

Project title:	Apple: Investigating the link between spray programme characteristics and the occurrence of diffuse browning disorder (DBD) in Cox.
Project number:	TF 166a
Project leader:	Mr C T Biddlecombe Farm Advisory Services Team Ltd. Experimental Farm North Street Sheldwich Faversham Kent ME13 0LN
Report:	Final report, June 2006
Previous reports:	None
Key workers:	Mr C T Biddlecombe Mr G M Saunders
Location of project:	Bardsley & Sons, River Farm, Staplehurst, Kent J.L. Baxter & Son, Westerhill Farm, Linton, Maidstone Kent Downingbury Farm, Maidstone Road, Pembury, Tunbridge Wells, Kent (P. Jervis) R. Shotton, Dillywood Farm, Dillywood Lane, Frinsbury, Strood, Kent
Grower co-ordinator:	To be advised
Date project commenced:	1 July 2005
Date completion due:	30 June 2006
Key words:	

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TF 166a

Apple: Investigating the link between spray programme characteristics and the occurrence of diffuse browning disorder (DBD) in Cox

Grower Summary

Headline

The results from this trial indicate that there is no definite link between the occurrence of DBD in Cox and elements of the spray programme. However the link between rates of Topas application should be further investigated.

Background and expected deliverables

The occurrence of diffuse browning disorder in stored Cox apples has become of increasing concern to the industry. Growers who have orchards that are at risk are restricted to storing fruit short term to avoid the potential development of DBD. This will reduce the potential income from the crop due to the necessity to market the fruit at a time where there is a traditional over supply of dessert apples, resulting in a low market price and in some years a significant financial loss.

The recent HDC project TF 139 “Investigating diffuse browning disorder (DBD) in stored Cox apples” failed to identify the cause of this problem and consequently further research is necessary to determine factors influencing the onset of DBD in Cox.

This project provides an opportunity to determine if there is a link between spray programme and the occurrence of DBD in Cox. Specifically:

- To determine any effects of rates, timings and mixtures on the occurrence of DBD in Cox
- To define common factors from spray programmes that might be linked to the occurrence of DBD in Cox

The potential benefits from this project are threefold. Firstly, greater economic returns are more likely from sales of Cox that has been stored long-term than from fruit that has to be marketed at a time when dessert apple availability is high. Secondly, there will be a greater confidence in storing Cox from orchards where DBD has not yet been observed. A further significant benefit would be a restoring of confidence through the marketing chain in stored Cox.

Summary of the project and main conclusions

This project assessed the occurrence of DBD in four orchard sites (Placewood II, Lower Hunton Hill, Transplant, Hugo's) over a two year period to determine any link between spray programme characteristics and the occurrence of DBD in Cox.

The occurrence of DBD was noted for each orchard site from the 2004 and 2005 crops. Comparisons between spray programme characteristics and the occurrence of DBD were then made.

In 2004 DBD was absent from Transplant and Hugo's but was severe in Placewood II and Lower Hunton Hill. For the 2005 crop Placewood II had 3% DBD, Lower Hunton Hill had 6% DBD, Transplant had 3% DBD and Hugo's had 0% DBD.

Spray volumes applied ranged from 112 litres per hectare up to 1,000 litres per hectare and appeared to have no effect on incidence of DBD.

Calypso, Captan, Cultar, Cuprokylt, Dithianon, Regulex, Runner, Scala and Strobry were used in orchards with and without symptoms of DBD at similar rates and timings. This indicates that the use of these products had no effect on the occurrence of DBD. Bavistin, Elvaron Multi, Insegar and Systhane were sometimes but not usually used in orchards that showed symptoms of DBD, but were not used in orchards that did not have DBD, they may therefore have some influence on the development of DBD. Topas was used in both orchards with and without DBD but the higher rates of application were used in orchards that showed DBD. This may infer

that there is a link between the rate at which this chemical is applied and the occurrence of DBD. This potential link between Topas and the occurrence of DBD should be investigated further.

Timings of spray applications were generally similar across the four orchards and showed no relationship to the incidence of DBD.

