Project number:	SF 012 (GSK200)
Title:	Autumn sprays for the control of aphids in blackcurrant autumn 2003 – spring 2005
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Final report:	*Contract report for GlaxoSmithKline and the Horticultural Development Council* June 2005
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Location of project:	Rosemary Farm, Flimwell, Kent
Date project commenced:	01 September 2003
Date project completed:	16 September 2005
Key words:	currant sowthistle aphid, blackcurrant aphid, redcurrant blister aphid, permanent currant aphid, blackcurrant, insecticide, aphicide, autumn 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

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

Mr Jerry V Cross
East Malling Research

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

Report authorised by:

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

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GROWER SUMMARY

Headline

- A single application of an aphicide in late September or early October offers a high degree of control of aphids in blackcurrants.

Background and expected deliverables

The overall aim of the work reported here was to determine whether commercially acceptable control of the most common and damaging aphids in commercial blackcurrant production in the UK can be adequately achieved by autumn application of aphicides. Two experiments were conducted.

- The objective of the first experiment was to test different timings of autumn sprays of pirimicarb (Aphox).
- The objective of the second experiment was to test two different timings of autumn sprays of pirimicarb (Aphox), thiacloprid (Calypso) and pymetrozine.

Summary of the project and main conclusions

Two large scale replicated field experiments investigated control of aphids on blackcurrants (Cv Ben Gairn) by application of aphicide sprays in the autumn. The first experiment in autumn 2003 examined the effects of sprays of pirimicarb (Aphox) applied on 19 September, 30 September, 10 October or 20 October or of two sprays applied on 19 September + 30 September, 30 September + 10 October or 10 October + 20 October on populations of aphids that developed the following spring. The second experiment in autumn 2004 evaluated single sprays of pirimicarb (Aphox), thiacloprid (Calypso) or pymetrozine (Plenum) applied on 30 September or 8 October 2004.

The results of the first experiment indicated that a spray of Aphox in early October, at the end of the migration of the currant sowthistle aphid, can give a high degree of control of the pest, though in this case not complete control. The single spray also gave good control of permanent currant aphid, blackcurrant aphid and redcurrant blister aphid. Application of Aphox on 19 September had no, or a greatly reduced, effect. Little benefit of two versus one spray was apparent

The results of the second experiment showed that single sprays of Aphox, Calypso or Plenum in late September or early October gave 90% control of currant sowthistle aphid. Differences between the timings or between the different aphicides were not significant statistically, though Calypso gave consistently the best results. For blackcurrant aphid, best results were obtained with the spray of Calypso or Plenum on 30 September. All the treatments, except Plenum on 8 October 2004, reduced numbers of infested shoots by >90%. This latter spray of Plenum was significantly less effective, only reducing numbers of infested shoots the following spring by 75%. Calypso and Plenum at either timing gave complete control of low populations of permanent currant aphid and redcurrant blister aphid

Overall, this work indicates that a single spray of an aphicide in late September or early October will give a high degree, though not complete, control of the main aphid pests of blackcurrant. Logically, it could be expected that more persistent systemic aphicides, such as thiacloprid (Calypso) are likely to give the best results if only a single application is made and this conclusion is more or less supported by these results. The Rothamsted Insect Survey aphid suction trap records for currant sowthistle aphid could be helpful in timing of sprays.

Financial benefits

This work has identified an optimum time to apply an aphicide for controlling the main aphid pests of blackcurrant. This will help growers to avoid unnecessary applications at the incorrect time. Improved timing will enhance control and reduce the cost of control measures.

Action points for growers

- To gain a high degree of control of aphids in blackcurrants, apply an aphicide in late September or early October.

SCIENCE SECTION

Aim and objectives

The overall aim of the work reported here was to determine whether commercially acceptable control of the most common and damaging aphids in commercial blackcurrant production in the UK can be controlled adequately by autumn application of aphicides. Two experiments were conducted.

