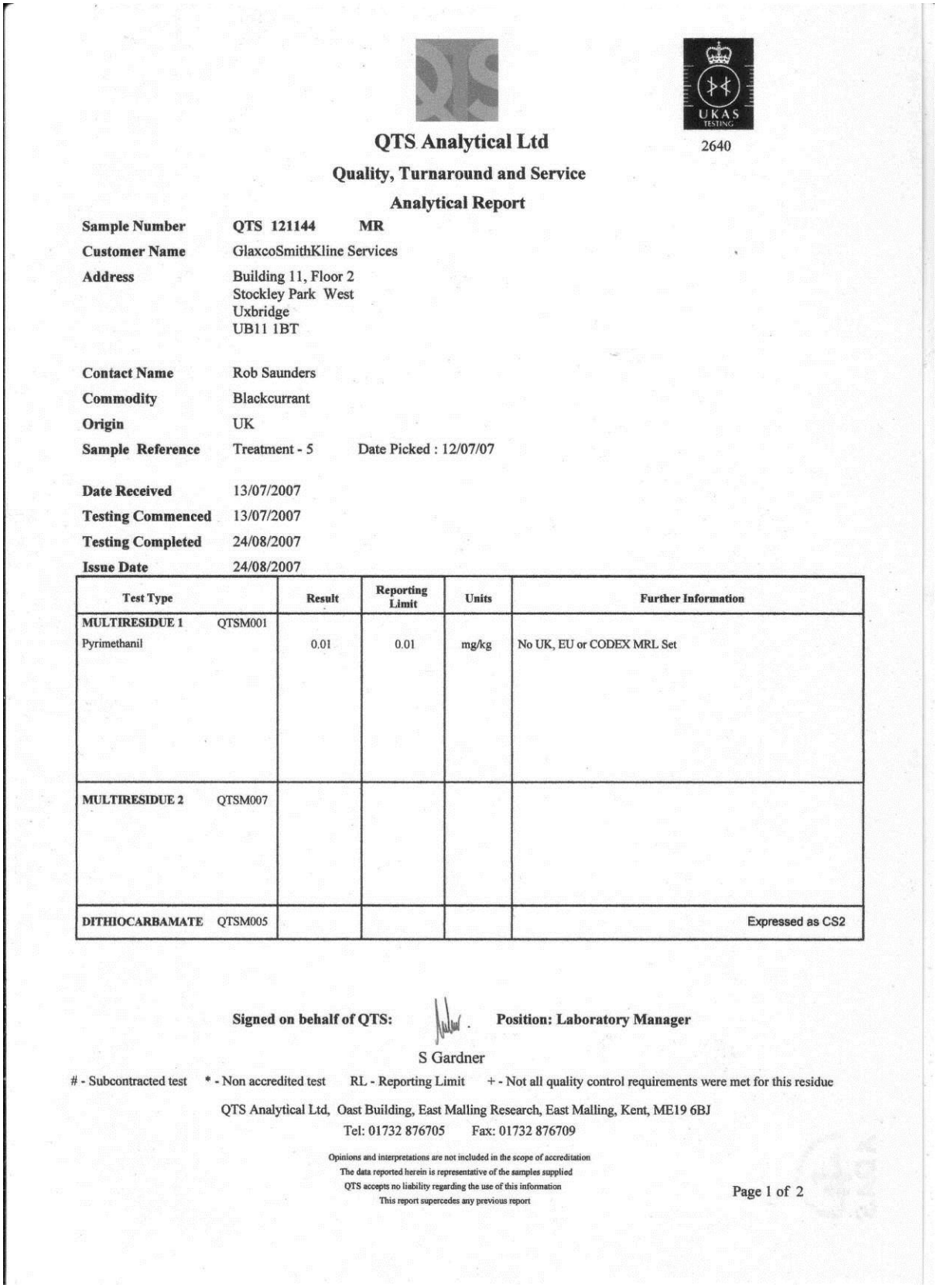
S Gardner

- Sub-contracted to a UKAS Accredited Laboratory who holds UKAS Accreditation for this Test

QTS Analytical Ltd, Oast Building, East Malling Research, East Malling, Kent, ME19 6BJ
Tel: 01732 876705 Fax: 01732 876709

Opinions and interpretations are not included in the scope of accreditation
The data reported herein is representative of the samples supplied
QTS accepts no liability regarding the use of this information
This report supercedes any previous report

Treatment 5. Artist 2.5 kg/ha



QTS Analytical Ltd

2640

Quality, Turnaround and Service

Analytical Report

Sample Number QTS 121144 MR

Customer Name GlaxcoSmithKline Services

Address Building 11, Floor 2
Stockley Park West
Uxbridge
UB11 1BT

Contact Name Rob Saunders

Commodity Blackcurrant

Origin UK

Sample Reference Treatment - 5 Date Picked : 12/07/07

Date Received 13/07/2007

Testing Commenced 13/07/2007

Testing Completed 24/08/2007

Issue Date 24/08/2007

Test Type	Result	Reporting Limit	Units	Further Information
MULTIRESIDUE 1 QTSM001 Pyrimethanil	0.01	0.01	mg/kg	No UK, EU or CODEX MRL Set
MULTIRESIDUE 2 QTSM007				
DITHIOCARBAMATE QTSM005				Expressed as CS2

