Raspberry: finding alternative desiccants to sodium monochloroacetate for spawn control

SF 73

Annual Report 2006 Second year

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The results and conclusions in this report are based on a series of experiments conducted over a two-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.

Stephen Perkins
Contract Manger
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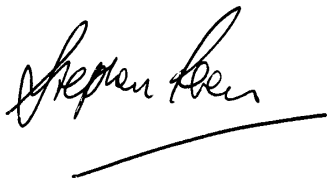
Signature...  … Date 3 August 2007

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GROWER SUMMARY

Headline

Carfentrazone-ethyl (Shark) showed greatest promise at controlling raspberry spawn compared with sodium monochloroacetate (SMA).

Background and expected deliverables

Established summer fruiting raspberries contain both fruiting canes (one year old) and primocanes (also known as spawn), which are produced in the current season.

Some varieties produce excessive quantities of spawn, and if left uncontrolled, this can lead to an increase in disease levels and reduce picking speeds by impeding access to fruit. This problem can be further exacerbated by the move to tunnel production, where the increase in temperatures leads to increased growth.

For many years, raspberry growers in the UK have relied upon chemical control to suppress the vigour of newly emerging primocanes (spawn) in main season raspberry plantations. The use of Dinoseb in oil was relied upon until the late 1980s, when its use was withdrawn. Research work conducted at the Scottish Crop Research Institute identified sodium monochloroacetate (Croptex Steel) as a replacement and a Specific Off-Label Approval was secured for this product in 1991. It has been employed by raspberry growers ever since.

With the advent of tunnel growing for cane fruit, the bulk of the area of raspberries is now covered, making it even more important to have a form of spawn control available.

Sodium monochloroacetate was not supported in the EC review to harmonise the use of pesticides across the European Union. However, the active ingredient received a ‘stay of execution’ following an application to secure continuing approval under the ‘essential use’ category. This will lapse in 2008, after which the UK industry will have no desiccation products approved for use in raspberry crops.

This trial was instigated by the HDC soft fruit sector with a view to securing an 'Off-Label Approval' for the most promising alternative desiccant to sodium monochloroacetate, by 2009.

Summary of the project and main conclusions

The trial was set up in an existing plantation of field-grown Glen Ample at Woodshoot Nurseries, Kings Bromley, part of New Farm, Elmhurst, Lichfield, Staffordshire WS13 8EX, by kind permission of Stephen McGuffie of R.D. McGuffie and Sons.

It was agreed with the HDC panel that candidate desiccants should be assessed under polythene tunnels in 2005 and 2006 to reflect current commercial practice. In 2007, the most promising candidate desiccants would be assessed in an uncovered plantation to assess efficacy at lower temperatures.

Following discussion with agrochemical companies, other horticultural sectors with experience of vegetation control and Vivian Powell (HDC's pesticide specialist), four candidate desiccants were chosen for assessment along with wetting agents (Table A). These were all compared with sodium monochloroacetate (Croptex Steel) and hand removal of the spawn.

It was decided to include only candidate desiccants that are likely to survive the ongoing harmonisation process of pesticides currently being undertaken by the EC. This will ensure that the best candidate can be used in future years by the UK industry.

Table A. Candidate desiccants evaluated for raspberry spawn control

Product (active ingredient)	**Rate of Use**	**Wetting Agent** (rate of use)	**Application Method**
Shark (carfentrazone-ethyl)	256 ml per 100 litres of water	Silwet L-77 (200 ml per 100 litres of water)	Applied at 100 ml per m^2 to the point of run-off
Cultamide (calcium cyanamide)	10 litres per 100 litres of water	Silwet L-77 (200 ml per 100 litres of water)	Applied at 100 ml per m^2 to the point of run-off
Reglone (diquat)	400 ml per 100 litres of water	Agral (100 ml per 100 litres of water)	Applied at 100 ml per m^2 to the point of run-off
Harvest (glufosinate ammonium)	750 ml per 100 litres of water	Ammonium sulphate (10 kg per 100 litres of water)	Applied at 100 ml per m^2 to the point of run-off
Control - Croptex Steel (sodium monochloroacetate) -	2 kg per 100 litres of water	Wayfarer (0.5 litres per 100 litres of water)	Applied at 100 ml per m^2 to the point of run-off

In both years, each desiccant was applied with or without a wetting agent, and in each case one application was compared with two applications. In addition, each application was compared with hand removal of the spawn, carried out once or twice.

All treatments were applied to plots of 3 metres of crop row, equating to six stools or an average of 24 canes. Each treatment was replicated four times.

Assessments were made of spawn die back, fruiting cane quality, signs of phytotoxicity, and yield and berry weights picked from each plot.