- The objective of the first experiment was to test different timings of autumn sprays of pirimicarb (Aphox).
- The objective of the second experiment was to test two different timings of autumn sprays of pirimicarb (Aphox), thiacloprid (Calypso) and pymetrozine.

Methods and materials

The two large scale replicated experiments were done in a commercial blackcurrant plantation. In the first experiment the spray treatments were applied in autumn 2003 and the effects of the treatments assessed in spring 2004. For the second experiment, treatments were applied in autumn 2004 and the effects were assessed in spring 2005.

Site

The experiments were done in two Ben Gairn plantations 'Aster' and 'Cambridge' at Rosemary Farm, Flimwell by kind permission of Peter Reeves. 'Aster' plantation (1.1 ha) consisted of 19 rows, the longest 12 of which were 240 m long. 'Cambridge' (2.0 ha) consists of 27 rows approximately 240 m long. The row spacing was 3m.

Treatments

Treatments in the first experiment were sprays of Aphox (50% pirimicarb w/w) applied at a dose rate of 280 g of product per ha per application plus an untreated control (Table 1).

Table 1. Treatments applied in the first experiment

Treat. no.	Dates of application of Aphox (2003)
1	19 Sept
2	30 Sept
3	10 Oct
4	20 Oct
5	19 Sept + 30 Sept
6	30 Sept + 10 Oct
7	10 Oct + 20 Oct
8	Untreated

Treatments in the second experiment were single sprays of pirimicarb (Aphox), thiacloprid (Calypso) or pymetrozine (Plenum) applied on 30 September or 8 October 2004 (Table 2 overleaf).

Treatment application

Sprays were applied at a volume rate of 469 l/ha with the growers Fantini Eco 1031 axial fan air assisted sprayer by Peter and Michael Reeves under the supervision of EMR staff. The sprayer was fitted with four red Albuz hollow cone hydraulic nozzles (two per side) operated at a pressure of 20 bars. The average flow rate was 3.05 litres per nozzle per minute. The forward speed was 10.4 km/h.

Experimental design and layout

Randomised complete block experimental design with five replicates of the seven (2004) or eight (2003) treatments (= 40 plots as the untreated control was double replicated in the second experiment) was used. Each block consisted of a 240 m length of three adjacent rows. Two of the blocks were in 'Aster' plantation and three were in 'Cambridge'. There were six-seven guard rows between blocks. Plots were arranged end to end in each block. Each plot was three rows wide and 30m long.

Table 2. Treatments applied in the second experiment

Treat. no.	Product	Active ingredient	Dose rate (/ha)	Date of application (2004)
1	Aphox	50% w/w pirimicarb WG	280 g	30 Sep
2	Aphox	50% w/w pirimicarb WG	280 g	8 Oct
3	Calypso	480 g/l thiacloprid SC	375 ml	30 Sep
4	Calypso	480 g/l thiacloprid SC	375 ml	8 Oct
5	Plenum	50% w/w pymetrozine WG	400 g	30 Sep
6	Plenum	50% w/w pymetrozine WG	400 g	8 Oct
7*	Untreated*	-	-	-

* Double replicated

Meteorological records

Wet and dry bulb temperature and windspeed were measured with an aspirated psychrometer and a whirling cup anemometer respectively before and after spraying. Wind direction and weather conditions were also recorded.

Assessments

In the first experiment, on 26 April 2004 when aphid colonies were clearly visible, the number of shoots infested with each of the four main species of aphid infesting blackcurrant on the entire 60m length of row per plot were counted. The average number of shoots in each plot was estimated by counting the total number of shoots in a 25-30m length of row in three of the plots, plot 1 in block 1, plot 3 in block 3 and plot 8 in block 5. Values for the shoot density were 56, 77 and 54 shoots/metre of row in the three rows respectively. The two plantations were sprayed with Meothrin + Aphox to control aphids on 22 May 2004 as the infestations were starting to cause serious damage. The number of shoots damaged by currant sowthistle aphid in each plot was counted on 7 June 2004.