The results from this trial indicate that for most chemical applications there are no links between the occurrences of DBD in Cox and spray applications. The only possible exception to this is Topas and it is recommended that this potential relationship should be further investigated.

Financial benefits

There are no financial benefits at this stage.

Action points for growers

There are no action points for growers.

Science section

Introduction

The occurrence of diffuse browning disorder in stored Cox apples has become of increasing concern to the industry. Growers who have orchards that are at risk are restricted to storing fruit short term to avoid the potential development of DBD. This will reduce the potential income from the crop due to the necessity to market the fruit at a time where there is a traditional over supply of dessert apples, resulting in a low market price and in some years a significant financial loss.

The recent HDC project TF 139 “Investigating diffuse browning disorder (DBD) in stored Cox apples” failed to identify the cause of this problem and consequently further research is necessary to determine factors influencing the onset of DBD in Cox.

This project provides an opportunity to determine any link between spray programme characteristics and the occurrence of diffuse browning disorder (DBD) in Cox.

The potential benefits from this project are threefold. Firstly, greater economic returns are more likely from sales of Cox that has been stored long-term than from fruit that has to be marketed at a time when dessert apple availability is high. Secondly, there will be a greater confidence in storing Cox from orchards where DBD has not yet been observed. A further significant benefit would be a restoring of confidence through the marketing chain in stored Cox.

Materials and Methods

Four orchards were selected for this study which investigated the potential link between spray programmes and the occurrence of DBD in Cox. For each orchard spray programmes were reviewed over two years, 2004 and 2005, and the incidence of DBD noted. Copies of the spray programmes were supplied by each grower.

The specific objectives were to determine:

- any effect of rates, timings and mixtures on the occurrence of DBD in Cox
- any common factors within the spray programmes linked to the occurrence of DBD in Cox

The trial orchards were located as follows:

Placewood II	Bardsley & Sons, River Farm, Staplehurst, Kent by kind permission of Mr. N. Bardsley.
Lower Hunton Hill	J.L. Baxter & Son, Westerhill Farm, Linton, Maidstone Kent by kind permission of Mr. C. Baxter.
Transplant	Downingbury Farm, Maidstone Road, Pembury, Tunbridge Wells, Kent by kind permission of Mr. P. Jervis.
Hugo's	R. Shotton, Dillywood Farm, Dillywood Lane, Frinsbury, Strood, Kent by kind permission of Mr. R. Shotton.

The incidence of DBD for the 2004 crop was assessed as low, medium or high by the individual growers. For the 2005 crop fruit for DBD determination was transported to East Malling Research for storage under standard Cox conditions. Fruit was stored until the 6th February 2006 when the fruit was taken from the store and left at room temperature for one week for DBD symptoms to develop before conducting post storage assessments.

Incidence of DBD was then compared to spray programme characteristics to seek to identify potential links between pesticide use and DBD incidence and to provide recommendations to for further research and initial recommendations to growers.

Results

Occurrence of DBD

For the 2004 crop DBD was absent from Transplant and Hugo's but was severe in Placewood II and Lower Hunton Hill. For the 2005 crop Placewood II had 3% DBD, Lower Hunton Hill had 6% DBD, Transplant had 3% DBD and Hugo's had 0% DBD in the samples stored at East Malling Research.

Spray Programme

There was a range of spray volumes applied to the on the farms from 112 litres per hectare up to 1,000 litres per hectare. Details of the spray programmes including date of application, product, rate of product applied and water volume applied are found in Appendix I.

The following results show the relationship between particular products and the occurrence of DBD:

- Calypso, Captan, Cultar, Cuprokylt, Dithianon, Regulex, Runner, Scala and Strobby were used in orchards with and without symptoms of DBD at similar rates and timings.
- Bavistin, Elvaron Multi, Insegar and Systhane were sometimes used in orchards that showed symptoms of DBD but were not used in orchards that did not have DBD.
- Topas was used in both orchards with and without DBD but the higher rates of application were used in orchards that showed DBD.

Generally timings of spray applications were similar. This is to be expected as growth stage and pest & disease emergences are dependant on the progression of the season.