- In this second year of the project carfentrazone-ethyl (Shark) provided more complete control of the primocanes than the other candidate desiccants (including sodium monochloroacetate).

- All of the other candidates provided incomplete control.

- Following one application of carfentrazone-ethyl (Shark), adequate numbers of return primocanes (spawn) were produced and these were of medium thickness.

- Following a second and subsequent application of carfentrazone-ethyl (Shark), the return primocanes (spawn) were weaker than the previous return flush of primocanes. They were also thinner, variable in height and sparse in number.

- Glufosinate ammonium plus ammonium sulphate was also effective but not as effective or easy to use as carfentrazone-ethyl.

Financial benefits

Pending an off label approval, carfentrazone-ethyl (Shark) will be a major benefit to the cane fruit industry. It will provide growers with an important management tool in which to suppress spawn growth. Correctly timed spawn control will help to speed up picking, reduce disease levels by reducing the size of the canopy and provide better fruiting canes in the following year.

As labour for picking and tying in is the principal cost in cane fruit production, any reduction in such costs will show a direct benefit in the gross margin. This trial has identified a product that can be used by the UK raspberry industry to reliably control excess primocane growth and vigour in commercial plantations.

Use of carfentrazone-ethyl (Shark) will increase growers' options for spawn management regimes and with the correct application timing, will give better picking speeds, improved pest and disease control and higher yields.

Action points for growers

- At the end of the second year of work, carfentrazone-ethyl (Shark) provided the most effective control of primocanes (spawn), of all of the candidate desiccants.

- When the SOLA is obtained carfentrazone-ethyl (Shark) will become the standard treatment for controlling unwanted spawn.

SCIENCE SECTION

Introduction

For many years, raspberry growers have relied upon cane desiccants to suppress the vigour of newly emerging spawn (primocanes) in the spring. Dinoseb in oil was used for several years until it was withdrawn from the market in the late 1980s. Following experimental work carried out at the Scottish Crop Research Institute to assess a range of alternatives to Dinoseb, an off-label approval was secured in 1991 for the use of sodium monochloroacetate (sold as Croptex Steel).

Croptex Steel has been used widely since then along with the adjuvant Wayfarer. Some growers use it in early spring to control the first flush of spawn at the base of fruiting canes in vigorous varieties such as Glen Ample and Tulameen. Others use it to control unwanted spawn on the outside edge of the crop row and in the alleyway. In the early years after it was granted an off-label approval, growers had mixed success with Croptex Steel. Some found that it worked extremely well and provided full control of developing spawn, while others had less success, finding that it only provided partial desiccation of the foliage, while the growing tip remained intact.

In general, growers in the south of England appear to have had better success than those further north, perhaps due to higher temperatures. Since the advent of polythene tunnels however, more growers have found it necessary to use Croptex Steel, and its efficacy has been better in higher temperatures. The increase in temperatures under these structures also leads to more rapid growth resulting in the production of extremely tall canes, which are difficult to manage and can impede picker access to ripe fruits. Without the use of a cane desiccant, growers find that cane management costs and picking costs increase, which can severely reduce the profitability of raspberry production.

Given the increase in importance of desiccants for spawn control in raspberries, the industry was disappointed when the active ingredient sodium monochloroacetate was not supported in the EC review to harmonise the use of pesticides across the European Union. Fortunately, the active ingredient received a ‘stay of execution’ following an application to secure continuing approval under the ‘essential use’ category of approvals. However, this will lapse in 2008 after which the UK industry will have no desiccants approved for use in raspberry crops.

The Horticultural Development Council (HDC) responded to concerns about this impending loss by commissioning ADAS Horticulture to conduct a research trial to assess some alternative products. This trial was set up in the spring of 2005 and is due to run for three growing seasons until autumn 2007.

It was initially agreed with the HDC that candidate desiccants should be assessed under polythene tunnels in 2005 and 2006 to reflect current commercial practice. In 2007, the most promising candidate desiccants will be assessed in an uncovered plantation to assess their efficacy at lower temperatures. Subsequently an extension of the project under covers in 2007 has been agreed by the HDC to test a wider range of rates of carfentrazone-ethyl.

This report presents results of the work in the 2006 trial.

Materials and methods

The trial was set up in an existing plantation of field-grown, tunnelled Glen Ample at Woodshoot Nurseries, Kings Bromley, Staffs, part of New Farm, Elmhurst, Lichfield, Staffordshire WS13 8EX, by kind permission of Stephen McGuffie of R.D. McGuffie and Sons.

Much discussion took place about the choice of candidate desiccants to include in the trial. ADAS and HDC took advice and guidance from crop specialists in other crop sectors such as potatoes and hops, where considerable work has been undertaken to assess crop desiccants and vegetation control.