In the second experiment, the numbers of shoots in each of the three rows of each plot infested or damaged by each aphid species was counted on 13 May 2005. The total number of shoots in one row of each of three plots was counted to obtain an estimate of the number of shoots per metre of row.

Statistical analysis

Analysis of variance was done on the data after appropriate square root transformation.

Aphid migration

The weekly records of the numbers of currant sowthistle aphid caught in the Rothamsted Insect Survey suction trap at Wye, Kent from 1999-2003 were obtained and histograms of the total numbers of individuals and numbers of males caught were plotted.

Results and discussion

Permanent currant aphid (Aphis schneideri)

In the first experiment, numbers of shoots infested with permanent currant aphid on 26 April 2004 were small but there were statistically significant treatment effects. Single sprays of Aphox on 30 September, 10 October or 20 October 2003 all significantly reduced numbers (Table 3). Although numbers for the single 19 September spray were smaller than the untreated control, they were not significantly so. Two spray treatments were not significantly better than the single spray treatments, though the lowest numbers of permanent currant aphid infested shoots occurred on the plots that received sprays on 30 September + 10 October 2003.

In the second experiment, numbers of permanent currant aphid were extremely small and erratic and it was not possible to draw sound conclusions from the data (Table 4), other than that the spray of Aphox on 8 October 2004 did not give complete control.

Blackcurrant aphid (Cryptomyzus galeopsidis)

In the first experiment, all the Aphox spray treatments greatly reduced the numbers of shoots infested with blackcurrant aphid by > 95% (Table 3). The analysis of variance, even of the square root transformed data, was not entirely satisfactory. However, all the two spray treatments gave > 98% control and appeared superior to the single spray treatments.

In the second experiment, the spray treatments on average reduced aphid numbers by 95% ($P<0.001$). On average, sprays applied on 30 September were more effective than those applied on 8 October (P=0.027). However, there were no statistically significant differences between the efficacy of the different products on either of the individual application dates (Table 4).

Red currant blister aphid (Cryptomyzus ribis)

In both experiments numbers of shoots infested with redcurrant blister aphid were extremely small (Table 3 & 4). However, in the first experiment the aphid appeared to be eliminated by the single Aphox treatments in October and by all the two-spray treatments. The 19 September Aphox spray appeared to have little effect. In the second experiment, the Aphox treatments appeared to reduce the numbers of red currant blister aphid colonies but did not give complete control. Calypso and Plenum at either timing appeared to eliminate this aphid.

Currant sowthistle aphid (Hyperomyzus lactucae)

The Rothamsted Insect Survey records for the aphid suction trap at Wye, Kent, the nearest to the experimental site, shows the temporal pattern of the migration of the currant sowthistle aphid in 2003 and 2004 (Figures 1 & 2, respectively). Numbers of currant sowthistle aphids migrating to blackcurrant in the late summer and autumn of 2003 was quite high, though not the highest on record. A total of 46 individuals (males + gynoparae) were caught, none being males (Table 3). Numbers captured during this period in 2004 were much lower, totalling 13 including one male. Numbers vary very greatly from year to year with zero or near zero being recorded in some years and high numbers in others. However, an average of 22.0 currant sowthistle aphid infested shoots were recorded per 100 m row on the untreated controls in late April 2003 (Table 3) whereas 36.6 were recorded per 100 m row in early May in 2004 (Table 4). The differences in the numbers of migrants were thus not reflected in the populations that developed the following spring.

In 2003, the autumn migration to blackcurrant, the winter host, started in week 36 (1^{st} week September) and finished in week 44 (last week October). However, the bulk of the migration occurred in weeks 39-41 (last week September to the first two weeks of October). The spray of Aphox applied on 19 September was before the bulk of the migration had occurred and the spray on 30 September was in the middle of the migration. Aphox is only likely to kill aphids present on the crop at the time of spraying and perhaps those that arrive for a few days after as it has only a short persistence.