Discussion

The four orchards over the two year period exhibited a range of severity of incidence of DBD. The spray programmes that were used in the different orchards showed general similarities in the timings of application, rates of chemical used and chemicals applied. Comparisons between the programmes showed that Calypso, Captan, Cultar, Cuprokult, Dithianon, Regulex, Runner, Scala and Strobby were regularly used on each farm in both seasons and thus were deemed to have no influence on the occurrence of DBD. Bavistin, Elvaron Multi, Insegar and Systhane were sometimes but not usually used in orchards that showed symptoms of DBD, but were not used in orchards that did not have DBD, they may therefore have some influence on the development of DBD. Topas was used in both orchards with and without DBD but the higher rates of application were used in orchards that showed DBD. This may infer that there is a link between the rate this chemical is applied at and the occurrence of DBD. There should therefore be further work investigating the link between Topas and the occurrence of DBD.

Conclusions

The results from this trial indicate that for most chemical applications there are no proven links between the occurrences of DBD in Cox and spray applications. The only possible exception to this is Topas and it is recommended that this potential relationship should be further investigated.

Appendix I: Spray data

Placewood II, 2004

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
22/03/2004	CUPROKYL FL	2.00	200
25/03/2004	BAVISTIN DF	0.5KG	200
25/03/2004	DITHIANON FLOWABLE	0.50	200
25/03/2004	CODACIDE OIL	1.00	200
05/04/2004	MAXICROP TRIPLE STRENGTH	1.00	200
05/04/2004	DITHIANON FLOWABLE	0.50	200
05/04/2004	CODACIDE OIL	1.00	200
15/04/2004	STROBY WG	0.2 KG	200
15/04/2004	CALYPSO	0.50	200
15/04/2004	SYSTHANE 20EW	0.23	200
15/04/2004	MAXICROP TRIPLE STRENGTH	1.00	200
26/04/2004	STROBY WG	0.2 KG	200
26/04/2004	SYSTHANE 20EW	0.40	200
26/04/2004	MAXICROP TRIPLE STRENGTH	1.00	200
26/04/2004	INSEGAR	0.2 KG	200
06/05/2004	BAVISTIN DF	0.5 KG	200
06/05/2004	STROBY WG	0.2 KG	200
06/05/2004	SYSTHANE 20EW	0.40	200
06/05/2004	MAXICROP TRIPLE STRENGTH	1.00	200
06/05/2004	CULTAR	0.14	200
06/05/2004	REGULEX	0.14	200
17/05/2004	ELVARON MULTI	1.5 KG	200
17/05/2004	SYSTHANE 20EW	0.40	200
17/05/2004	CULTAR	0.14	200
17/05/2004	REGULEX	0.14	200
27/05/2004	STROBY WG	0.2 KG	200
27/05/2004	TOPAS EC	0.40	200
27/05/2004	SENIPHOS	5.00	200
27/05/2004	CULTAR	0.15	200
27/05/2004	REGULEX	0.15	200
07/06/2004	RUNNER	0.40	200
07/06/2004	TOPAS EC	0.50	200
07/06/2004	CAPTAN WG	0.84 KG	200
07/06/2004	SENIPHOS	4.00	200
07/06/2004	CULTAR	0.30	200
21/06/2004	TOPAS EC	0.50	200

Placewood II, 2004

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
21/06/2004	DURSBAN	2.00	200
21/06/2004	SENIPHOS	4.00	200
21/06/2004	CULTAR	0.25	200
01/07/2004	RUNNER	0.40	200
01/07/2004	TOPAS EC	0.50	200
01/07/2004	SENIPHOS	5.00	200
01/07/2004	CULTAR	0.25	200
12/07/2004	TOPAS EC	0.50	200
12/07/2004	CAL CL2 LIQOUR	5.00	200
12/07/2004	MAXICROP TRIPLE STRENGTH	1.00	200
12/07/2004	CULTAR	0.25	200
23/07/2004	TOPAS EC	0.50	200
23/07/2004	CAL CL2 LIQOUR	7.00	200
23/07/2004	CAPTAN WG	1 KG	200
23/07/2004	MAXICROP TRIPLE STRENGTH	1.00	200
23/07/2004	CULTAR	0.25	200
02/08/2004	TOPAS EC	0.50	200
02/08/2004	CAL CL2 LIQOUR	7.00	200
02/08/2004	MAXICROP TRIPLE STRENGTH	1.00	200
02/08/2004	CULTAR	0.25	200
16/08/2004	ELVARON MULTI	1.5 KG	200
16/08/2004	TOPAS EC	0.40	200
16/08/2004	CAL CL2 LIQOUR	7.00	200