Having identified a number of candidates, further consideration was made to the long-term future of each. Given the ongoing harmonisation and review process of pesticides by the EC, it was agreed that only active ingredients that were likely to survive this review process should be included.

In addition to choosing candidate desiccants, rates of use and optimum wetting agents for each had to be chosen (Table 1). This was also done through consultation with other crop sectors based on experience.

In addition two other products were assessed in 2006 (Table 2). Each product was applied to two plots of previously untreated canes adjacent to the trial area.

Table 1. Candidate desiccants, rates of use, wetting agents and application methods

Product (active ingredient)	**Rate of Use**	**Wetting Agent** (rate of use)	**Application Method**
Shark (carfentrazone-ethyl)	256 ml* per 100 litres of water	**Silwet L-77** (200 ml per 100 litres of water)	Applied at 100 ml per m^2 to the point of run-off
Cultamide (calcium cyanamide)	10 litres per 100 litres of water	**Silwet L-77** (200 ml per 100 litres of water)	Applied at 100 ml per m^2 to the point of run-off
Reglone (diquat)	400 ml per 100 litres of water	**Agral** (100 ml per 100 litres of water	Applied at 100 ml per m^2 to the point of run-off
Harvest (glufosinate ammonium)	750 ml per 100 litres of water	**Ammonium sulphate** 10 kg per 100 litres of water	Applied at 100 ml per m^2 to the point of run-off
Croptex Steel (sodium monochloroacetate) - Control	2 kg per 100 litres of water	**Wayfarer** (0.5 litres per 100 litres of water)	Applied at 100 ml per m^2 to the point of run-off

* This was a high rate for this product, as used in other agronomic applications, so a range of rates was checked by application and visual inspection. It appeared to work well at a range of rates. The rate used in 2007 was modified after these findings.

Table 2. Additional products tested in 2006, adjacent to the trial area

Product (active ingredient)	Rate of Use	**Wetting Agent** (rate of use)	Application Method
212H	0.2 kg/ha	**Agral** 0.4 litre/ha	Applied in 400 litres/ha water

Regalis (prohexadione-calcium)	1.25 kg/ha	**Exchange** 1.0 litre/ha	Applied in 400 litres/ha water

Trial design

The trial consisted of 20 treatments in a randomised block design with four blocks and one plot of each treatment in each block, making 80 plots in total.

Each desiccant except sodium monochloroacetate was applied with or without a wetting agent, and in each case one application was compared with two applications. In addition, each application was compared with hand removal of the spawn, carried out once or twice. For the treatment details see table 3.

All treatments were applied to plots of 3 m of crop row, equating to 6 stools and an average of 24 canes.

Treatment timing

The first application of each treatment was made to all foliage below 45 cm in the crop canopy, when spawn had reached a height of 10 to 20 cm. Where second applications were required, these were made when the spawn re-growth had reached the height at which the first application was made. Hand removal was conducted at the same times as chemical applications.

In 2006 all of the first treatments were applied on 20th April and all of the second on the 11th May.

Assessments

The following assessments were done in 2006:

- Spawn die back 10 days after treatments (DAT).
- Spawn (re-growth) and fruiting cane girth and height, 10 DAT.

- Fruiting cane quality and visible signs of phytotoxicity, 10 DAT.
- Primocane numbers, density, height, girth and fruiting cane quality,18 weeks after first treatment.
- At harvest, total berry yield and average berry weight.

It was originally planned to assess the spawn die back and the fruiting canes both 2 and 14 DAT. However, when the site was visited 2 DAT, it was found that insufficient time had lapsed for the effects of each candidate desiccant to become fully apparent. The decision was therefore taken to make an assessment 10 DAT, but not at 2 and 14 DAT.

In 2007, treated plants from the most promising treatments will be assessed to determine fruit yield and primocane height, and the effect on general plant vigour of two applications of desiccants in two consecutive years.

Unprotected field crop experiment (2007)

In 2007, the efficacy of the two best candidate desiccants identified from the protected crop experiment will be assessed in a commercial summer fruiting raspberry plantation outdoors without any protection. Design, treatments (omitting two candidate desiccants) and assessments will be as for the protected field experiment. This work will ensure that any adverse effects which may arise from use outdoors can be identified.

Results and Discussion

Effects of the first treatment timing

First applications were made on 20th April and first assessments were on 4th May 2006.

Assessments were made 14 days after the first treatment. The results for the four replicated plots from each treatment were very similar, and treatment means are reported (Table 3).