Single sprays of Aphox on 30 September, 10 and 20 October 2003 all significantly reduced the numbers of shoots infested and damaged by currant sowthistle aphid in spring 2004. The 10 October spray was the most effective, reducing the numbers of shoots infested on 26 April 2004 by 98% (Table 2). This spray was applied at the end of the migration period but perhaps before significant numbers of overwintering eggs had been laid. The 19 September spray did not reduce numbers or damage significantly, though mean values were lower than the untreated control. None of the two-spray treatments appeared to perform markedly better.

In 2004, the autumn migration started in week 39 (3^{rd} week in September) peaking in week 40 (last week in September). However, there was no significant difference in the efficacy of the two-spray timings, insecticide sprays both on average reducing numbers of infested shoot by about 90% compared to the untreated. Differences between the three different aphicides were not significant statistically, though Calypso did give consistently the best results at both spray timings (Table 4).

Conclusions

- The results of the first experiment indicated that a spray of Aphox in early October, at the end of the migration of the currant sowthistle aphid, can give a high degree of control of the pest, though in this case not complete control.

- The single spray also gave good control of the three other pest species.

- Little benefit of two versus one spray was apparent.

- The results of the second experiment showed that single sprays of Aphox, Calypso or Plenum in late September or early October gave 90% control of currant sowthistle aphid. There were no statistically significant differences between the timings, nor between the different aphicides, though Calypso gave consistently the best results.

- For blackcurrant aphid, best results were obtained with the spray of Calypso or Plenum on 30 September. All the treatments, except Plenum on 8 October

2004, reduced numbers of infested shoots by >90%. This latter spray of Plenum was significantly less effective only reducing numbers of infested shoots the following spring by 75%.

- Calypso and Plenum at either timing gave complete control of low populations of permanent currant aphid and redcurrant blister aphid.
- Overall, this work indicates that a single spray of an aphicide in late September or early October will give a high degree, though not complete, control of the main aphid pests of blackcurrant.
- Logically, it could be expected that more persistent systemic aphicides, such as thiacloprid (Calypso) are likely to give the best results if only a single application is made and this conclusion is more or less supported by these results.
- The Rothamsted Insect Survey aphid suction trap records for currant sowthistle aphid could be helpful in timing of sprays.