Placewood II,2005

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
18/03/2005	CUPROKYLT FL	2.00	200
24/03/2005	DITHIANON FLOWABLE	0.50	200
24/03/2005	CARBENDAZIM FL (ASHLADE)	0.50	200
04/04/2005	BARBARIAN	4.00	200
04/04/2005	HEADLAND TRINITY	4.00	200
08/04/2005	BAVISTAN DF	0.5 KG	200
08/04/2005	MAXICROP TRIPLE STRENGTH	1.00	200
08/04/2005	INSEGAR	0.2 KG	200
08/04/2005	DITHIANON FLOWABLE	0.50	200
18/04/2005	CALYPSO	0.25	200
18/04/2005	MAXICROP TRIPLE STRENGTH	1.00	200
18/04/2005	NIMROD	1.00	200
18/04/2005	DITHIANON FLOWABLE	0.50	200
28/04/2005	PHOSFIK	1.40	200
28/04/2005	CAPTAN WG	1 KG	200
28/04/2005	MAXICROP TRIPLE STRENGTH	1.00	200
28/04/2005	NIMROD	1.00	200
28/04/2005	SCALA	0.35	200
09/05/2005	CAPTAN WG	1 KG	200
09/05/2005	NIMROD	1.00	200
09/05/2005	REGULEX	0.15	200
09/05/2005	SCALA	0.35	200
20/05/2005	TOPAS EC	0.30	200
20/05/2005	SENIPHOS	3.00	200
20/05/2005	REGULEX	0.20	200
20/05/2005	DITHIANON FLOWABLE	0.50	200
31/05/2005	TOPAS EC	0.30	200
31/05/2005	SENIPHOS	3.00	200
31/05/2005	REGULEX	0.20	200
31/05/2005	DITHIANON FLOWABLE	0.50	200
10/06/2005	RUNNER	0.40	200
10/06/2005	TOPAS EC	0.50	200
10/06/2005	SENIPHOS	3.00	200
10/06/2005	CULTAR	0.20	200
10/06/2005	DITHIANON FLOWABLE	0.50	200
20/06/2005	SYSTHANE 20EW	0.45	200
20/06/2005	CAPTAN WG	1 KG	200

Placewood II,2005

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
20/06/2005	SENIPHOS	3.00	200
20/06/2005	CULTAR	0.30	200
01/07/2005	RUNNER	0.40	200
01/07/2005	DURSBAN	2.00	200
01/07/2005	SYSTHANE 20EW	0.45	200
01/07/2005	SENIPHOS	4.00	200
01/07/2005	CULTAR	0.30	200
11/07/2005	SYSTHANE 20EW	0.45	200
11/07/2005	SENIPHOS	4.00	200
11/07/2005	CULTAR	0.30	200
21/07/2005	RUNNER	0.40	200
21/07/2005	CALCIUM CHLORIDE FLAKES	5 KG	200
21/07/2005	SYSTHANE 20EW	0.45	200
21/07/2005	MAXICROP TRIPLE STRENGTH	1.00	200
21/07/2005	CULTAR	0.30	200
02/08/2005	CALCIUM CHLORIDE FLAKES	5 KG	200
02/08/2005	SYSTHANE 20EW	0.45	200
02/08/2005	MAXICROP TRIPLE STRENGTH	1.00	200
02/08/2005	CULTAR	0.15	200
12/08/2005	ELVARON MULTI	1.5 KG	200
12/08/2005	CALCIUM CHLORIDE FLAKES	5 KG	200
12/08/2005	SYSTHANE 20EW	0.45	200
12/08/2005	MAXICROP TRIPLE STRENGTH	1.00	200