Table 3. Effects of the first application of the candidate desiccants - 2006

Treatment	**Percentage kill of spawn**	**Regrowth level**	**Strength of fruiting cane**
1. Harvest x 1	76	Low	Strong
2. Harvest x 2	72	Medium	Strong
3. Harvest x 1 plus wetter	87	Low	Strong
4. Harvest x 2 plus wetter	96	Low	Strong
5. Shark x 1	94	Low	Medium
6. Shark x 2	92	Low	Weak
7. Shark x 1 plus wetter	96	Low	Strong
8. Shark x 2 plus wetter	93	Low	Medium
9. Cultamide x 1	60	High	Strong
10. Cultamide x 2	57	High	Medium/strong
11. Cultamide x 1 plus wetter	59	High	Medium
12. Cultamide x 2 plus wetter	60	High	Strong
13. Croptex steel/ Wayfarer x1	57	High	Medium
14. Croptex steel/ Wayfarer x2	52	High	Strong
15. Reglone x 1	50	High	Strong
16. Reglone x 2	50	High	Strong
17. Reglone x 1 plus wetter	54	High	Strong/medium
18. Reglone x 2 plus wetter	57	High	Strong
19. Hand x 1	100	High	Strong
20. Hand x 2	100	High	Weak/medium
212H*	75	Low/medium	Weak/medium
Regalis *	No effect seen	High	Strong

* 2006 only, outside the trial design.

Effects of treatments after the second treatment timing

The second assessments were made on 21 May, 10 days after the second treatment on 11 May 2006. All plots that had been treated for a second time were assessed and results are shown in Table 4. This table also includes comment on the plots with only one treatment.

Table 4. Effects of each treatment after the second treatment timing - 2006

Treatment	Percentage kill of spawn	Regrowth Level PC	Strength of fruiting cane (FC)	Comments
Harvest x 1	76	Medium	Strong	PC healthy but variable FC Vigorous
Harvest x 2	87	Low	Strong	FC Scorch of lower leaves and laterals, PC some damaged spawn recovery
Harvest x 1 plus wetter	87	Low	Strong	PC Variable emergence FC Vigorous
Harvest x 2 plus wetter	90	Low	Medium/ strong	FC Lower laterals and leaves scorched PC Variable emergence
Shark x 1	94	Medium	Medium	PC variable, FC some fleck on laterals
Shark x 2	100	Low	Weak	FC Kill on lower laterals and leaves PC Little emergence
Shark x 1 plus wetter	95	Medium/ low	Medium	FC Some fleck, PC variable
Shark x 2 plus wetter	100	Low	Medium	FC Yellow fleck to 1m lower leaf and lateral scorch PC Little emergence
Cultamide x 1	60	High	Strong	PC Patchy variable FC Scorch to low leaf
Cultamide x 2	25	Medium	Medium/ Strong	FC Scorch to lower leaves PC damaged not killed
Cultamide x 1 plus wetter	59	High	Medium/ strong	PC Patchy and variable FC Scorch to low leaf
Cultamide x 2 plus wetter	42	Medium	Strong	FC Scorch of old leaves PC Damaged not killed
Croptex steel/	57	High	Medium	PC variable, some scorch FC Scorch

Wayfarer x 1				
Croptex steel/ Wayfarer x 2	57	Medium	Strong	FC Scorch of old leaf and laterals variable PC killed off
Reglone x 1	50	High	Strong	FC Some flecking PC Vigorous
Reglone x 2	30	Low	Medium	FC Lower fruit laterals scorched, PC chlorotic and necrotic
Reglone x 1 plus wetter	54	High	Strong / Medium	FC Lower leaf scorch Variable PC dense in places
Reglone x 2 plus wetter	35	Low	Medium	FCLower leaves and laterals yellow flecked, PC 1st and 2nd flush damaged but recovering
Hand x 1	100	Medium	Medium/ Strong	FC Variable PC strong
Hand x 2	100	High	Weak/ medium	FC Weak PC strong also weed cover
212H *	90	Low	Weak/ medium	FC Oldest leaves of laterals scorched PC killed 0.3m in height
Regalis *	0	Low	Medium/ Strong	FC Oldest leaves of low laterals PC yellow. PC damaged not killed, black lesions into rind of PC and leaf petiole bases

PC = Primocane

FC = Fruiting cane

* 2006 only, outside the trial design.