Signed on behalf of QTS: **Position: Laboratory Manager**

S Gardner

- Subcontracted test * - Non accredited test RL - Reporting Limit + - Not all quality control requirements were met for this residue

QTS Analytical Ltd, Oast Building, East Malling Research, East Malling, Kent, ME19 6BJ
Tel: 01732 876705 Fax: 01732 876709

Opinions and interpretations are not included in the scope of accreditation
The data reported herein is representative of the samples supplied
QTS accepts no liability regarding the use of this information
This report supercedes any previous report

Page 1 of 2

Treatment 5. Artist 2.5 kg/ha – Multi residue test page 1

QTS Analytical Ltd

Quality, Turnaround and Service

Multi Residue 1 List

Sample NumberQTS 121144

	Reporting Limit		Reporting Limit		Reporting Limit
Acephate +	0.01	Endosulfan Sulphate	0.01	Oxadixyl	0.01
Aldrin	0.01	Endosulfan-I	0.01	p,p'-DDE	0.01
Atrazine	0.01	Endosulfan-II	0.01	Parathion ethyl	0.01
Azinphos-ethyl	0.01	Endrin +	0.01	Parathion methyl	0.01
Azinphos-Methyl	0.01	Ethion	0.01	Penconazole	0.01
Azoxystrobin +	0.01	Ethoprophos	0.01	Pendimethalin	0.01
Benalaxyl	0.01	Fenarimol	0.01	Permethrin	0.01
Bendiocarb	0.01	Fenbuconazole	0.01	Phosalone	0.01
Benzene, hexachloro-	0.01	Fenchlorvos	0.01	Phosfolan	0.01
Bifenthrin	0.01	Fenhexamid	0.01	Phosmet	0.01
Biphenyl	0.05	Fenitrothion	0.01	Phosphamidon	0.01
Bitertanol	0.01	Fenpropathrin	0.01	Pirimicarb	0.01
Boscalid +	0.01	Fenpropimorph	0.01	Pirimiphos methyl	0.01
Bromophos methyl	0.01	Fenthion	0.01	pp-DDD	0.01
Bromophos-ethyl	0.01	Fenvalerate-I +	0.01	pp-DDT +	0.01
Bromopropylate	0.01	Fenvalerate-II +	0.01	Prochloraz +	0.01
Bupirimate	0.01	Fluazifop butyl	0.01	Procymidone	0.01
Buprofezin	0.01	Flusilazole	0.01	Profenophos	0.01
Cadusafos	0.01	Folpet +	0.01	Prometryn	0.01
Captan	0.01	Fonofos	0.01	Propachlor	0.01
Carbaryl	0.01	HCH	0.01	Propanil	0.01
Carbofenothion	0.01	Heptenophos	0.01	Propiconazole	0.01
Carbofuran	0.01	Hexaconazole	0.01	Propyzamide	0.01
Chlorfenvinphos *	0.01	Imazalil	0.01	Prothiofos	0.01
Chlorothalonil	0.01	Iprodione	0.05	Pyraclostrobin +	0.01
Chlorpropham	0.01	Isofenphos	0.01	Pyrimethanil	0.01
Chlorpyrifos	0.01	Isofenphos methyl*	0.01	Quinalphos	0.01
Chlorpyrifos methyl	0.01	Kresoxim methyl	0.01	Quintozene	0.01
Chlordane	0.01	Lambda cyhalothrin	0.01	Simazine	0.01
Cyfluthrin +	0.01	Malathion	0.01	Tebuconazole	0.01
Cypermethrin +	0.01	Mepanipyrim	0.01	Tecnazene	0.01
Cyproconazole	0.01	Metalaxyl	0.01	Terbufos *	0.01
Cyrodinil	0.01	Methacrifos	0.01	Tetrachlorvinphos	0.01
Deltamethrin +	0.01	Methamidophos +	0.01	Tetradifon	0.01
Demeton-S-methyl +	0.01	Methidathion	0.01	Thiabendazole	0.05
Diazinon	0.01	Methoxychlor +	0.01	Tolclofos methyl	0.01
Dichlofluanid +	0.01	Metribuzin	0.01	Tolylfluanid	0.01
Dichloran	0.01	Mevinphos	0.01	Triadimefon	0.01
Dichlorvos	0.01	Monocrotophos	0.01	Triadimenol	0.01
Dicofol	0.01	Myclobutanil	0.01	Triazophos	0.01
Dieldrin	0.01	o,p'-DDE	0.01	Trietazine	0.01
Dimethoate	0.01	o-Hydroxybiphenyl	0.01	Trifluralin	0.01
Diphenylamine	0.05	Omethoate +	0.01	Vinclozolin	0.01
Disulfoton	0.01	op-DDD	0.01		
Disulfoton sulfone	0.01	op-DDT	0.01		

Version 8 28/03/06

Treatment 5. Artist 2.5 kg/ha – Multi residue test page 2