Lower Hunton Hill, 2004

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
17/03/2004	Cuprokult	2.55	200
17/03/2004	Codacide Oil	0.72	200
26/03/2004	Dithianon	0.76	200
26/03/2004	Codacide Oil	0.76	200
26/03/2004	Bavistin	0.54kg	200
06/04/2004	Dithianon	1.08	200
06/04/2004	Codacide Oil	0.74	200
06/04/2004	Simazine (lqd)	2.80	270
06/04/2004	Roundup Campbells New	2.76	270
06/04/2004	C	2.76	270
06/04/2004	Codacide Oil	1.23	270
17/04/2004	Dithianon	1.03	1000
17/04/2004	Systhane 20	0.31	1000
17/04/2004	Maxicrop Triple	1.56	1000
17/04/2004	Urea	1.06kg	1000
17/04/2004	Bavistin	0.53kg	1000
17/04/2004	Calypso	0.26	1000
27/04/2004	Dithianon	0.70	200
27/04/2004	Systhane 20	0.30	200
27/04/2004	Maxicrop Triple	1.51	200
27/04/2004	Urea	1.00kg	200
27/04/2004	Runner	0.40	200
27/04/2004	Regulex	0.21	200
05/05/2004	Dithianon	0.98	300
05/05/2004	Systhane 20	0.45	300
05/05/2004	Maxicrop Triple	1.48	300
05/05/2004	Urea	1.00kg	300
05/05/2004	Scala	0.34	300
14/05/2004	Dithianon	0.96	300
14/05/2004	Systhane 20	0.43	300
14/05/2004	Maxicrop Triple	1.43	300
14/05/2004	Urea	0.96kg	300
14/05/2004	Scala	0.10	300
24/05/2004	Elvaron Multi	1.45kg	200
24/05/2004	Systhane 20	0.40	200
24/05/2004	Maxicrop+iron	1.45	200
24/05/2004	Urea	0.96kg	200

Lower Hunton Hill, 2004

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
24/05/2004	Cultar	0.24	200
24/05/2004	Magflo	2.90	200
24/05/2004	Insegar	0.20kg	200
03/06/2004	Elvaron Multi	1.50kg	200
03/06/2004	Systhane 20	0.40	200
03/06/2004	Maxicrop+iron	1.48	200
03/06/2004	Cultar	0.23	200
03/06/2004	Magflo	2.97	200
03/06/2004	Runner	0.40	200
14/06/2004	Captan 83	1.02kg	200
14/06/2004	Topas 100	0.50	200
14/06/2004	Maxicrop+iron	1.53	200
14/06/2004	Cultar	0.26	200
14/06/2004	Panda	4.09	200
14/06/2004	Aztec	0.50	200
25/06/2004	Captan 83	1.52kg	500
25/06/2004	Topas 100	0.50	500
25/06/2004	Maxicrop+iron	1.52	500
25/06/2004	Cultar	0.25	500
25/06/2004	Panda	8.00	500
25/06/2004	Dursban 4	1.98	500
07/07/2004	Topas 100	0.50	300
07/07/2004	Maxicrop Triple	1.51	300
07/07/2004	Cultar	0.25	300
07/07/2004	Panda	8.03	300
08/07/2004	Weedazol	3.30	270
08/07/2004	Campbells New C	3.30	270
08/07/2004	Codacide Oil	1.19	270
15/07/2004	Captan 83	0.99kg	300
15/07/2004	Topas 100	0.50	300
15/07/2004	Maxicrop+iron	1.48	300
15/07/2004	Cultar	0.25	300
15/07/2004	Panda	9.90	300
15/07/2004	Runner	0.40	300
20/07/2004	Captan 83	1.39kg	300
20/07/2004	Topas 100	0.46	300
20/07/2004	Maxicrop+iron	1.39	300
20/07/2004	Cultar	0.23	300