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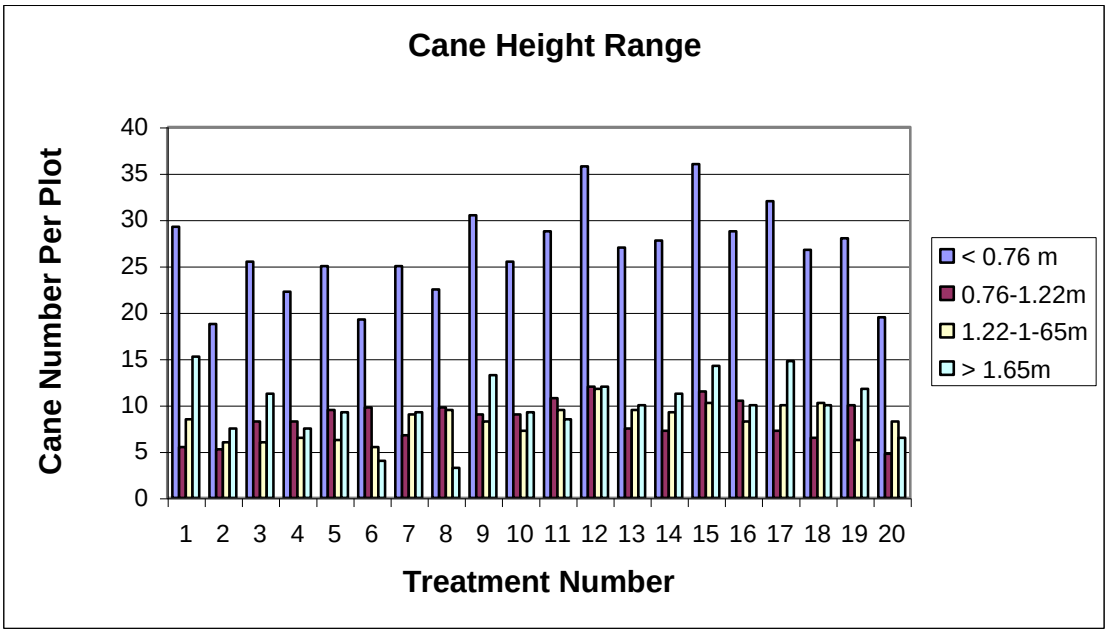
Third assessment

An assessment was made on 31st August to examine the subsequent growth of primocanes in all plots. The numbers of canes falling into different height categories were recorded for each plot, along with the average diameters of these canes. For ease of reporting, the mean number of canes (falling into each cane height category) was calculated across the four replicates of each treatment. The average for each treatment along with the average cane heights is recorded in **Figure 1** below.

Figure 1. Mean numbers of canes per plot in height categories



LSD (at 5% level, 57df)	**>0.76 mm**	**8.71**
	0.76-1.22m	**7.22**
	1.22-1.65m	**4.49**
	>1.65m	**6.33**

It is usually recommended that 6-8 canes per plant, over 1.22 m in height, are tied in to crop the following year, so ideally there would be some 18 – 24 canes per 3 m plot.

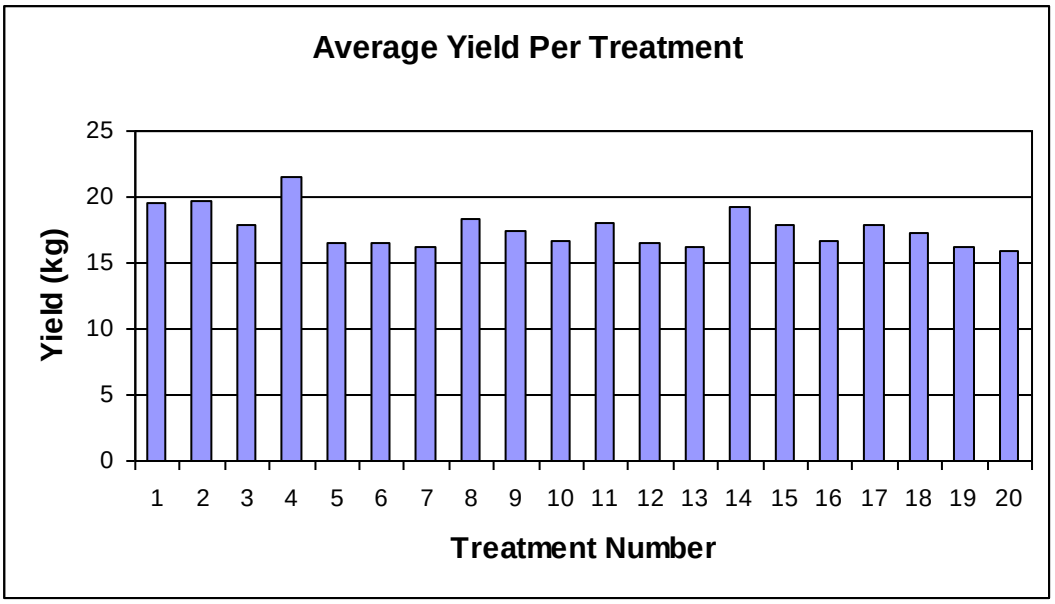
Both of the double Shark treatments had low numbers of long canes indicating this double treatment could be too severe, especially on crops lacking in vigour.

Yields and fruit weight

Each plot was harvested 2 or 3 times per week. There were a total of 18 picking occasions, starting on 10th June and finishing on 2nd August. The total fruit weight for each plot was recorded on each occasion, along with the weight of 25 berries from each plot. This allowed the mean fruit weight for each plot to be calculated for each picking occasion.