Acknowledgements

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APPENDIX

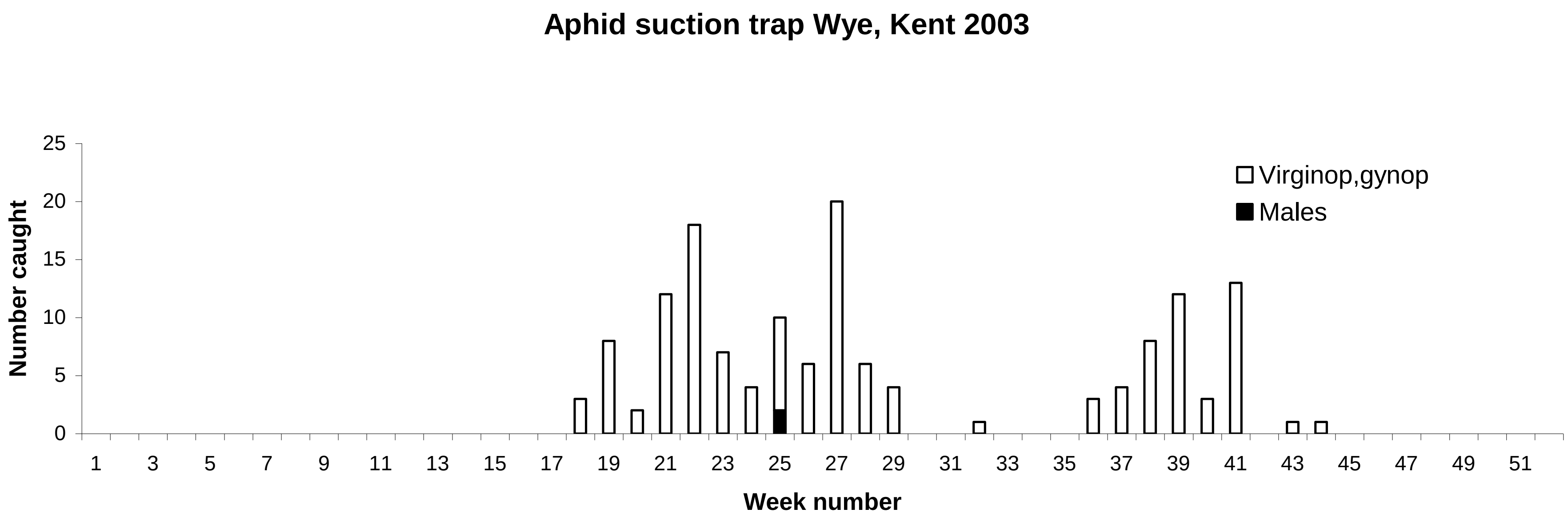

Figure 1. Weekly total catches and catches of currant sowthistle aphid in the Rothamsted Insect Survey aphid trap at Wye in 2003

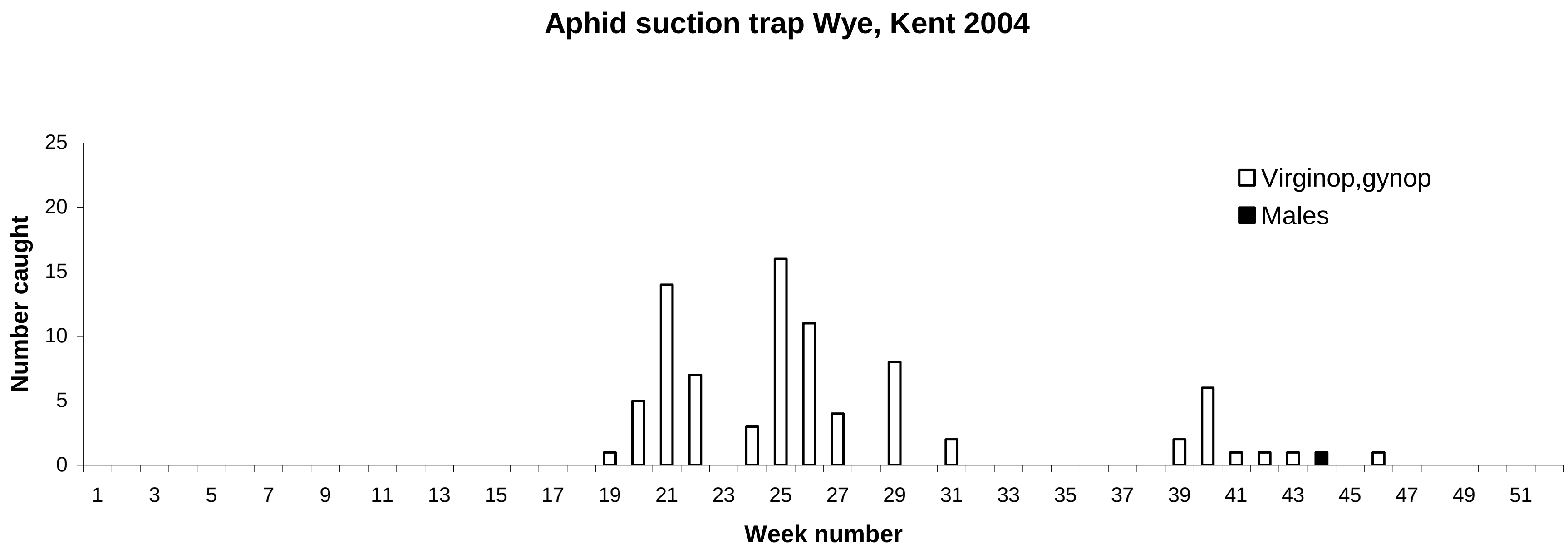

Figure 2. Weekly total catches and catches of currant sowthistle aphid in the Rothamsted Insect Survey aphid trap at Wye in 2004