Lower Hunton Hill, 2004

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
20/07/2004	Panda	9.24	300
28/07/2004	Captan 83	1.03kg	500
28/07/2004	Topas 100	0.50	500
28/07/2004	Maxicrop+iron	1.55	500
28/07/2004	Cultar	0.26	500
28/07/2004	Panda	10.35	500
11/08/2004	Elvaron Multi	1.40kg	500
11/08/2004	Topas 100	0.47	500
11/08/2004	Maxicrop Triple	1.40	500
11/08/2004	Panda	9.34	500
19/08/2004	Elvaron Multi	1.50kg	500
19/08/2004	Topas 100	0.50	500
19/08/2004	Maxicrop Triple	1.50	500
19/08/2004	Panda	10.00	500

Lower Hunton Hill, 2005

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
23/03/2005	Dithianon	1.00	200
23/03/2005	Codacide Oil	0.70	200
31/03/2005	Dithianon	1.00	200
31/03/2005	Scala	0.35	200
31/03/2005	Bavistin Liq	0.50	200
31/03/2005	Fast Cab	0.70	200
11/04/2005	Dithianon	1.00	300
11/04/2005	Scala	0.35	300
11/04/2005	Bavistin Liq	0.50	300
11/04/2005	Fast Cab	0.70	300
11/04/2005	Urea	3.00kg	300
19/04/2005	Roundup	3.48	270
19/04/2005	Campdex	3.48	270
21/04/2005	Dithianon	1.04	500
21/04/2005	Scala	0.36	500
21/04/2005	Topas 100	0.53	500
21/04/2005	Bavistin Liq	0.53	500
21/04/2005	Calypso	0.27	500
28/04/2005	Dithianon	0.96	300
28/04/2005	Topas 100	0.50	300
28/04/2005	Scala	0.35	300
28/04/2005	Maxicrop		
28/04/2005	Triple	1.46	300
28/04/2005	Regulex	0.15	300
09/05/2005	Captan 83	2.08kg	300
09/05/2005	Topas 100	0.53	300
09/05/2005	Maxicrop		
09/05/2005	Triple	1.56	300
09/05/2005	Regulex	0.22	300
17/05/2005	Captan 83	1.90kg	300
17/05/2005	Topas 100	0.50	300
17/05/2005	Maxicrop		
17/05/2005	Triple	1.41	300
17/05/2005	Regulex	0.18	300
27/05/2005	Captan 83	2.00kg	300
27/05/2005	Topas 100	0.50	300
27/05/2005	Maxicrop		
27/05/2005	Triple	1.50	300
27/05/2005	Regulex	0.20	300

Lower Hunton Hill, 2005

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
27/05/2005	Cultar	0.25	300
06/06/2005	Captan 83	1.75kg	300
06/06/2005	Topas 100 Maxicrop	0.50	300
06/06/2005	Triple	1.50	300
06/06/2005	Regulex	0.30	300
06/06/2005	Cultar	0.30	300
06/06/2005	Insegar	0.30kg	300
06/06/2005	Panda	4.00	300
06/06/2005	Wuxal Top P	3.00	300
28/06/2005	Systhane 20 Maxicrop	0.45	300
28/06/2005	Triple	1.50	300
28/06/2005	Cultar	0.30	300
28/06/2005	Runner	0.40	300
28/06/2005	Panda	5.00	300
28/06/2005	Wuxal Top P	3.00	300
07/07/2005	Systhane 20 Maxicrop	0.45	300
07/07/2005	Triple	1.50	300
07/07/2005	Cultar	0.30	300
07/07/2005	Panda	10.00	300
07/07/2005	Urea	1.00	300
12/07/2005	Bavistin Liq Maxicrop	0.50	500
12/07/2005	Triple	1.50	500
12/07/2005	Panda	10.00	500
12/07/2005	Urea	1.00kg	500
12/07/2005	Runner	0.40	500
28/07/2005	Systhane 20	0.45	500
28/07/2005	Dursban 4 Maxicrop	2.00	500
28/07/2005	Triple	1.50	500
28/07/2005	Panda	10.00	500
28/07/2005	Urea	1.00kg	500
28/07/2005	Cultar	0.30	500
15/08/2005	Elvaron Multi	1.50kg	500
15/08/2005	Systhane 20	0.45	500
15/08/2005	Panda	10.00	500
15/08/2005	Urea	1.00kg	500
15/08/2005	Maxicrop	1.50	500