Mean yields for each treatment are presented in Figure 2. The mean fruit weight is presented for the first pick, a mid-harvest pick and a late pick in the harvest period. There was little difference between treatments in terms of yield. Treatment 4, 2 x Harvest plus ammonium sulphate, gave a significantly higher yield per treatment than some of the others including the double hand removal (treatment 20). Other differences were not significant.

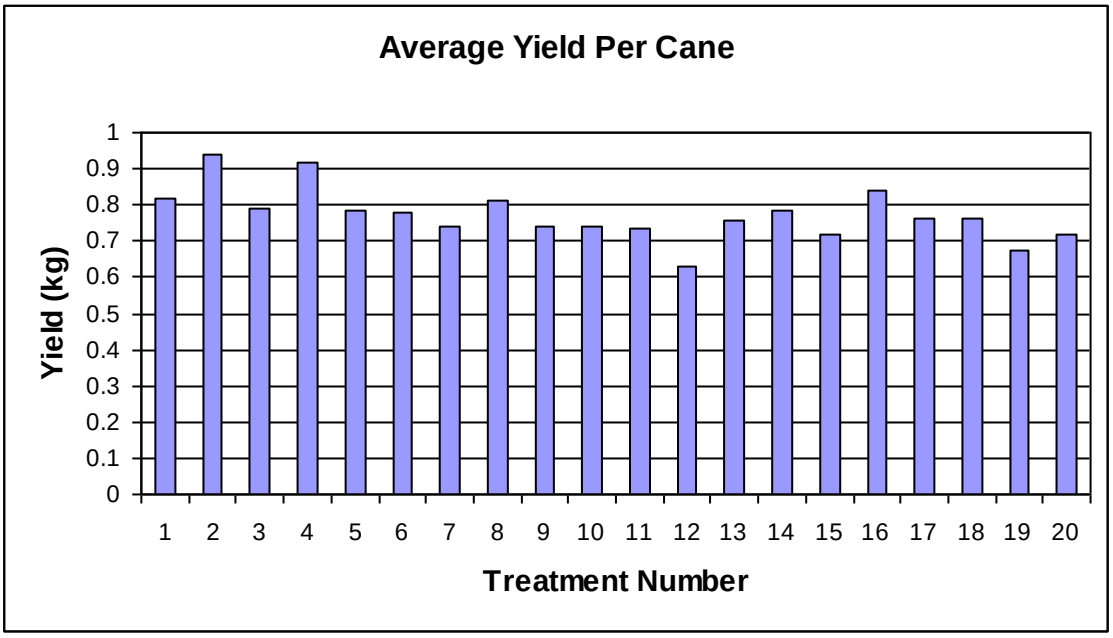
Figure 2. Yield per treatment.



LSD (at 5% level, 57df) 3.30

The double Harvest treatments (2 and 4) gave significantly greater yields per cane (Figure 3) than treatments 12 (Cultamide/Silwet x 2) and 19 (Hand x 1). Other differences were minor and not significant.