Table 3. Mean and mean square root numbers of shoots per 100 m of row infested by permanent currant aphid, blackcurrant aphid, redcurrant blister aphid and currant sowthistle aphid on 26 April 2004 and number of shoots per 100 m of row damaged by currant sowthistle aphid on 7 June 2004, after the whole trial area had been over-sprayed with Aphox + Meothrin on 22 May 2004

Treatment	**Permanent currant**		**Blackcurrant aphid**		**Red currant blister**		**Currant sowthistle aphid**			
							26 April 2004		**7 June 2004**	
Date(s) of Aphox application 2003	**n**	**√n**	**n**	**√n**	**n**	**√n**	**n**	**√n**	**n**	**√n**
19 Sept	8.6	2.88	1.8	1.10	2.4	0.96	17.4	3.90	561.5	23.10
30 Sept	4.4	1.67	1.4	0.86	0.4	0.30	6.8	2.16	278.1	16.02
10 Oct	2.0	1.26	3.1	1.24	0.0	0.00	0.4	0.42	138.7	9.76
20 Oct	2.8	1.21	3.1	1.32	0.0	0.00	3.5	1.55	278.5	11.70
19 Sept+30 Sept	2.3	1.26	0.2	0.21	0.0	0.00	4.8	2.04	68.8	7.28
30 Sept+10 Oct	1.3	0.87	0.7	0.65	0.0	0.00	2.4	1.39	200.4	10.39
10 Oct+20 Oct	3.6	1.82	0.7	0.63	0.0	0.00	2.9	1.37	132.0	8.18
Untreated	11.8	2.73	39.9	5.49	2.5	1.21	22.0	4.39	890.1	26.45
Fprob(28 df)		0.049		<0.001				<0.001		0.021
SED		0.673		0.861				0.626		5.96

Table 4. Mean and mean square root numbers of shoots per 100 m of row infested by permanent currant aphid, blackcurrant aphid, redcurrant blister aphid and currant sowthistle aphid on 13 May 2005

Treatment	Permanent currant	Blackcurrant aphid		Currant sowthistle		Red currant blister
	n	**n**	**√n**	**n**	**√n**	**n**
Aphox 30 Sep	0	12.53	3.50	8.00	2.23	0.80
Aphox 8 Oct	0.53	11.87	3.43	5.96	1.86	1.07
Calypso 30 Sep	0	6.84	2.46	1.42	0.88	0
Calypso 8 Oct	0	14.40	3.51	1.60	0.75	0
Plenum 30 Sep	0	5.82	1.95	1.78	1.02	0
Plenum 8 Oct	0	43.64	5.70	6.40	2.14	0
Untreated	0.13	167.54	12.68	36.60	4.97	2.93
SED(29 df) comparisons with untreated			1.016		1.140	
other comparisons			1.173		1.317	

Table 3. Total number of migrant currant sowthistle aphid caught in the Rothamsted Insect Survey aphid suction trap at Wye, Kent between 1 August and 31 December in different years.

Year	Total number migrants 1 Aug -31 Dec	Total number males 1 Aug -31 Dec
2004	13	1
2003	46	0
2002	24	4
2001	9	0
2000	0	0
1999	10	1
1998	17	0
1997	101	9
1996	15	1
1995	8	3
1979	12	3
1978	58	18
1977	5	1
1976	1	0
1975	3	2
1974	2	0
1973	16	2
1972	12	5
1971	25	10
1970	20	2
1969	91	42
1968	19	6
1967	8	0