Lower Hunton Hill, 2005

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
	Triple		

Transplant, 2004

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
29/03/2004	Dithianon	0.63	168
09/04/2004	Dithianon	0.63	168
	Headland		
09/04/2004	Panda	7litre/455litres	168
09/04/2004	Poliverdol	0.70	168
16/04/2004	Dithianon	0.63	168
16/04/2004	Topas	0.28	168
16/04/2004	Poliverdol	0.70	168
16/04/2004	Runner	0.35	168
	Headland		
16/04/2004	Panda	7litre/455litres	168
26/04/2004	Dithianon	0.63	168
26/04/2004	Topas	0.28	168
26/04/2004	Poliverdol	0.70	168
26/04/2004	Calypso	0.19	168
	Headland		
26/04/2004	Panda	7litre/455litres	168
26/04/2004	Silwet	0.00	168
03/05/2004	Stroby	0.11	168
03/05/2004	Topas	0.21	168
03/05/2004	Poliverdol	0.70	168
	Headland		
03/05/2004	Panda	7litre/455litres	168
03/05/2004	Occidor	1.12	168
03/05/2004	Regulex	0.21	168
11/05/2004	Stroby	0.11	168
11/05/2004	Topas	0.21	168
11/05/2004	Poliverdol	0.70	168
	Headland		
11/05/2004	Panda	7litre/455litres	168
11/05/2004	Occidor	1.12	168
11/05/2004	Regulex	0.21	168
11/05/2004	Cultar	0.21	168
24/05/2004	Stroby	0.07	168
24/05/2004	Topas	0.21	168
24/05/2004	Poliverdol	0.70	168
	Headland		
24/05/2004	Panda	7litre/455litres	168
24/05/2004	Occidor	0.49	168
24/05/2004	Regulex	0.21	168

Transplant, 2004

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
24/05/2004	Cultar	0.21	168
24/05/2004	FAST Mag	7litre/455litres	168
24/05/2004	Runner	0.35	168
03/06/2004	Dithianon	0.56	168
03/06/2004	Topas	0.21	168
03/06/2004	Poliverdol	0.70	168
03/06/2004	Pitstop	1.05	168
03/06/2004	Occidor	0.49	168
03/06/2004	Regulex	0.21	168
03/06/2004	Cultar	0.21	168
03/06/2004	FAST Mag	7.02	168
17/06/2004	Topas	0.21	168
17/06/2004	Cultar	0.14	168
17/06/2004	Regulex	0.14	168
17/06/2004	Poliverdol	0.70	168
17/06/2004	Pitstop	1.05	168
30/06/2004	Topas	0.21	168
30/06/2004	Pitstop	1.05	168
30/06/2004	Poliverdol	0.70	168
30/06/2004	Cultar	0.21	168
13/07/2004	Topas	0.21	168
13/07/2004	Pitstop	1.05	168
13/07/2004	Poliverdol	0.70	168
13/07/2004	Cultar	0.21	168
13/07/2004	Runner	0.35	168
28/07/2004	Nimrod	0.56	168
28/07/2004	Pitstop	0.84	168
13/08/2004	Ca Chloride	6.72kg/455litres	168
13/08/2004	Pitstop	0.84	168
27/08/2004	Ca Chloride	6.72kg/455litres	168
27/08/2004	Pitstop	0.84	168