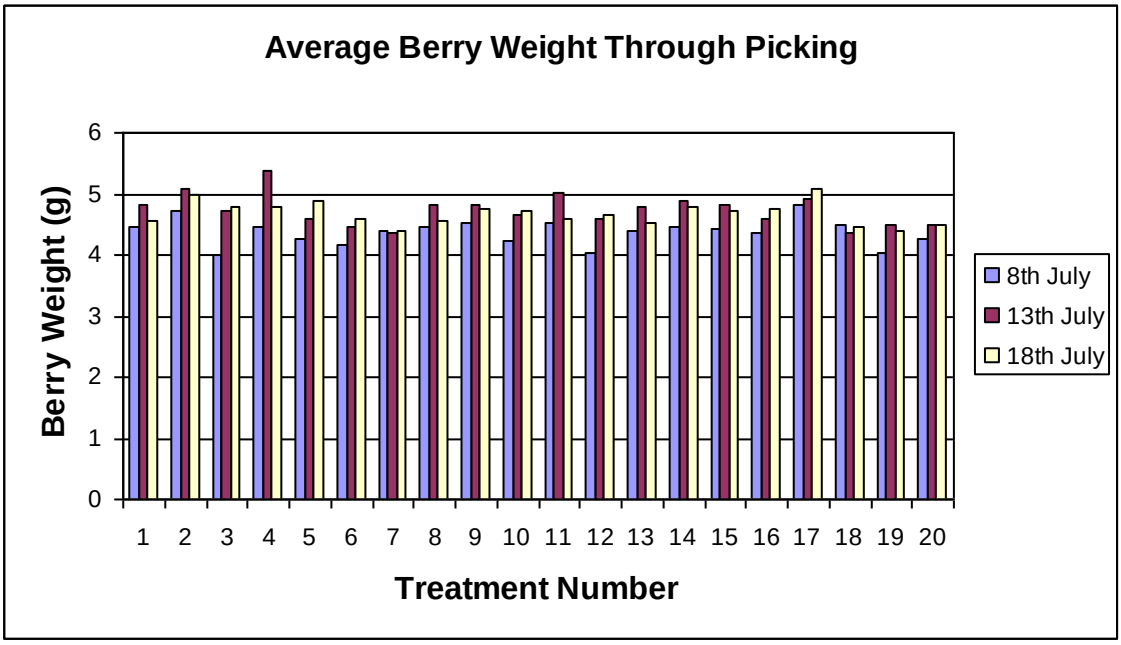
Figure 3. Yields per cane



LSD (at 5% level, 57df) 0.143

The weight of the individual berries (Figure 4) did not significantly differ between treatments at any of the assessment dates. This indicates that no treatment had any effect on fruit size

Figure 4. Individual berry weights at three harvest dates



LSD (at 5% level, 57df) 8th July 0.671

13th July 0.549

18th July 0.610

Table 5. Final spawn measurement, 30 November 2006

	Cane numbers per 3m plot by height			
Treatment	< 0.76m	0.76 – 1.22m	1.22 – 1.65m	>1.65m
1 Harvest X1	29.25	5.5	8.5	15.25
2 Harvest X2	18.75	5.25	6.0	7.5
3 Harvest + WetterX1	25.5	8.25	6.0	11.25
4 Harvest + wetter X2	22.25	8.25	6.5	7.5
5 Shark X1	25.0	9.5	6.25	9.25
6 SharkX2	19.25	9.75	5.5	4.0
7 SharkX1 + Wetter	25.0	6.75	9.0	3.25
8 SharkX2 + Wetter	22.5	9.75	9.5	3.25
9 Cultamide X1	30.5	9.0	8.25	13.25
10 Cultamide X2	25.5	9.0	7.25	9.25
11 Cultamide + Wetter X1	28.75	10.75	9.5	8.5
12 Cultamide + Wetter X2	35.75	12.0	11.75	12.0
13 Croptex steel wayfarer X1	27.0	7.5	9.5	10.0
14 Croptex steel wayfarer X2	27.75	7.25	9.25	11.25
15 Reglone X1	36.0	11.5	10.25	14.25
16 Reglone X2	28.75	10.5	8.25	10.0
17 Reglone + wetter X1	32.0	7.25	10.0	14.75
18 Reglone + wetter X2	26.75	6.5	10.25	10.0
19 Hand X1	28.0	10.0	6.25	11.75

20 Hand X2	19.5	4.75	8.25	6.5
L.S.D	8.708	7.223	4.493	6.334

Additional Plots

212H	11.5	3.5	7.5	0.5
Regalis	41.0	14.0	17.5	9.0

For tying in purposes, 1.22 m is the absolute minimum height which can be considered for the following season's crop. With plots 3 m in length, a minimum density of 6 canes per metre would give a figure of 18 canes/ plot; 20 would be optimal.

Both Harvest applied twice treatments (i.e. with and without wetter) caused a drop in cane number, although this was barely significant.

All of the Shark treatments had a similar effect; again differences were only just significant.

The remainder of the treatments (except for the Hand Removal twice) produced an acceptable number of canes for tying in.

These results suggest the more effective treatments such as Shark and Harvest can only be used safely on vigorous plantations, especially if applied twice.

On the additional plots trialled, the experimental material 212H was too severe in its effect on cane vigour, whereas Regalis was relatively 'kind'.

The above comments are made on the basis of the trial plantation, which was weak to medium in vigour and was tunnelled

Summary of performance of each candidate desiccant

Shark

Shark provided more complete control of the primocanes than the other desiccants. In the initial assessments after application, complete kill had been achieved with both Shark and Shark/Silwet. There appeared to be little difference between application on its own and application with the wetting agent. There were no adverse effects on the floricanes.

In assessments made in August following the single application, adequate numbers of primocanes had returned and in some replicates some extra hand thinning was

required. The return primocanes were of medium thickness. No adverse effects were apparent on the floricanes.

In assessments made in August following two applications, the return primocanes were weak, thin, variable in height and generally smaller than those in the single application treatment. They were also very sparse in number. No adverse effects were apparent on the floricanes.

At the final assessment in November 2006 after growth had ceased there was a shortage of material sufficiently tall enough to tie in on all treatments. This result was however barely significant.

Cultamide

Although there was some effective control of primocanes in places with both the Cultamide and Cultamide/Silwet mix, the control was generally poor. There were no adverse effects on the floricanes and new primocanes did emerge.

In assessments made in August following the single application, adequate numbers of primocanes were found in the middle of the crop row. They were of medium thickness and of variable height. No adverse effects were apparent on the floricanes.

In assessments made in August following two applications, the return primocanes were of thin to medium thickness and variable in height. They were adequate in number. No adverse effects were apparent on the floricanes.

Adequate numbers of cane were produced at the final measurement.

Reglone

Control of primocanes with both Reglone and Reglone/Agral was variable but incomplete. Yellow blotches and leaf scorch was apparent on both primocanes and the lower foliage on the fruiting canes. Some primocanes that had been treated started to re-grow within a few days of application. Damaged primocanes that are not killed, but continue to grow, are undesirable.

In assessments made in August following the single application, there were generally adequate numbers of primocanes following both the Reglone and Reglone/Agral treatments. However, there were generally more primocanes in the Reglone treatment and in some cases, these would require hand thinning. The canes were generally medium in thickness and tended to be tall. No adverse effects were apparent on the floricanes.

In assessments made in August following two applications, the density of primocanes varied from being adequate in number to being sparse in some plots of the Reglone treatments. The canes were medium to thin and very variable in height. No adverse effects were apparent on the floricanes.

In the final assessment the treatments produced enough cane to tie in.

Harvest

Harvest plus ammonium sulphate was an effective desiccant although not as good as Shark. However it was fairly difficult to mix. The addition of ammonium sulphate improved spawn control.

In general, the control using both Harvest and Harvest/ammonium sulphate mix was incomplete. In most cases, some yellowing and scorch was apparent around the leaf margins, both of the primocane leaves and the youngest leaves on the low fruiting laterals of the floricanes. The primocanes that had been treated started to re-grow within a few days of application.

In assessments made in August following the single application, there were generally adequate numbers of primocanes, although there were some gaps found in one of the Harvest/ammonium sulphate plots. The canes were of medium thickness and of variable height, and tall in places. No adverse effects were apparent on the floricanes.

In assessments made in August following two applications, the density of primocanes in both Harvest and Harvest/ammonium sulphate treatments varied considerably. At worst, some plots were sparse. Cane thickness and cane height also varied considerably. No adverse effects were apparent on the floricanes.

At the final assessment the Harvest treatments appeared to reduce cane numbers for tying in but these were barely significant.

Croptex Steel

The control of primocanes using Croptex Steel (with Wayfarer) was only partial and in general, only the smallest primocanes were controlled completely. Some primocanes that had been treated started to re-grow within a few days of application. No adverse effects were apparent on the floricanes.

In assessments made in August following the single application, there were more than adequate numbers of primocanes and hand thinning would be required. The primocanes were medium in thickness and variable in height. No adverse effects were apparent on the floricanes.

In assessments made in August following two applications, there were adequate numbers of primocanes. They were medium in thickness and variable in height. No adverse effects were apparent on the floricanes.

At the final assessment there were enough canes to tie in.

Hand removal

Complete control of primocanes had been achieved through hand removal, but significant re-growth was occurring within days of treatment. No adverse effects were apparent on the floricanes.

In assessments made in August following the single removal, there were very high numbers of primocanes growing very densely. The canes were of medium thickness and variable in height although some were very tall. No adverse effects were apparent on the floricanes.

In assessments made in August following two removals, there were very high numbers of primocanes growing very densely. However, these were slightly smaller, thinner and weaker than those in the single removal treatment. No adverse effects were apparent on the floricanes.

The double hand removal appeared to be a severe treatment but the differences were barely significant.

Conclusions

1. Shark provided the most complete control of primocanes and performed better than all other desiccants. There did not appear to be any great difference in the efficacy of Shark applied alone or with the wetting agent Silwet. However, it appeared that two applications of this desiccant gave rise to some weakening of the return canes and the production of inadequate numbers of canes.

2. Shark could become an important tool for cane fruit growers. Management decisions will have to be based on crop vigour as weaker plantations will not produce adequate new spawn after treatment. In tunnelled crops note will have to be made of increased vigour associated with tunnelled crops.

3. Most of the other desiccants produced poor control of spawn including the commercial standard Croptex Steel. It was interesting to note that only the smallest primocanes were controlled completely using this desiccant and this is typical of the results that some commercial growers experience.

4. Harvest performed reasonably well especially with the addition of ammonium sulphate and could be a future alternative product, as this product already has clearance in cane fruits although not as a spawn desiccant.

5. The trial has been successful in identifying a better treatment than the current commercial standard. Shark is both reliable and easy to use. It is now vital that a SOLA is gained for this product in time for spawn management in 2008.

6. Meanwhile as an alternative, Harvest and ammonium sulphate also performed well and gave good yields.