Transplant, 2005

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
29/03/2005	Dithianon	0.63	168
12/04/2005	Dithianon	0.63	168
12/04/2005	Topas	0.21	168
12/04/2005	Pitstop	0.70	168
12/04/2005	Chlorpirifos	0.56	168
26/04/2005	Dithianon	0.63	168
26/04/2005	Topas	0.21	168
26/04/2005	FAST CaB	7litres/455litres	168
26/04/2005	Calypso	0.19	168
26/04/2005	Poliverdol	0.70	168
26/04/2005	Designer	1 litre/1000litres	168
26/04/2005	Occidor	0.28	168
10/05/2005	Stroby	0.14	168
10/05/2005	Topas	0.21	168
10/05/2005	Pitstop	0.70	168
10/05/2005	Regulex	0.21	168
10/05/2005	Poliverdol	0.70	168
10/05/2005	Occidor	0.35	168
23/05/2005	Stroby	0.14	168
23/05/2005	Topas	0.21	168
23/05/2005	Pitstop	0.70	168
23/05/2005	Regulex	0.21	168
23/05/2005	Poliverdol	0.70	168
23/05/2005	Occidor	0.35	168
23/05/2005	Magister	1.05	168
03/06/2005	Dithianon	0.63	168
03/06/2005	Topas	0.21	168
03/06/2005	Pitstop	0.70	168
03/06/2005	Regulex	0.21	168
03/06/2005	Poliverdol	0.70	168
03/06/2005	Cultar	0.21	168
03/06/2005	Magister	1.05	168
03/06/2005	Runner	0.35	168
21/06/2005	Magister	1.05	168
21/06/2005	Topas	0.21	168
21/06/2005	Pitstop	0.70	168
21/06/2005	Regulex	0.14	168

Transplant, 2005

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
21/06/2005	Cultar	0.14	168
06/07/2005	Runner	0.35	168
06/07/2005	Topas	0.28	168
06/07/2005	Pitstop	0.70	168
06/07/2005	Poliverdol	0.70	168
20/07/2005	Poliverdol	0.70	168
20/07/2005	Topas	0.28	168
20/07/2005	Pitstop	0.70	168
03/08/2005	Nimrod	0.35	168
03/08/2005	Pitstop	0.70	168
18/08/2005	Captan	1.12kg	168
18/08/2005	Calbit C Elvaron	1.40	168
04/09/2005	Multi	0.84	168
04/09/2005	Calbit C	1.40	168

Hugo's, 2005

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
21/03/2005	Cuprolyte	2.5 kg/500L	225
21/03/2005	Occidor	0.28	112
01/04/2005	Dithianon	0.56	112
01/04/2005	Scala	0.35	112
01/04/2005	Occidor	0.28	112
05/04/2005	PDQ	4.21	337
05/04/2005	Diuron	4.91	337
11/04/2005	Dithianon	0.56	112
11/04/2005	Scala	0.35	112
11/04/2005	Occidor	0.28	112
22/04/2005	Captan 80	0.70	112
22/04/2005	Calypso	0.12	112
22/04/2005	Topaz	0.14	112
22/04/2005	Nimrod	0.28	112
29/04/2005	Captan 80	0.70	112
29/04/2005	Scala	0.35	112
29/04/2005	Topaz	0.14	112
29/04/2005	Ronilan	0.35	112
05/05/2005	Captan 80	0.70	112
05/05/2005	Topaz	0.14	112
05/05/2005	Regulex	0.18	112
12/05/2005	Captan 80	0.70	112
12/05/2005	Topaz	0.14	112
12/05/2005	Nimrod	0.28	112
12/05/2005	Regulex	0.18	112
19/05/2005	Captan 80	0.70	112
19/05/2005	Topaz	0.14	112
19/05/2005	Regulex	0.18	112
19/05/2005	Cultar	0.18	112
25/05/2005	Captan 80	0.70	112
25/05/2005	Topaz	0.18	112
25/05/2005	Cultar	0.21	112
31/05/2005	Topaz	0.18	112
31/05/2005	Cultar	0.18	112

Hugo's, 2005

Date	Spray Product	Rate litres/hectare	Volume litres/hectare
31/05/2005	Regulex	0.18	112
31/05/2005	Insegar	0.21	112
31/05/2005	Calypso	0.14	112
09/06/2005	Topaz	0.21	112
09/06/2005	Nimrod	0.35	112
09/06/2005	Cultar	0.14	112
09/06/2005	Regulex	0.14	112
09/06/2005	Runner	0.29	112
17/06/2005	Aphox	0.56	449
23/06/2005	Topaz	0.21	112
23/06/2005	Nimrod	0.56	112
23/06/2005	Cultar	0.21	112